FISHERY MANAGEMENT PLAN
FOR
THE UPPER SACRAMENTO RIVER
(Box Canyon Dam to Lake Shasta)

2000 TO 2005

SHASTA/SISKIYOU COUNTIES, CALIFORNIA

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State of California
The Resources Agency
California Department of Fish and Game
Northern California - North Coast Region

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Executive Summary

This fishery management plan briefly outlines the upper Sacramento River's history and recommends a course for the Department's management of the river for the next five years (2000 to 2005). This document is not intended to serve as major treatise on the upper Sacramento River, since most of the river's available history can be found in other places. Rather, this document is intended to guide how the Department plans to manage and monitor the river to insure the fishery and its associated benefits are maximized for the public. The Department's general goals are to;

- Maintain a diversity of angling opportunities in the upper Sacramento River.
- Maintain quality trout habitat.
- Maintain a trout monitoring plan.
- Insure an adequate number of angler access points.

The Department's specific goals for fishery management of the upper Sacramento River are;

- Utilize fishery management applications that take advantage of the high natural productivity of the upper Sacramento River to develop a world-class wild trout fishery. The river is capable of producing abundant wild trout and special angling regulations will be used to maintain the wild trout population at levels producing high quality angling opportunities.

- Maintain high quality trout habitat. The river's capability to produce abundant trout is dependent on adequate quality habitat. The Department's management will include fostering land use and water management activities that maintain the exceptional productivity of the river. The Department should seek to influence decisions made by other regulatory and management agencies involved in the watershed to maintain quality habitat.

- Maintain a diversity of angling opportunities. The river is large enough to provide for anglers interested in harvesting trout and for anglers interested in catch-and-release fishing. In addition to an expansion of wild trout management for the upper Sacramento, the Department will pursue new put-and-take angling opportunities for rainbow trout in the Dunsmuir/Mt Shasta area, in waters separated from the upper Sacramento River and its tributaries.

In order to assess fishery management of the upper Sacramento River, the Department proposes the following objectives:

- For those portions of the upper Sacramento River managed for wild trout (no stocking) with a reduced bag-limit and artificial lure restriction, strive to maintain a minimum

angler catch rate of 0.75 trout per hour as measured by a 3-year average of voluntary angler survey box returns.

- Maintain a wild rainbow trout average length of nine inches as measured by periodic sampling using established Department electrofishing surveys for the upper Sacramento River.

- For the Dunsmuir catch-and-keep area of the upper Sacramento River, stocked with catchable-sized hatchery trout (Zone 2), maintain an angler catch rate of at least 0.5 trout per hour as measured by a 3-year average of voluntary angler survey box returns.

The Department examined, analyzed, and considered several management alternatives as outlined in the body of this management plan (page 35). In order to meet the objectives of this plan and provide desired angling opportunities for a range of anglers, while maintaining a healthy wild trout population, the Department will adopt the **Preferred Alternative** which utilizes three distinct fishery management zones.

Zone 1 - Box Canyon Dam downstream to Scarlett Way in Dunsmuir. Trout limit, zero; artificial lures with barbless hooks required; recommend both Wild Trout and Catch-and-Release (C/R) designation. Trout stocking is prohibited per Wild Trout Policy (see Attachments section).

Zone 2 - Scarlett Way downstream to the county bridge at Sweetbriar. Trout limit, 5; no special gear restrictions; recommend put-and-take designation with the stocking of approximately 20,000 catchable, Mt Shasta-strain, rainbow trout per year.

Zone 3 - County bridge at Sweetbriar downstream to Shasta Lake. Trout limit, two; artificial lures with barbless hooks required; recommend both Wild Trout and C/R designation pursuant to section 1726 of the Fish and Game Code (see Attachments section).

Tributaries - Confluent tributary streams should have the same angling regulations as the associated zone, except for Castle Creek and Soda Creek. Angling regulation recommendations for these steams will be zero limit, with artificial lures with barbless hooks.
All tributaries to the upper Sacramento River will be managed for wild trout. This means that there will be no stocking of domestic strains of catchable hatchery trout, per Wild Trout Policy. This policy does not include waters of the upper Trinity Divide.

* The above angling regulation recommendations will be made to the California Fish and Game Commission in October 2001, as part of the normal regulation cycle. If adopted by the Commission, they will become effective for the 2002 fishing season.

This **Preferred Alternative** was chosen based on the overall biology of the trout population in the upper Sacramento River and the desires of a wide range of anglers with a vested interest in this water. Our willingness to expand the catch-and-keep area is based on several observations indicating that some trout stocking is not severely detrimental to the wild trout population. Our choice not to return to more extensive stocking, but to instead manage more of the river (compared to pre-spill) for wild trout, is based on a concern that return rates of stocked trout in lower areas of the river do not meet Commission policy, that more extensive stocking can be detrimental to the wild trout population and the wild trout fishery for various reasons, and the need to provide wild trout refugia: Refugia will provide a healthy, genetically robust wild trout population to assist in reestablishing the trout population should another catastrophic event occur. Also, current data indicate that by encouraging catch-and-release angling while allowing limited harvest in Zone 3, the river will be capable of realizing its full potential as a world-class wild trout fishery, benefiting both anglers and the local business community.

These regulations and management tools will be part of a program requiring periodic evaluation to determine success. Success will be determined based on the stated objectives of this plan. However, this should not be construed to mean that angling regulations should be adjusted at each regulation cycle. Stated another way, it is best to set angling regulations that are appropriate and stable, which allow the trout population to undergo natural cycles, and that do not attempt to mirror trout population trends.

Designation of Wild Trout and Catch-and-Release Areas

In October 2000, the Department will recommend that the California Fish and Game Commission designate Zone 1 and Zone 3 as both Wild Trout and Catch-and-Release waters in conformance with Wild Trout Policy and sections 1726 and 1727 of the Fish and Game Code (see Attachments 1 and 2). This designation will encourage the Department to continue utilizing artificial lure regulations and reduced bag limits in these areas, and allow the consideration of minimum or maximum size restrictions to further enhance the quality of the wild trout fishery. The Catch-and-Release designation allows a zero, one or two-trout bag limit, depending on the most appropriate management strategy.

Designation of Put-and-Take Area

In October 2001, the Department will recommend that the California Fish and Game Commission expand the existing Dunsmuir catch-and-keep area downstream to the county bridge at Sweetbriar (Zone 2), with a five-trout limit and no special gear restrictions. This will allow continued stocking of catchable hatchery trout in about 10 miles of the river. This reach will be managed as a put-and-take fishery.

In summary, the Department believes that this management strategy will provide ample protection of the wild trout population and the associated fishery, will insure a genetically robust wild trout population, and will provide exceptional opportunities for most types of trout anglers.

PREFACE

Almost 38 miles of the Sacramento River became an isolated stream first by completion of Shasta Dam in 1944 cutting off the river from most of its historic length, then further upon completion of Box Canyon Dam in 1969 interrupting the biological connection between the upper river and its headwaters. The Department of Fish and Game (Department) managed this area, which has come to be known as the upper Sacramento River, primarily as a put-and-take fishery (see Stocking of Trout, page 15) until 1982 when the lower 14 miles (Shotgun Creek to Shasta Lake) was formally designated as a Catch-and-Release water by the California Fish and Game Commission (Commission). This area of the river was managed to encourage a self-sustaining wild trout population by minimizing angler harvest through reduced bag limits; no other special regulations were imposed. The remaining 24 miles of river continued to be managed primarily as a put-and-take fishery, but wild trout were also caught and kept. This management regime continued until July 1991.

The Cantara Spill, which occurred in July of 1991 (see Cantara Spill), resulted in a total kill of essentially all aquatic life from the Cantara Loop to Shasta Lake. The Commission imposed a total prohibition on angling in the entire upper river for the three years following the spill to allow the native fauna and flora to recover from this devastating event.

Beginning in 1994, angling was allowed in the entire upper river under two distinct management schemes. Almost 32 miles of river were opened to catch-and-release angling with a zero-limit, and artificial lure with barbless hooks gear restriction. Six miles of the river surrounding Dunsmuir were opened to angling with a five-trout limit and barbless hooks gear restriction. The barbless hook requirement was eliminated from this reach in 1998. The Department planted between 12,000 and 19,000 catchable-sized trout per year in this reach between 1994 and 1998. Other significant actions and studies were undertaken to expedite and quantify the recovery of the fishery (see Attachment 4).

This fishery management plan briefly outlines the river's history and recommends a course for the Department's management of the river for the next five years (2000 to 2005). This document is not intended to serve as major treatise on the upper Sacramento River; most of the river's available history can be found in other places. Rather, this document is intended to guide how the Department plans to manage and monitor the river to insure the fishery and its associated benefits are maximized for the public. The Department's goal for this area of the river is to provide a diversity of angling opportunities, while protecting populations of native wild trout and other aquatic species.

GENERAL RECOMMENDATIONS

Maintain a diversity of angling opportunities in the upper Sacramento River.

Managing the upper river for both put-and-take angling and catch-and-release angling is justified from a biological and fishery management perspective, considering all available data. The river has been largely catch-and-release with zero bag limit since 1994, except for the Dunsmuir reach. The number of angler hours has increased and the business community appears to be benefitting from the current regulations by attracting large numbers of fly and lure anglers seeking a quality, wild trout experience, and by attracting anglers interested in catching and keeping trout, both wild and planted in the Dunsmuir reach. This management strategy for the upper Sacramento seems to provide ample resource protection, while affording a range of angling opportunities attracting a wide range of anglers and tourists to the area.

Maintain quality trout habitat.

This can be accomplished by monitoring and regulating various land use activities which negatively affect trout habitat. The Rapid Biological Assessment technique can be employed to monitor trout habitat from a fishery independent perspective. Utilizing this technique and working closely with private landowners and regulatory agencies can insure that quality trout habitat is maintained.

Maintain a trout monitoring plan.

This can be accomplished by a combination of creel surveys, voluntary angler survey boxes, snorkel surveys of established index reaches, and electrofishing surveys.

Insure an adequate number of access points.

Efforts should be continued to develop new river access points and to “legalize” those access points currently used illegally. This will require that the Department and the local community pursue agreements with landowners and possibly assist angler organizations with outright land purchases.

RESOURCE STATUS

Description of the Area

General Setting

The "upper Sacramento River" is defined as that segment of the Sacramento River upstream of Shasta Lake and downstream of Box Canyon Dam (Lake Siskiyou) in Northern California. The upper Sacramento River flows southerly through Siskiyou and Shasta counties into the northern end of Shasta Lake (Figure 1).

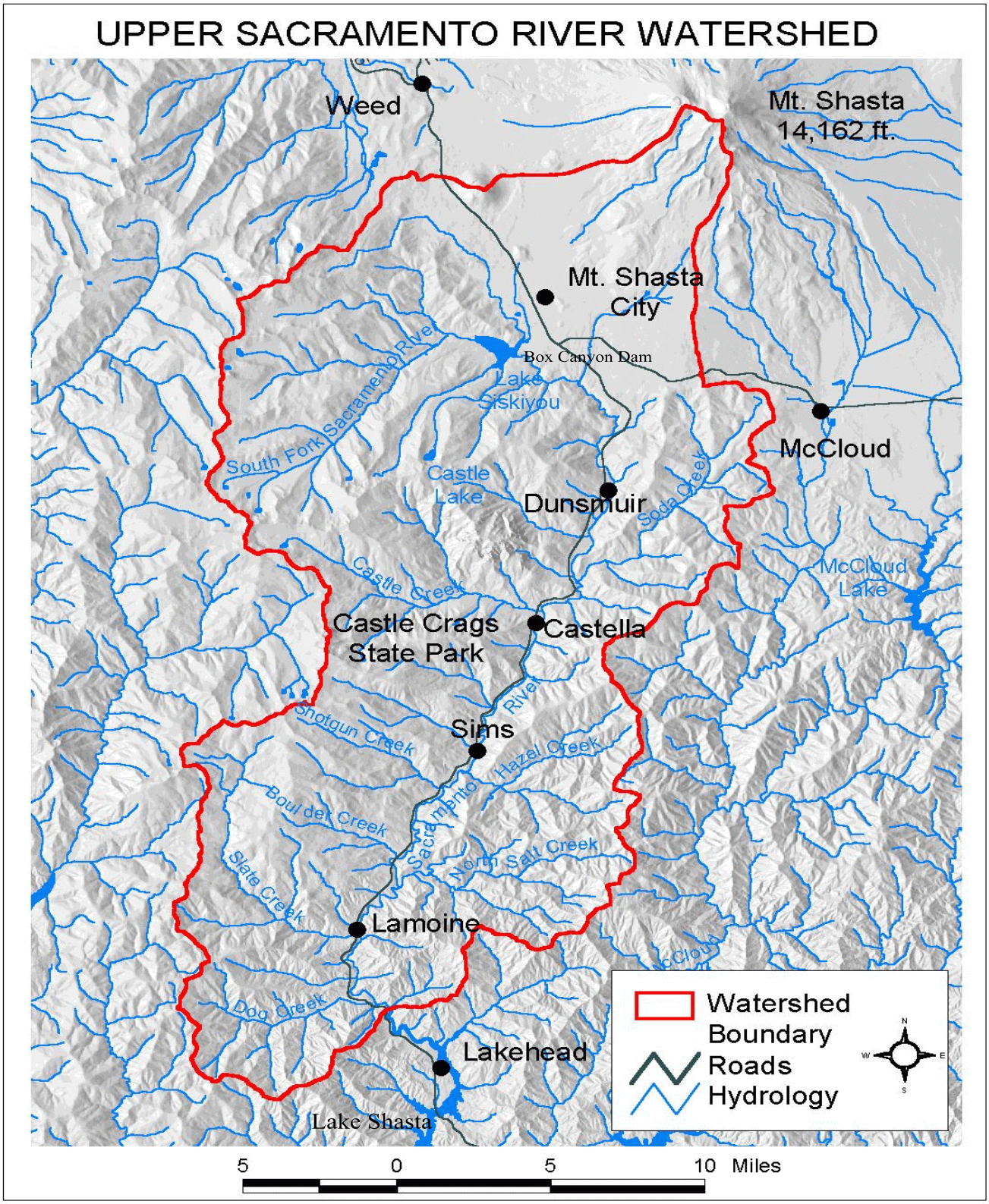

Figure 1. Upper Sacramento River, watershed boundaries and major tributaries.

The Sacramento River originates on the east slopes of the Trinity Divide, Siskiyou County, as the north, middle and south forks. In 1969, Box Canyon Dam was built several miles downstream from the confluence of the three forks, creating Lake Siskiyou to provide recreational opportunities. Lake Siskiyou is purported to be the only lake in California created solely for recreation. Dam operation is designed to optimize downstream water temperatures for trout and to provide for a minimal flow release of 40 cubic feet per second (cfs). Its power production is run-of-the-river, and does not cause dramatic, unnatural fluctuations in stream flow.

From Box Canyon Dam, the river flows approximately 37.3 miles to the full-pool mark of Shasta Lake. All but approximately 2.3 miles of this reach is downstream from the Cantara Loop where the metam sodium spill occurred in 1991. The Cantara Loop is defined and discussed in the Cantara Spill section of this plan. Flows during the late summer and early fall average approximately 50 cfs near Cantara Loop, 100-200 cfs just above Castella, and 200-300 cfs at the Delta Gaging Station near Shasta Lake. Stream elevations range from about 3,000 feet above sea level at Box Canyon Dam to 1,067 feet at Shasta Lake (full-pool), resulting in an average stream gradient of 49 feet per mile.

The upper Sacramento River is a highly productive, cold-water, freestone mountain stream for most of its length. This quality is due in part to the cold, nutrient-rich, and well-oxygenated water emanating from Lake Siskiyou and numerous tributary streams and springs downstream of Box Canyon Dam. Riverine habitat types are variable and representative for a stream of this type, and include pools, runs, riffles, cascades, and pocket-water. The relative abundance of habitat types, habitat dimensions and environmental conditions vary along the length of the river. For example, the river's late-summer average water temperature ranges from the low 50's ^{o}F above the Cantara Loop to the high 60's ^{o}F near Shasta Lake. The upper river is generally swifter and of steeper gradient, with longer riffles and shorter, shallower pools than the lower river. These differences in river characteristics result in relative species abundance, productivity, and biomass variability along the length of the river.

Land Ownership

Land ownership in the basin is both public and private, with private ownership dominating the river corridor. The Union Pacific Railroad Company (UP) owns a large area of land associated with the railroad tracks running nearly the entire length of the upper Sacramento River. Smaller private land owners, including numerous individuals, control much of the remainder. Except for Castle Crags State Park, the U.S. Forest Service campground at Sims, City of Dunsmuir property, and the Department-owned Ney Springs and Cantara Wildlife Areas, very little land along the upper Sacramento River is owned or controlled by public agencies.

Public Access

Both Interstate 5 and the Union Pacific Railroad parallel the upper Sacramento River for more than 30 miles between Lake Shasta and the Cantara Loop. With these major transportation

facilities in such close proximity, physical access for anglers along the river is relatively abundant. However, the vast majority of current access points involve illegal ingress and egress from a controlled access freeway (illegal parking along Interstate 5), trespass across private lands or unauthorized use of the UP right-of-way.

Relatively few river access points are in public ownership, and these tend to be unevenly distributed. Most of the developed sites provide access to the upper river between Castella and Box Canyon Dam. These include three sites managed by the Department; Ney Springs (River Mile 37), Cantara Loop (River Mile 36), and Prospect Avenue (River Mile 33). All were purchased in the early to mid-1980's as public fishing accesses. The Cantara and Ney Springs sites were re-designated as the Cantara/Ney Springs Wildlife Area in 1996 to better manage public use. California Trout purchased 61 acres downstream from the Wildlife Area (including the site of the 1991 derailment) as an angling access in 1996. Additional access to the upper river is provided at Dunsmuir City Park (River Mile 32) and Castle Crags State Park (River Miles 25-26). Riverside camping and picnicking sites are featured at the park as well as more than a mile of foot trail along the river between Castella and Soda Creek.

The lower 24 miles of the river corridor are served by only three sites on lands managed by the Shasta-Trinity National Forest. Sims Campground (River Mile 16) offers camping and day use facilities and is a popular put-in site for boaters during the rafting season. A new day use facility was constructed in 1998 on Forest Service land at Pollard Flat (River Mile 7) with funding from the Cantara Trustee Council. Access to the lowermost reach of the river is available at the confluence of Dog Creek (River Mile 1). However, no facilities are provided at this site.

In 1997, Union Pacific began posting its right-of-way and issuing trespass warnings to anglers parked along the tracks. Subsequent meetings with the railroad and members of the community resulted in changes in the language on the signs and a clarification of UP policy regarding public use of the right-of-way. More important, these community-based meetings pointed out the need for additional discussions regarding public access to the river. A river access steering committee has been meeting since October 1998 to identify constraints and opportunities for river access sites that meet the needs of anglers, property owners, and other river users. The committee intends to recommend community-based projects to address problems at existing access points as well as develop new access sites that are compatible with the environment.

History of the Fishery

Angler Use and Success

Angler use and success must be separated into pre- and post-spill categories. Knowledge of pre-spill angler use is limited to information obtained from four creel surveys (1978, 1979, 1980, and 1986). The 1979 and 1986 creel surveys were conducted for only a portion of the season. Hatchery trout were marked with a fin clip to allow anglers and survey clerks to easily determine if trout were of hatchery or wild origin.

Angler Surveys: Pre-Spill

In 1978, bait anglers dominated the fishery and hatchery trout dominated the catch. However, as distance increased from stocking sites, the contribution of wild trout to the catch increased. The catch of wild trout exhibited peaks early and late in the season while the catch of hatchery trout was relatively constant. The average length of wild trout caught was 11.2 inches, with the average being larger in lower river sections as compared to upper areas. Scale analysis showed a faster growth rate for wild trout in the lower river as compared to the upper river. No catch per unit effort (trout/hour) data were obtained. This survey was conducted over the entire fishing season.

In 1979, bait anglers remained the dominant anglers. Interviews conducted with 254 anglers indicated that 30 wild trout (10%) and 270 hatchery trout were harvested (no expansions of these data were made). The catch rate was estimated to be one fish/hour for hatchery trout, and 0.1 fish/hour for wild trout. The average length of wild trout creeled was 9.6 inches, with almost 70% being less than 10 inches. Few anglers caught wild trout, and most of those who did, released them. This creel survey was conducted between 20 September and 15 November.

In 1980, the creel survey was conducted for the entire season. The documented harvest (from creel sampling) was 702 wild (19% of harvest) and 2,990 hatchery trout. The harvest of wild trout peaked in June and was low for the remainder of the season; 85% were caught before Labor Day. The average catch rate was 0.5 fish/hour for hatchery trout and 0.1 fish/hour for wild trout. The average length of creeled, wild trout was 10.3 inches. From electrofishing surveys, the average length of wild trout was 10.2 inches at Dog Creek and 8.8 inches at Soda Creek.

During the 1980 survey we determined that: 1) more than ⅔ of anglers favored adoption of catch-and-release regulations for at least some portion of the river; 2) the area downstream of Sims Campground was being used primarily as a catch-and-release area; 3) few wild trout were being caught in the areas stocked with hatchery trout; and, 4) about 128 hatchery trout planted in 1979 survived the winter, as determined by expansion of creel data (only four were seen in angler creels in 1980).

In 1982, the California Fish and Game Commission designated the 14 miles from Shotgun Creek downstream to Shasta Lake as a Catch-and-Release area, and established a two-fish limit with no gear restrictions. As a result, the Department began managing this area for wild trout and discontinued stocking.

In 1986, bait anglers still dominated the fishery and they both creeled and released the largest number of wild and hatchery trout. However, their catch rate was lower than that for anglers using artificial lures and flies. The average catch rate for hatchery trout was 0.4 fish/hour and 0.1 fish/hour for wild trout. The average length of wild trout was 12.9 inches, with almost 60% being greater than 14 inches. The average size of wild trout found in stocked areas was significantly smaller than the size of wild trout found in un-stocked areas. A majority of

anglers favored no stocking in the Catch-and-Release area as well as continued stocking of upper river areas. As compared to the1980 results, the percentage of trout released increased from 26 to 37% and fewer wild trout were creeled. The average length of wild trout increased significantly compared to 1980.

Angler Surveys: Post-Spill

Since the Cantara spill, the upper Sacramento River has been one the most studied waters in California. This is certainly justified given the magnitude of the environmental disaster and the associated litigation. More important however, these studies provide the Department, the Commission, and the public with increased knowledge and information in developing recommendations and making decisions regarding fishery management of the river. Changing angling regulations is one of the most significant management tools available for controlling fish mortality.

Angler surveys on the upper Sacramento River since 1994 have provided the Department with estimates of the numbers of trout harvested and lost to hooking mortality, estimates of the hours of fishing use, and estimates of the types of anglers using the two different management areas of the river. Estimates of angler-induced mortality on wild rainbow trout (trout harvested and those lost to hooking mortality) were relatively high in the Dunsmuir area where bait angling and harvest was allowed. Most of the harvest in this area was by bait anglers, who kept 71% of the trout they caught in 1996. In contrast, fly anglers kept only 8% of the trout they caught in this same area.

Good river access, the ability to use bait, the presence of hatchery trout, and the ability to harvest trout are all factors leading to higher angler use in the Dunsmuir reach. Fifty-eight percent of the anglers fishing in this reach during 1996 used bait, followed by 30% using flies, and 12% using lures (Turek 1998). The rate of fishing effort (hours fished/mile of river/day) in the Dunsmuir reach is about double the effort in the upper reach above Dunsmuir, and quadruple the effort in the lower reach below Dunsmuir (Table 1). The moderate use in the catch-and-release, upper reach is higher than expected given the poor accessability and rugged terrain in this area. More than 90% of the anglers in this reach used flies in 1996 with the remaining anglers using lures. The catch-and-release, lower reach is somewhat remote and rugged in most areas, which likely explains the low use of this area compared to the rest of the river. Eighty-two percent of the anglers in this area used flies in 1996, followed by 14% using lures and 4% illegally fishing with bait.

The diversity of angling opportunities and good access in the Dunsmuir reach results in the highest angler use on the upper Sacramento River. Harvest and hooking mortality associated

with bait angling substantially decreases the number of wild trout in this reach each year. This harvest has been offset by supplemental stocking of hatchery trout and the catch-and-release regulations upstream and downstream of the reach. The current 32 miles of catch-and-release water provides ample recruitment of wild trout as indicated by the recovery of the fishery.

Table 1. 1994, 1995, 1996 and 1997 Upper Sacramento River Creel Survey totals for effort, catch, and catch-per-unit-effort by reach and catch-per-unit-effort for angler survey boxes during 1995, 1996 and 1997.

		Effort			Catch			Catch-per-unit-effort	
Reach	Year	Hours fished	SE	Hours fished/ mile/day	Trout caught	SE	Trout caught/ mile/day	Creel Survey Trout/hour	Survey Box Trout/hour
Lower[a]	1994	33587.2	1431.94	6.4	25468	1761.79	4.8	0.76	.n/a
	1995	31753.4	1697.15	6.1	14282	1369.57	2.7	0.45	0.74[b]
	1996	28188.5	2055.74	5.3	20833	2507.65	3.9	0.74	0.86[b]
	1997	31841.4	2738.19	6.0	19944	2327.36	3.7	0.63	1.09[b]
Dunsmuir[a]	1994	30671.9	1129.77	24.6	27032	1659.65	21.7	0.88	
	1995	30573.8	1229.02	24.5	25364	1876.84	20.3	0.83	1.21[c]
	1996	30898.9	1372.14	24.5	31487	1969.23	24.9	1.02	1.62[c]
	1997	29821.9	1648.21	23.5	31981	2390.98	25.1	1.07	0.48[c]
Upper	1994	13877.9	754.08	11.1	9165	789.35	7.4	0.66	
	1995	16827.7	1358.55	13.5	9302	1045.54	7.4	0.55	1.21[d]
	1996	14339.6	1134.64	11.4	11244	1558.86	8.9	0.78	1.48[d]
	1997	16910.6	1874.48	13.4	12009	1354.76	9.5	0.71	0.80[d]
Total	1994	78137.0	1973.70	10.1	61666	2545.86	7.9	0.79	
	1995	79154.9	2095.43	10.3	48949	2547.82	6.3	0.62	1.00[e]
	1996	73427.0	2719.60	9.3	63565	3549.12	8.1	0.87	1.37[e]
	1997	78573.8	3705.13	10.0	63935	3601.22	8.1	0.81	0.85[e]

[a]Data for roving creel surveys conducted in the Lower and Dunsmuir Reaches are analyzed using only angler efforts that are equal to ½ hour at the time of the interview as recommended by Pollock, Jones, and Brown (1994).

[b]Combined Catch-per-unit-effort for the State Park, Sims, and McCardle Flat angler survey boxes during 1995, 1996 and 1997.

[c]Catch-per-unit-effort for the Dunsmuir City Park angler survey box during 1995, 1996 and 1997.

[d]Catch-per-unit-effort for the Prospect, Cantara, and Ney Springs angler survey boxes during 1995, 1996 and 1997.

[e]Catch-per-unit-effort for all seven upper Sacramento River angler survey boxes during 1995, 1996 and 1997.

Stocking of Trout

Three species of trout were once stocked in the upper river, rainbow trout, brown trout and eastern brook trout. Rainbow trout were by far the most prevalent. Domestic catchable rainbow trout have been planted in the upper Sacramento on a regular basis since at least 1930, except for 1992 and 1993, when no domestic strains of fish were planted. Catchable brown and brook trout were planted in 1963 and 1983, respectively. Sub-catchable brown trout were also planted in 1970. No other fish species were planted by the Department. Trout were planted from well above Dunsmuir downstream to Shasta Lake at many locations. Trout were planted at a smaller size (usually 3-5/lb.) until the late 1980's when the Department adopted a policy to increase the size of catchable (stocked) trout to 2/lb. Rainbow trout were planted, ranging from 55,497 (1990) to more than 700,000 (1970) per year, averaging about 80,000 per year. Historically, the highest stocking level was more than four million trout in 1936 (most of these fish were of 'sub-catchable' size).

Post-spill stocking numbers (domestic strain, catchable trout) ranged from zero in 1992 and 1993 to a high of 19,000 in 1998, averaging about 15,000 during the years when hatchery stocking occurred. All these fish were planted in the Dunsmuir reach. Catchable-sized trout were planted to provide angling opportunity on a put-and-take basis. No domestic strains of hatchery trout were planted in the upper or the lower reaches of the upper Sacramento River after the spill.

However, in an effort to speed up the recovery process, the Department obtained eggs from wild, local trout, which were reared the Mt Shasta Hatchery for release to the upper Sacramento. Unfortunately, these wild progeny experienced a high mortality rate at the hatchery and the program was discontinued.

Nearly all trout planted in the upper Sacramento River were spawned and reared at the Mt. Shasta Fish Hatchery from stock originating from either the Sacramento or the McCloud rivers.

Cantara Spill

The event known as the Cantara Spill is well documented in other publications and will not be covered in detail in this document. The reader is referred to the Natural Resource Damage Assessment Report (NRDA) published by the Department of Fish and Game on October 15, 1991 for complete detail and analysis.

The Cantara metam sodium spill occurred on the night of July 14, 1991, when a Southern Pacific railroad train derailed on a curved stretch of track known as the Cantara Loop, a relatively sharp 14 degree curve. The California Public Utilities Commission reported that between 1977 and 1991, no less than 36 separate derailments occurred along this section of track. In this event, several cars slipped off the track bed and toppled into the river just upstream of Dunsmuir. One of these cars was a chemical tank car carrying a potent soil fumigant (pesticide) called metam sodium. The tank car ruptured spilling at least 19,000 gallons of the

chemical directly into the river. The chemical quickly dispersed into the swift moving river and formed several highly toxic compounds. These compounds killed all aquatic life in the river and much of the riparian vegetation along the river. The chemicals were apparent in the river and a small portion of Shasta Lake for nearly two weeks. The spill event, the fate of chemicals, and subsequent actions are thoroughly covered in the NRDA report.

The Department and the Commission took several actions to hasten the recovery of the river and associated resources. One of these actions aimed at reestablishing the wild trout population was a moratorium on angling for the three years following the spill (remainder of 1991, and all of 1992 and 1993).

Description of the Current Fishery

Aquatic Species Present (including fish from Lake Shasta)

Native rainbow trout are the dominant salmonid in the upper Sacramento River, comprising approximately 99% of the wild trout population; introduced wild brown trout make up the remainder. Other native fish species present include hardhead, Sacramento pikeminnow (squawfish), California roach, riffle sculpin, Sacramento sucker, and speckled dace. Non-native species such as smallmouth bass, Alabama spotted bass, and channel catfish are also found in the lower reaches of the river, primarily near and below the confluence of Dog Creek (approximately 36 miles downstream from Box Canyon Dam) The Sacramento sucker and the riffle sculpin are the only representatives of the Catostomidae and Cottidae families known to inhabit the upper river. Based on fish carcass surveys subsequent to the Cantara Spill, the riffle sculpin was the most abundant fish species in the upper river (Cantara Trustee Council, 1997).

Within the broad habitat categories of riffle, pool, run and pocket-water, fish generally orient either to the bottom, living amongst the substrate (sculpin) or at the bottom (sucker), or up in the water column (trout, pikeminnow, hardhead). Trout and sculpin are generally found in all major habitat types, while pikeminnow, hardhead and suckers prefer the quieter habitat found in pools. Young of all species, except sculpin, are usually found in shallow, quiet water along stream margins or backwater areas.

Along the length of the upper Sacramento River, species distribution varies with upstream areas inhabited almost exclusively by trout and sculpin. Other fish species increase in abundance downstream, making up approximately 45% of the fish population near the mouth of Dog Creek. Smallmouth and Alabama spotted bass, channel catfish, speckled dace and California roach inhabit the quieter areas of the lower river.

Trout Habitat

Trout habitat in the upper river is in generally good to excellent condition at this time. The run-of-the-river operation of Box Canyon Dam allows high winter flows to scour and clean the channel, redistributing gravel and cobble while washing excessive sediment to Shasta Lake.

However, according to a report prepared by the California Regional Water Quality Control Board, Central Valley Region (*1997-98 Annual Report; Identification and Control of Pollution Sources in the Upper Sacramento River)*, several tributaries were identified as chronic or significant sources of sediment, including Little Castle Creek, Castle Creek, and Flume Creek. There is no current evidence that these sources of sediment are adversely affecting the wild trout population. Water temperatures also are good to excellent for trout in most of the river.

The lower river warms enough in summer and is low enough in gradient that warm water species from Shasta Lake can be found a few miles upstream by late summer and early fall. In these areas, competition and predation may be a concern, but due to warm late summer and early fall water temperatures, trout habitat in this area is marginal.

The many tributary streams which enter the upper river downstream of Box Canyon Dam appear to be providing adequate recruitment of spawning gravel and large woody debris. Based on observations of young-of-the-year trout and the relatively rapid recovery of the wild trout population following the spill, the Department does not believe juvenile recruitment is a limiting factor in the upper Sacramento River. Large woody debris necessary in many salmonid streams to provide cover for trout is deposited in the river during large storm events. In the upper Sacramento much of this important habitat component is washed through the system to Shasta Lake. However, the volume of woody debris present and the complexity of cobble and boulder elements in the channel appear to be providing quality trout habitat.

Based on habitat typing surveys conducted by Cantara staff, the river is approximately 25% pools, 40% riffles, and 35% runs (Figure 2). Cascades and pocket water are included in riffles. A more detailed breakdown by river section and by year is shown in Table 2. Note that the data from 1997 reflect the condition of the river following the January 1997 flood event. The upper river is generally more swift and of steeper gradient, with longer riffles and shorter, shallower pools than the lower river. This, combined with increasing summertime water temperature (the lower river is considerably warmer than the upper river), creates the variability seen in trout habitat quality between the upper and lower sections of the upper Sacramento River.

Trout Populations

Prior to the Cantara spill, population estimates for wild rainbow and brown trout in the upper Sacramento were not made. Based on carcass recovery surveys conducted by Cantara staff and others immediately after the spill, it was estimated that the wild trout population was approximately 6,700 to 8,800 fish per mile. However, this estimate, while generated using sound statistical analysis, must be used with caution because it includes trout of all size classes and is based on a “body count”, and is therefore not directly comparable to most other fish population estimation techniques, such as snorkel surveys.

Electrofishing surveys were conducted in selected areas in 1980 and again from 1993 through 1998. The results of these efforts are summarized in Table 3 and Figure 4. The mean length of fish captured ranged from 9.11 inches in 1980, to a high of 10.51" in 1993, and a low of 8.83" in 1996.

Table 2. Breakdown of habitat types of the upper Sacramento River for 1995 and 1997.

Percentage of Habitat Types:

		1995	1997
Run 1 (Upper River)	Pool	29.21	28.77
	Riffle	33.34	36.04
	Run	37.45	35.19
Run 2	Pool	22.96	20.93
	Riffle	36.57	40.34
	Run	40.47	38.73
Run 3	Pool	27.22	25.93
	Riffle	41.64	42.02
	Run	31.14	32.06
Run 4 (Lower River)	Pool	19.72	32.44
	Riffle	41.42	35.27
	Run	38.86	32.29
Total (overall)	Pool	25.43	26.55
	Riffle	39.62	39.78
	Run	34.95	33.6

Systematic snorkel surveys were conducted in the upper river to estimate the number of rainbow trout larger than four inches from 1992 through 1999 by Tom Payne and Associates (TRPA) under a contract administered by the Cantara Program. A summary of these results is provided in Figure 3. However, as noted above, these estimates cannot be directly compared to the carcass count numbers, since only fish greater than four inches were counted, and not all fish were seen by dive teams. Therefore, the total number of fish present is certainly higher than the number reported. Therefore, the number of fish reported should be considered as an index from which trends in abundance can be observed as the population fluctuates from year to year. Trout numbers appeared to rebound steadily to the high of 2,688 fish per mile (snorkel survey estimate) in 1996, then numbers decreased in 1997 (1,359/mile) and 1998 (1,096/mile), most likely due to the extreme flood event of January 1997 and the record rainfall and corresponding sustained high flows of 1998.

It appears that the trout population of the upper river in 1996 was approaching recovery from the effects of the Cantara Spill. However, the winters of 1997 and 1998 were severe and are likely the primary factor for the lower trout numbers, as compared to 1995 and 1996. Monitoring planned for 1999, 2000 and 2001 should provide adequate information to determine if a point of natural equilibrium has been reached, or if the population is still expanding.

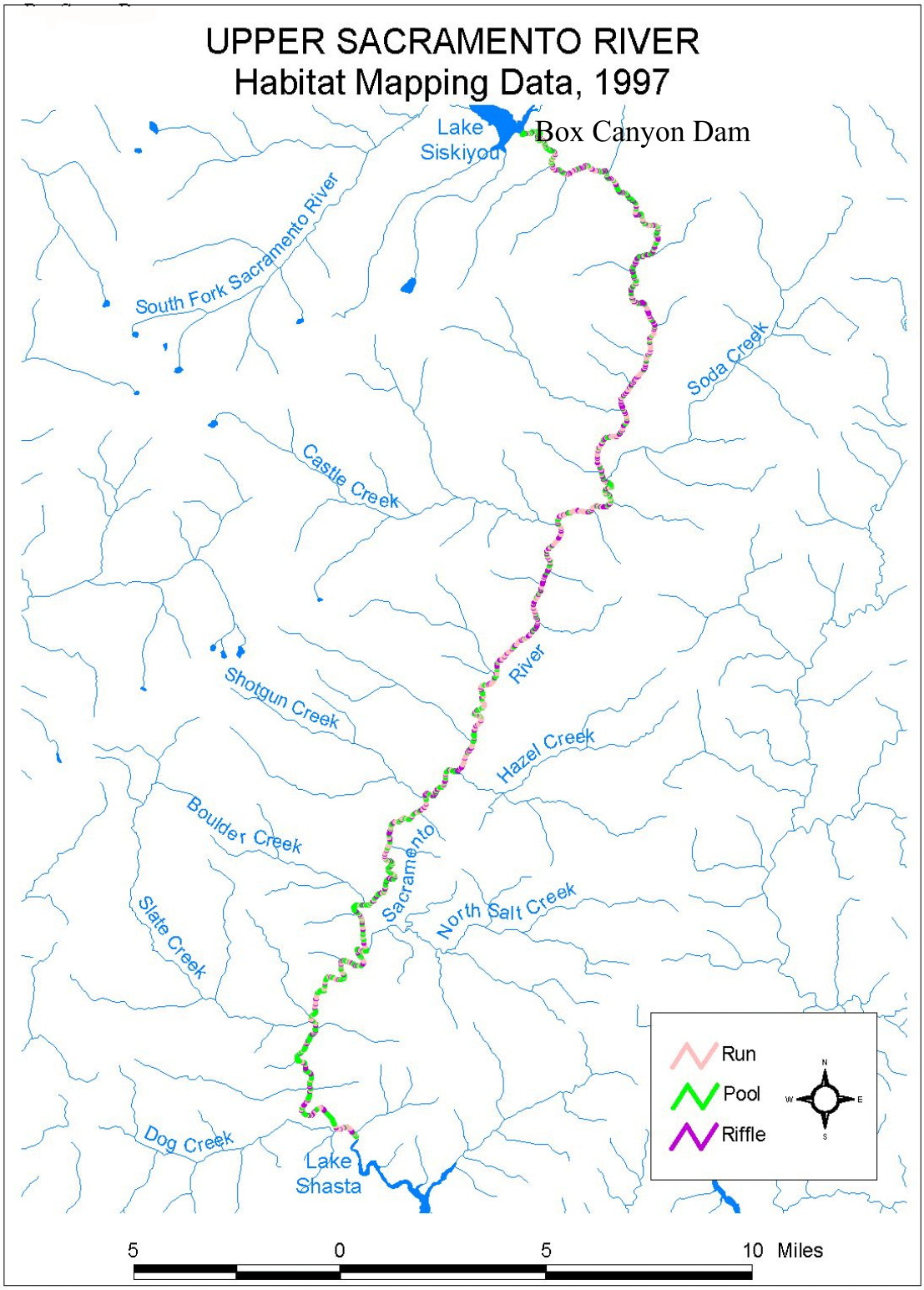

Figure 2. Occurrence of dominant habitat types in the Upper Sacramento River. Note increasing occurrence of pool habitat in the lower river areas.

Table 3. Summary of electrofishing survey data for the upper Sacramento River from 1980, 1993, and 1997.

Location	Date	Wild Rainbow Trout	Hatchery Rainbow Trout	Wild Brown Trout	Hatchery Brown Trout	Sacramento Sucker	Pikeminnow	Bass
Dog Creek	11/24/80	62	0	6	0	0	0	1
McCardle Flat	11/13/80	99	1	3	0	2	0	0
Sims Flat	11/20/80	82	7	0	0	84	1	0
Castella Middle	10/30/80	128	13	1	1	25	0	0
Above Soda	11/03/80	90	5	0	0	0	0	0
Prospect Ave.	11/26/80	39	1	0	0	0	0	0
Stink Creek	10/29/80	59	2	0	0	0	0	0
Ney Springs	11/06/80	104	1	0	0	0	0	0
Total		663	30	10	1	111	1	1

Location	Date	Wild Rainbow Trout	Wild Brown Trout	Riffle Sculpin	Sacramento Sucker	Pikeminnow	Bass	Green Sunfish	Speckled Dace
McCardle Flat	11/03/93	80	3	0	28	13	2	0	1
Sims Flat	11/04/93	125	2	2	39	12	0	0	0
Above Soda	11/05/93	52	0	0	0	0	0	0	0
Prospect Ave.	11/16/93	111	0	0	0	0	0	0	0
Ney Springs	11/09/93	107	1	19	0	0	1	1	0
Total		475	6	21	67	25	3	1	1

Location	Date	Wild Rainbow Trout	Hatchery Rainbow Trout	Chinook Salmon	Riffle Sculpin	Sacramento Sucker	Pikeminnow	Bass
Dog Creek	11/03/97	94	15	1	9	4	9	11
Sims Flat	12/01/97	112	0	0	3	0	11	0
Castella Lower	12/03/97	101	0	0	2	0	0	0
Financial Ave.	12/02/97	98	9	0	3	0	0	0
I-5 Pool	11/20/97	99	0	0	8	0	0	0
Prospect Ave.	11/17/97	91	3	0	28	0	0	0
Ney Springs	11/12/97	114	0	0	21	0	0	0
Total		709	27	1	74	4	20	11

Note: The above data represent population samples, not population estimates.

However, a determination of a recovered trout population will be based on sound professional judgement, based on available information, and not based on rigorous statistical tests. This is due to the lack of statistically valid population estimates prior to the Cantara spill.

Trout Growth

Historically, rainbow trout growth in the upper Sacramento River was considered good and compared well with most other cold, freestone streams of California. Trout growth in the upper Sacramento was historically almost 1.5 times greater than the nearby lower McCloud River.

Trout growth is determined from an analysis of scale samples taken from trout in a particular body of water, and from many size classes of fish. Scales were taken from trout in the upper Sacramento River and analyzed for age/length relationships by the Department in 1978 and 1981, and by Cantara staff in 1991 through 1998. Scale sets from 1991, 1994, and 1996 were analyzed by a graduate student from Humboldt State University under the direction of Dr. David Hankin (Glowacki, 1998).

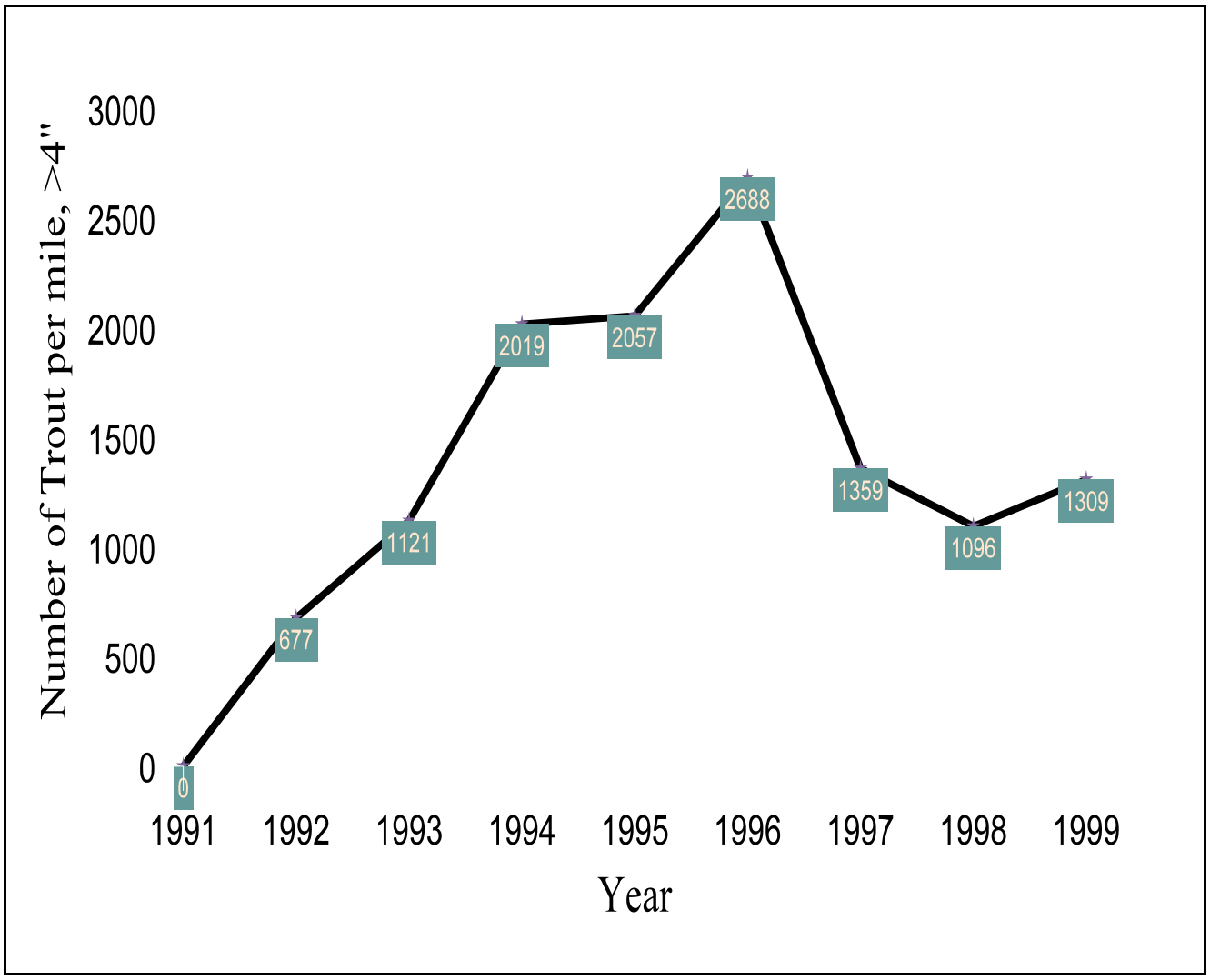

Figure 3. Annual trend in abundance of rainbow trout larger than 4 inches in length (trout per mile), as determined by snorkel survey; Thomas R. Payne & Associates data.

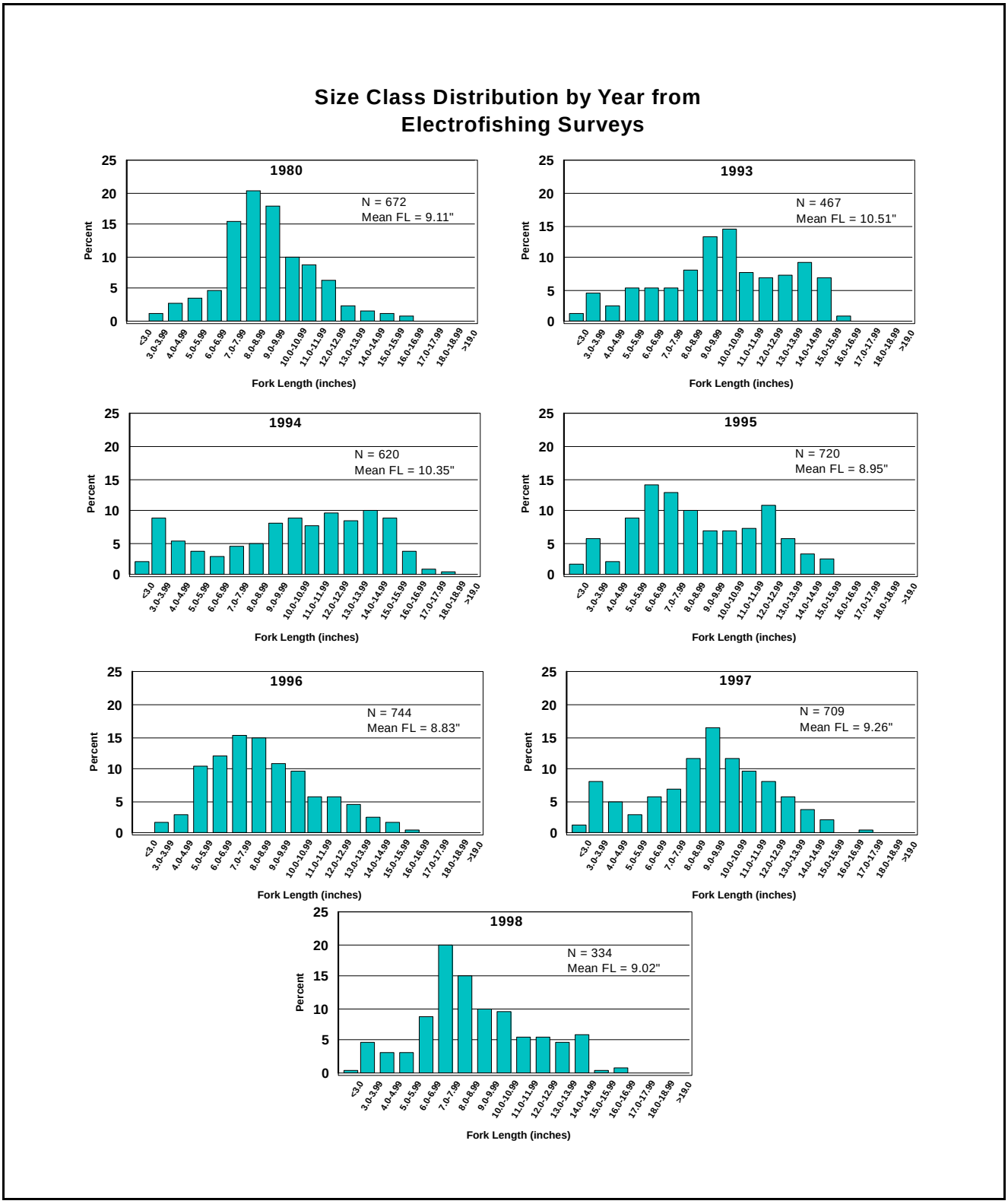

Figure 4. Size distribution of rainbow trout captured during electrofishing surveys in the upper Sacramento River, by year (FL = fork length; N = total number in sample).

The results of work from 1978 and 1981 indicate that rainbow trout in the upper Sacramento reached about 100mm (3.9 inches) in the first year, 216mm (8.5 in.) in the second year, 300mm (11.8 in.) in the third year, 380mm (15 in.) in the fourth year, and 450mm (17.7 in.) in the fifth year.

Scales analyzed by Glowacki from the 1996 sample showed a somewhat slower growth rate for age 1+ through age 5+ trout, with average length at age being104 mm (4.2 in.), 177.8mm (7 in.), 254.6mm (10 in.), 326.5mm (12.9 in.), and 380mm (15 in.), respectively. Dr. David Hankin has postulated that the slow recovery of the riffle sculpin population may account for this observation because sculpin may provide a significant high-protein food source for larger trout. The relative lower abundance of sculpin means trout must spend more energy preying upon less protein-rich food sources such as insects and other small aquatic invertebrates. Consequently, growth rates would likely be slower. At present, there is inadequate information available to properly evaluate this hypothesis, and a combination of factors may be affecting growth rates.

Scales collected from dead trout recovered immediately after the Cantara Spill were found to have a weak correlation (low R^2 value) between scale size and fish length, and consequently did not warrant back-calculations for fish size. Several possible explanations for this observation are discussed by Glowacki (1998), none of which are pertinent to this management plan.

Competition and Predation

Wild trout in the Upper Sacramento compete with other wild rainbow trout and to a lesser extent, with hatchery trout planted as part of the put-and-take program, as well as other fish species. Interactions between wild fish are natural and affect the overall population and average fish size. Hatchery trout can have a dramatic impact on wild fish by competing for food and space. While this is an important consideration in the Upper Sacramento, the subject itself will not be addressed in this plan. The reader is referred to other authors discussing the subject in depth (White, Nehlsen, and Karr, 1994; 1995).

Based on the historical stocking record of the upper Sacramento, one would expect significant influences from hatchery trout upon the wild trout population. Relatively few wild trout should be present and their average size should be small, or their condition factor poor (low). However, based on observations, this does not appear to be the case. First, despite stocking approximately 80,000 to 100,000 hatchery trout per year for more than fifty years, the upper Sacramento has been renown for at least that long as an outstanding wild trout fishery. Second, based on carcass counts, the Cantara Spill provided a dramatic demonstration that wild trout numbers were robust throughout much of the system. Third, based on scale analysis completed by Dr. David Hankin and genetic analysis completed by Dr. Jennifer Nielsen, almost all the rainbow trout recovered in the carcass surveys were wild fish: Dr. Nielsen's work found alleles in tissue samples from carcasses that do not occur in any known hatchery raised trout. And fourth, the natural recovery of the wild trout population was relatively rapid following this devastating event. These observations demonstrate that the negative influences normally attributed to hatchery trout do not appear to have dramatically impaired the wild trout population in the upper Sacramento River.

One reason for this effect may be that hatchery trout do not survive long enough to cause serious harm, at least partly due to the high catch rate of planted trout (69 to 91% are caught by anglers during the year they are planted, Turek 1998), and the inability of hatchery trout to survive rigorous winter conditions. However, some negative influences around stocking locations are evidenced by fewer and smaller wild trout there compared to unstocked areas, and the significant increase in the catch rate of wild trout (from 0.1 fish/hour to nearly 1.0 fish/hour) after cessation of stocking. Whether this is a competition or mixed stock fishery effect is unknown, but probably both factors are at work.

Non-human predation of trout in the upper river is generally limited to birds, other trout, pikeminnow (squawfish), river otters, and possibly spotted bass in the lower river. Predation by birds and other trout is a part of natural mortality and is unavoidable. Pikeminnow are a serious concern in some California waters, but trout in the upper Sacramento have evolved with pikeminnow, and as such they represent an important component of the natural river ecosystem. Further, prior to the completion of Shasta Dam, the river in the area now occupied by Shasta Lake contained many large pools and relatively large numbers of pikeminnow. Control of pikeminnow in the upper river is unnecessary.

The occurrence of spotted bass, a non-native species, in the lower river has caused some concern. A study of the feeding habits of spotted bass was conducted by TRPA under a grant from the Cantara Trust Council (TRPA; 1999). This study found that spotted bass in the lower river do indeed feed primarily on fish, but prey species were primarily juvenile suckers, sculpin, and pikeminnow. The study concludes that the areas occupied by spotted bass are used as rearing areas by fish from Shasta Lake, and that young-of-the-year trout likely to become prey are not found in large numbers in these lower river reaches, primarily due to high water temperatures. Competition may be a concern but more study will be required to fully understand possible effects.

Angler Use and Catch Rates

As can be seen from Table 1 (page 14), angler use varies by river section. Angler use was highest in the Dunsmuir reach and lowest in the lower river. This is somewhat misleading however, since the lower river section is much larger and angler use is expressed in terms of hours fished per mile per day. The total number of hours fished in the lower reach is quite comparable to the much shorter Dunsmuir reach.

During the creel survey period of 1994 through 1997, angler use remained fairly constant and averaged just over 77,000 angler hours per season. This represents a significant increase in angler use compared to 1980 (6,000 angler hours were documented during interviews covering 87% of available fishing days).

Based on creel surveys, catch rates varied between 0.45 and 1.07 fish per hour, overall. Outside the Dunsmuir planted area, catch rates for wild trout varied between 0.45 and 0.78 fish/hour. The standard for a quality wild trout water is at least 0.5 fish per hour. It is interesting to note that based on creel surveys, when the entire river was stocked heavily with hatchery trout, the catch rate for wild trout was consistently 0.1 fish/hour. Further, in 1995 and 1996 the catch rate for wild trout in

the Ney Springs/ Cantara areas exceeded 1.0 fish/hour. These data suggest that the cessation of stocking increased the wild trout catch rate significantly.

Based on volunteer angler survey box data, catch rates averaged 1.0 fish per hour in 1995, 1.4 fish/hour in 1996, and 0.85 fish/hour in 1997. It should be noted that voluntary angler survey box data may be biased toward successful anglers: Unsuccessful anglers are less likely to complete survey forms. (Pollock, et al., 1994; also, see right columns in Table 1, page 14).

Based on creel survey, bait anglers dominated the fishery prior to the Cantara Spill. After the spill, only anglers using artificial gear could legally fish the upper and lower river sections, and they represented about 96% of anglers in these areas. About 4% of anglers illegally used bait in these areas. In the Dunsmuir catch-and-keep, no gear restrictions area, the number of anglers using artificial gear increased to more than 40%, compared to 20% in 1980.

Size of Trout

Based on creel surveys conducted from 1994 through 1997, the average length of wild trout caught was 12.9 in., 12.8 in., 11.4 in., and 11.6 in., respectively.

Based on volunteer angler survey box data, the average length of rainbow trout caught was 11.1 inches in 1995, 9.3 in. in 1996, 10.4 in. in 1997, and 9.9 in. in 1998.

Data from electrofishing surveys (Figure 4) shows that the average length of wild rainbow trout captured, ranged from 9.1 in. in 1980, to a high of 10.5 in. in 1993, and a low of 8.8 in. in 1996.

A review of electrofishing methods and site locations for 1980 indicates that there were no significant differences compared to methods and sites used for data collection after the spill. This means that these data should be directly comparable, and do not exhibit obvious bias. However, boat electrofishing sites are biased by nature because they are limited by their accessibility and tend to emphasize pool habitat.

There has been some concern about the size distribution of rainbow trout in the upper Sacramento since the Cantara spill. The following table, based on electrofishing surveys, lists the percentage of trout in two size classes for seven different years. Based on the growth data discussed previously, the size category of 7 to 11 inches would include most two and three-year-old fish, and the category equal to or greater than 13 inches would include all four and five year old fish. These data suggest that the size distribution of trout for the last three years is nearing that of 1980 (Table 4).

Three years after the spill (summer, 1994), it would be expected that the number of larger trout would be fairly large and the number of smaller wild trout would be expanding. This would result in a large average length. As the number of individuals in younger age classes expands, the average length of the population would tend to decrease. This effect would become more noticeable as natural mortality, harvest, and incidental hooking mortality begin to remove 3, 4, and 5-year-old (and older) wild trout from the population, especially once angling was re-opened. If the population is reaching natural equilibrium, average trout length should stabilize and approximate that of pre-spill observations. A review of the appropriate data indicates that this is the case.

Table 4. Comparison of the percentage of wild trout in two age classes, by year (electrofishing data).

Year >>	**1980**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Age**
Size Class 7 to 11"	64.3%	41.1%	26.6%	37.1%	50.9%	47%	56%	2+, 3+
≥ 13 "	7.1%	25%	32.8%	11.9%	9.6%	12.3%	12.3%	4+, 5+

Hooking Mortality

Catch-and-release angling and/or reduced bag limits are becoming a very popular alternative to harvesting trout in waters that support self-sustaining populations of wild trout. Special gear restrictions must be used in conjunction with this type of management in order to be effective. Hooking mortality studies on resident wild trout have shown that fish caught and released on bait are eight times more likely to die as fish caught and released on artificial lures and flies. A 1992 report summarizes 18 past hooking mortality studies for non-anadromous trout (Taylor and White, 1992). Five of the studies analyzed the mortality of resident wild trout that were caught and released using bait. The mean hooking mortality rate in these studies was 43.6 %. In other words, nearly ½ of resident wild trout that are caught and released using bait will die. In contrast, resident wild trout caught and released on artificial lures or flies showed an average hooking mortality rate of 5.1 % in 12 studies. Therefore, only one in 20 resident wild trout will die when caught and released with artificial lures. Clearly, if the goal in a wild trout fishery is to reduce the effects of angler induced mortality, then bait should not be used.

Taylor and White (1992) also summarized the hooking mortality literature for barbed versus barbless hooks and single versus treble hooks. They found that the use of barbless hooks and artificial lures can reduce the hooking mortality rate nearly in half (to 2.6 %) when compared to barbed hooks (4.8 %). There do not appear to be significant differences in hooking mortality for trout for single hooks and artificial lures (4.8 %) compared to treble hooks and artificial lures (4.7 %).

The conclusion from reviewing these studies is that fish can be caught and released on artificial lures and have an excellent chance to survive to be caught again, to reproduce, and perpetuate the wild trout population. Therefore, the Department will strive to manage areas of the river for an optimal number and optimal size of wild trout using a variety of regulations, including terminal gear restrictions.

Angling Regulations

Pre-spill angling regulations on the upper Sacramento River were consistent with general trout season regulations for the Sierra District: open season- last Saturday in April through November 15; bag limit- 5 trout per day, 10 in possession; no special gear restrictions. In 1982, the California Fish and Game Commission formally designated 14 miles of the upper Sacramento River as a Catch-and-Release water from Shotgun Creek downstream to Shasta Lake. In this area, the season and gear requirements were unchanged but the bag limit was reduced to two trout. Stocking of hatchery trout was discontinued in this reach and it was managed as a wild trout area. This designation and regulation change were intended to allow a fishery on a self-sustaining population of wild trout.

Immediately after the spill, the upper Sacramento River was closed to all angling until April 30, 1994 when it was reopened under special regulations. These regulations separated the river into two zones; a catch-and-keep zone around Dunsmuir (six miles, from Scarlett Way to Soda Creek), and zero limit, catch-and-release zone on the remainder (32 miles). The Dunsmuir zone allowed the harvest of five hatchery trout and required the use of barbless hooks. This regulation remained in effect until March 1998 when the barbless hook requirement was eliminated. The remainder of the river was restricted to the use of artificial lures with barbless hooks, and requiring that all trout be immediately released.

The trout fishing season in 2000 runs from the last Saturday in April through November 15 and is restricted to one hour before sunrise to one hour after sunset each day. The six mile reach from Box Canyon Dam downstream to the Scarlett Way Bridge including tributaries and the 26-mile reach from the mouth of Soda Creek downstream to Shasta Lake including tributaries are open to angling requiring the use of artificial lures with barbless hooks and immediate release of all trout caught. The six mile reach from the Scarlett Way Bridge downstream to the mouth of Soda Creek including tributaries except Soda Creek, the Dunsmuir reach, allows the use of bait with barbed hooks and a daily five trout bag limit and a limit of ten in possession. This harvest area of river receives an annual allotment of 9,000 pounds of hatchery trout, or about 15,000 fish.

Managing the trout fishery of the upper Sacramento River has been a challenging endeavor since the Cantara Spill. Some of the factors considered while establishing angling regulation recommendations over the past six years are: the recovery status of the fishery, balancing the desires of the angling public, the ability to enforce regulations, meeting Departmental policies, and examining new approaches to trout management. The Department must weigh all of these factors when evaluating proposed angling regulations from the public and developing recommendations for the Commission. Ultimately, the Commission makes the final decision regarding new regulations.

ENVIRONMENTAL PROBLEMS AND ISSUES

Prevention of Future Spills

Litigation brought against Union Pacific Railroad (UP) subsequent to the spill has focused on physical and operational changes to railroad facilities and how trains are allowed to pass through the canyon. A second rail has been added to the tracks in the Cantara Loop which is intended to prevent derailed cars from leaving the railbed and toppling off the tracks. It is unknown if this technique will work. However, additional actions are being taken such as, increasing the number of engines required, reducing train speed through the turn, and a total ‘cage’ is being installed (summer of 2000) to help prevent another derailment.

However, the railway runs nearly the entire length of the upper river and there are other areas where future spills are possible. Additionally, Interstate Highway 5 runs along most of the river’s length and there are several areas where vehicle accidents could result in chemicals reaching the river.

Stocking of Hatchery Trout

Catchable-size hatchery trout (two or three to the pound) are stocked in many California waters to provide put-and-take fisheries. Their use is particularly valuable in areas where natural production of wild trout is low, where angler pressure is high, and/or where trout harvest is high. Statewide, the production of catchable trout in all of the State's hatcheries is fully allocated to various waters, and therefore, there are no "surplus" catchable trout available. If expansion of the catch-and-keep area is pursued at current stocking densities, fish would have to come from redirecting existing allotments or through additional funds.

What does this mean for the management of the upper Sacramento River fishery? If bait fishing and the five-trout bag limit are expanded to a larger area of the river, the current hatchery trout allotment may be spread thinner over a wider area. Angler success could decline and existing wild trout populations could be negatively affected. Therefore, the planned expansion of the catch-and-keep area will require that more trout be made available for stocking. This will require coordination with the Department's Hatchery Operations Committee to reallocate existing catchable trout resources, or to find a way to raise the additional fish needed. Mt. Shasta Fish Hatchery staff believe that the 20,000 catchable trout necessary can be allocated without a major shift in resources.

The stocking of hatchery trout in the Dunsmuir area (catch-and-keep reach) is warranted and appropriate due to the large number of access points, the high angling pressure, and the strong desire of many anglers to be able to keep five fish. Wild trout numbers are lower in this reach than areas up or downstream as a result of the high angling pressure and considerable harvest. Creel surveys between 1994 and 1997 estimated that between 2,000 and 3,300 wild trout are harvested from the Dunsmuir reach each season (Turek, 1998). If hatchery trout were not planted and angler effort remained the same, the number of wild trout harvested in this reach would certainly increase.

This points out the importance of maintaining special catch-and-release regulations (in some form) in those areas up and downstream of the Dunsmuir reach. By reducing harvest and other angling-related mortality, these areas provide recruitment of wild trout into the Dunsmuir reach. This provides an opportunity for anglers to catch-and-keep some wild trout without being detrimental to the overall wild population.

Suction Dredging

The upper Sacramento River is classified a Class A stream under suction dredge rules, closed to suction dredging, except by special permit. As a result of California Environmental Quality Act (CEQA) requirements, no special suction dredge permits will be issued. Any changes in this status will require a separate CEQA document and full public review.

If suction dredging is again allowed at some future date, inspection related to permits should be conducted during weather and stream flow conditions that allow biologists to accurately assess the physical and biological factors under consideration.

Timber Harvest

Timber production is the dominant land use in the upper Sacramento River canyon with more than 80% of the land base dedicated to this use. Private ownership predominates with Roseberg Resources Company and Sierra Pacific Industries as the major land holders. The U.S. Forest Service manages most of the remainder.

Intensive timber harvesting began in the 1880's when the Southern Pacific Railroad was constructed through the canyon. Since then, most of the watershed has been harvested several times and/or has burned as a result of fires started by old steam locomotives, and other causes. Most of the timber harvesting conducted prior to World War II was unregulated with little or no stream protection. Numerous stream courses were used as logging skid trails causing extreme disruption of instream and riparian habitat. Since the early 1970's, timber harvesting has been more strictly regulated, particularly near streams. However, the practice of clear-cutting is making a comeback after several decades, when selective harvesting predominated. Young to medium age second growth forests now cover most of the watershed. Little, if any, “old growth forest” remains.

Timber harvesting can adversely impact fish and fish habitats in many ways. Of primary concern in the upper Sacramento River watershed are operations that can lead to increases in water temperature during the hot summer months, particularly in low flow years. Water temperature monitoring conducted by the Central Valley Regional Water Quality Control Board (CVRWQCB) during 1997 and 1998 indicates that river water temperature above Mossbrae Falls is controlled by releases from Box Canyon Dam and that Mossbrae Falls moderates temperatures downstream to Castle Creek. Below Castle Creek, water temperature is most affected by insolation on the main stem and by water temperatures of tributaries (Harvey 1999). In the summer of 1997, water temperatures from the Sims monitoring station and downstream to Lake Shasta exceeded the Water Quality Control Plan temperature objective and the temperature criteria for freshwater fish (US EPA 1977). This suggests that shade canopy retention along the mainstem and perennial tributaries downstream from Sims should be regulated above the 50% minimum required by California Forest Practice Rules.

Production of sediment from timber harvest operations is another concern. The CVRWQCB identified three tributary streams as chronic and/or significant sources of sediment, including Little Castle Creek, Castle Creek and Flume Creek (Harvey 1999). Timber harvesting was associated with at least one large landslide in Flume Creek. There is also a significant slide near Pollard Flat.

Predator Control and Barriers

Native pikeminnow and sculpin populations have co-evolved and coexisted in the river with rainbow trout. Some anglers and biologists consider these native fish to be detrimental to the rainbow trout fishery because they are known to prey on trout and trout eggs, and to compete for food. However, because each species occupies its own ecological niche, competition and predation are minimized. Further, since these species have co-evolved, their interaction is an integral part of the natural balance in the river and no effort will be made to eliminate them.

The concept of constructing a fish barrier in the river some distance upstream of Shasta Lake has occasionally been discussed by various groups. Proponents believe that a barrier would keep

undesirable Shasta Lake fish from entering the river and result in an improved trout fishery. However, non-game fish are already established in the river near Shasta Lake, making the construction of a barrier irrelevant. Further, such a barrier would also prevent movement of rainbow and brown trout out of the lake into the river. It is believed that these fish may comprise a significant component of the fishery in the lower river.

River Flows

River flows, as discussed above, are largely controlled through water releases from Box Canyon Dam. Minimum releases from the dam required by the Federal Energy Regulatory Commission license are 40 cfs during the summer, and the facility is operated in a "run-of-the-river" mode throughout most of the year. This results in a fairly natural flow regime, especially during winter and spring. Many tributary streams as well as numerous springs contribute high quality, cool water to the mainstem year around. Except for the lower reach of the upper Sacramento River, where water temperatures reach the upper limit for acceptable trout habitat, water quality and quantity are not significant issues. Flows in the lower river usually exceed 2,000 cfs during winter, and routinely exceed 20,000 cfs during major storm events (based on data available from the Delta gauging station near Lakehead).

Illegal Fishing

Poaching is a problem of varying degrees depending on the particular water, specific locations within a given water, and time of year. Department wardens have a strong presence in the upper Sacramento, but they have large areas to cover. Poaching has been documented during various creel surveys, but is not believed to be a significant problem at this time. By allowing angling in all of the upper river, the anglers themselves (by their presence) assist wardens in keeping poaching to a minimum.

Public education is an important component of the management of any fishery, and this is especially true of the upper Sacramento River. By keeping the public informed of the goals of our management program and including them in the management of it, we should be able to keep poaching to insignificant levels.

Enforcement of Angling Regulations

Historically the upper Sacramento Canyon was patrolled by a Fish and Game Warden headquartered in Weed, CA, and was part of a much larger district comprising large areas of the Shasta Valley, the Trinity Divide, Mt. Shasta/McCloud Flats and the McCloud River drainage. This position was supervised by a Lieutenant headquartered in Mt. Shasta. This position was eliminated in 1993.

Presently, a full-time warden position is funded by the Cantara Program to patrol the upper Sacramento River canyon. Funding for this position is scheduled to end on June 30, 2000. The Department is actively pursuing funding to resolve this shortfall. In any case, the Regions' Wildlife Protection function has expressed assurances that the necessary level of patrol will be maintained on the upper Sacramento River.

Barriers to Trout Movement

Construction of Interstate Highway 5 and the Southern Pacific Railroad along the west side of the upper Sacramento River forced the lower reaches of many westside tributaries through culverts or over man-made falls. These structures may act as barriers to trout migrating up tributaries to spawn (Miller, et al. 1996). The California Department of Transportation (CalTrans) has built fish passage structures through the culverts on Little Castle Creek and Shotgun Creek. However, these structures require routine maintenance to remain effective. "Baffles" were also installed in the long highway culvert on Boulder Creek. However, these baffles have not been maintained and their effectiveness is in doubt.

CalTrans currently has a proposal before the Cantara Trustee Council to construct more fish ladders to alleviate this problem. Cantara staff are evaluating the effectiveness of existing ladders and the need and efficacy of possibly increasing the number of ladders. Other possible barriers exist on several tributary streams. Concerned organizations and groups have expressed interest in participating in barrier removal projects. The Department will encourage involvement in these activities.

MANAGEMENT PROGRAM

Management Goals

The Department's goals for fishery management of the upper Sacramento River are;

1. Utilize fishery management applications that take advantage of the high natural productivity of the upper Sacramento River, to develop a world-class wild trout fishery. The river is capable of producing abundant wild trout and special angling regulations will be used to maintain the wild trout population at levels producing high quality angling opportunities.

2. Maintain high quality trout habitat. The river's capability to produce abundant trout is dependent on adequate quality habitat. The Department's management will include fostering land use and water management activities that maintain the exceptional productivity of the river. The Department should seek to influence decisions made by other regulatory and management agencies involved in the watershed to maintain quality habitat.

3. Maintain a diversity of angling opportunities. The river is large enough to provide for anglers interested in harvesting trout and for anglers interested in catch-and-release fishing. In addition to an expansion of wild trout management for the upper Sacramento, the Department will pursue new put-and-take angling opportunities for rainbow trout in the Dunsmuir/Mt Shasta area, in waters separated from the upper Sacramento River and its' tributaries.

Management Objectives

In order to assess fishery management of the upper Sacramento River, the Department proposes the following objectives:

- For those portions of the upper Sacramento River managed for wild trout (no stocking) with a reduced bag-limit, artificial lure restriction, strive to maintain a minimum angler catch rate of 0.75 trout per hour as measured by a 3-year average of voluntary angler survey box returns.
- Maintain a wild rainbow trout average length of nine inches as measured by periodic sampling using established Department electrofishing surveys for the upper Sacramento River.
- For the Dunsmuir catch-and-keep area of the upper Sacramento River, stocked with catchable-sized hatchery trout, maintain an angler catch rate of at least 0.5 trout per hour as measured by a 3-year average of voluntary angler survey box returns.

The Department will use voluntary angler survey box data to aid in the evaluation of the fishery because angler creel surveys are prohibitively expensive. Angler surveys conducted since 1994 have been labor-intensive and very costly. There is currently inadequate funding to continue annual surveys. However, angler survey boxes which have been utilized since 1995, have produced more than 200 surveys per year (through 1997) and are inexpensive to maintain. The catch rate objectives established above consider the potential bias of the voluntary surveys and the knowledge of catch rates estimated from previous on-stream angler surveys.

Fishery Management Elements

Monitoring the Fishery

1) Population and Fishery Monitoring

Indices of trout abundance will be obtained every second or every third year through a combination of snorkel surveys in established index reaches, return of volunteer angler survey forms, and electrofishing surveys. In addition, creel surveys should be conducted every five years. These tasks will also yield important information about angler success and satisfaction, as well as average size of trout and condition factor. Species composition and the occurrence of predators and non-native species will also be obtained.

Creel surveys will require additional funds to complete. Current budget allotments do not provide adequate funding to accomplish this task. The necessity of conducting creel surveys will be determined through the evaluation of the results of electrofishing, snorkel surveys, and voluntary angler survey box information.

The use of volunteer angler survey boxes will be continued and encouraged through public education.

2) Use of Volunteers

The use of volunteers in managing the fishery of the upper Sacramento will be encouraged. Volunteers can assist with data collection by utilizing the angler survey boxes, assisting with electrofishing and possibly snorkel surveys, assisting with the marking of hatchery trout (when deemed necessary), and providing help with public education efforts.

Further, more organized volunteer effort should be encouraged. Angling organizations could further assist the Department by forming 'Fish for Science' events, where group members fish specified areas of the river for specified periods of time, measuring all the fish they catch to aid in the determination of parameters such as average fish length, catch per hour, species composition, etc. Volunteers could also be utilized to help inform and educate other anglers about the use and importance of angler survey boxes, and to collect samples for rapid biological assessments, per State protocols.

3) Rapid Biological Assessment

Rapid Biological Assessment (RBA) is a fairly simple technique to determine baseline conditions and assess long term changes in a stream environment by monitoring the occurrence and changes in relative abundance of specific aquatic macroinvertebrates. Our understanding of the upper Sacramento River would benefit from this information.

The Department does not currently have the resources to conduct such a long term project. However, as part of this management plan, we are working with local concerned organizations to begin a RBA monitoring program. Properly trained volunteers could easily collect required samples once in the late spring and again in late summer or early fall. Grant funding will be sought to have the samples processed by a qualified vendor. Local high school or college students and others could perform the simple biometric calculations. This information would provide important, fishery independent data on the health of the upper river, and possibly provide an early warning system to changes before they are reflected in the fishery.

Angling Regulations

The Commission adopts angling regulations during odd numbered years, based on biology, socioeconomic needs and public input. The Department, as well as other agencies, organizations, and individuals make recommendations to the Commission for changes in angling regulations for each regulation cycle.

If, as current data indicates, the river has essentially recovered from the effects of the Cantara spill and is rebounding from recent flood events, the Department will recommend changes in angling regulations during the next regulation cycle (2001). Proposed recommendations include a zero limit, artificial lure (barbless hooks) regulation for the area between Scarlett Way and Box Canyon Dam

(Zone 1), a five-trout limit, with no special gear restrictions for the Dunsmuir catch-and-keep area between Scarlett Way and Sweetbriar (Zone 2) and a two-trout limit, artificial lure (barbless hooks) regulation for the area from Sweetbriar bridge downstream to Lake Shasta (Zone 3).

Zone 1 is an important wild trout refugia and could be critical to the recovery of the fishery should another catastrophic event occur. This area is also difficult to access and provides a scenic, aesthetically pleasing wild trout experience.

Zone 2 is ideal for stocking of hatchery trout due to abundant easy access and high angling pressure. The Department will recommend expansion of the Dunsmuir catch-and-keep area downstream to Sweetbriar (see Preferred Alternative below), which will result in increased angler opportunities for hatchery trout. This area is best suited for put-and-take trout management.

Zone 3 has limited easy access and is capable of producing large trout. The two-trout limit will allow some harvest of trophy trout or fish not likely to survive if released, but will encourage catch-and-release fishing. This management strategy will maximize the size and number of trout present in the lower river, and will allow the river to reach its full potential as a world-class trout fishery.

Tributaries: The Department will recommend that tributary streams have the same regulation as that section of the river with which they are confluent, except for Castle Creek and Soda Creek. The Department will recommend that Castle and Soda Creeks be managed for wild trout with a zero-trout limit, and requiring the use of barbless artificial lures. This strategy will also provide wild trout refugia as protection against another catastrophic event, and aid in the goal of establishing a world-class wild trout fishery in the upper Sacramento River.

Stocking

Stocking of hatchery trout has been discussed in previous sections and will follow policies as required by the Fish and Game Commission, and as described in this plan. If the Commission adopts the proposed regulation changes expanding the put-and-take area downstream to Sweetbriar (an increase of 4 miles; total of 10 miles), an increase in the number of planted trout will be necessary to maintain the current stocking density and catch-rates, and afford protection to wild trout (buffering the effects of high angling pressure). This will require the stocking of approximately 20,000 catchable trout per year in Zone 2.

Past Stream Habitat Management

Past stream habitat management has focused on protection of the stream and riparian environment through regulation of land use by involvement in planning and land development projects, development of mitigation measures, and through the issuance of streambed alteration agreements (1600 agreements). Review of timber harvest plans and review of other industrial and non-industrial land uses has also been a focus.

Instream restoration and/or improvement projects have not been attempted in the upper Sacramento River. Fish ladders have been installed to eliminate barriers caused by roads to allow trout access to tributary streams for spawning. These structures are currently being evaluated. If current evaluations demonstrate benefit, more effort may be expended to improve fish passage to tributary streams. (See Barriers to Trout Movement section)

Stream Habitat Management

The Department does not propose any new strategies for habitat management of the stream and riparian corridor. The Forest Practices Act provides certain requirements regulating timber harvest. We will continue our efforts to insure these rules are followed, and will work toward more stringent requirements if deemed necessary. We also intend to work with Union Pacific Railroad (UP) and CalTrans to help create a transportation management system that minimizes risk to the river.

The Department will continue working with large private landowners to facilitate the establishment of habitat conservation plans within the context of required sustained yield plans. These efforts should help to secure improvements in land use practices to the benefit of all species, including aquatic species. The Department has recently hired additional staff to help accomplish this task.

The Department will also continue to work with other agencies (county Planning Departments, Regional Water Board staff, etc.) on proposed development projects to help insure that the management goals of this plan are achieved.

Land Acquisition and Public Access

The Department will work cooperatively with the local community, the Cantara Trustee Council, State Park staff, members of local government, the Upper Sacramento River Exchange and the U.S. Forest Service to insure that issues and actions related to access are consistent with the goals and objectives of this plan.

Management Alternatives Considered

To meet the fishery management goals set forth above, a variety of alternatives have been considered. The goal of utilizing management that uses the river's natural productivity can be realized with wild trout management tools. The goal of providing angling diversity can be achieved through various applications of wild trout management, stocking of hatchery trout, and angling regulations.

Regardless of the level of hatchery trout stocking feasible with current or projected hatchery resources, wild trout will occupy the river in significant (large) numbers. The following alternatives represent potential strategies of stocking hatchery trout, wild trout management, and special angling regulations that could be applied.

A) Stocking Alternatives

- Continue stocking 6-mile Dunsmuir reach with current allotments (9,000 lb/year).
- Continue stocking 6-mile Dunsmuir reach and expand this area downstream to Castle Creek or Sweetbriar (this will necessitate an increase in the allotment of hatchery trout if current stocking densities are maintained).
- Expand trout stocking to historic (pre-1991) levels and locations.
- Discontinue trout stocking and manage the river entirely for wild trout populations.

B) Angling Regulation Alternatives

- Continue with zero-limit areas upstream and downstream of the five-trout (catch-and-keep) area near Dunsmuir (existing strategy).
- Retain existing strategy but expand five-trout limit area (with stocking) downstream to Castle Creek or Sweetbriar.
- Return to a five-fish limit for the entire river upstream of Shotgun Creek.
- Retain existing strategy but allow a two-trout limit with artificial lure, barbless hook restriction downstream of Dunsmuir catch-and-keep area.
- Retain existing strategy but allow a one- or two-trout limit with no artificial lure restrictions downstream of Dunsmuir catch-and-keep area.
- Eliminate five-trout limit area; use existing zero-limit area (above Dunsmuir) and expand it to Dunsmuir area; and add one- or two-trout limit area downstream of Dunsmuir.
- Eliminate five-trout limit, catch-and-keep area completely; use zero-limit on entire river.

Preferred Management Alternative

In order to meet the objectives of this plan and provide desired angling opportunities for a range of anglers, while maintaining a healthy, stable wild trout population, the Department proposes the use of three distinct fishery management zones (Figure 5).

Zone 1 - Box Canyon Dam downstream to Scarlett Way in Dunsmuir.
Trout limit zero; artificial lures with barbless hooks required; Wild Trout and Catch-and-Release designation (no stocking).

Zone 2 - Scarlett Way downstream to the county road bridge at Sweetbriar.
Trout limit 5; no special gear restrictions; put-and-take designation with the stocking of approximately 20,000 catchable trout per year.

Zone 3 - County bridge at Sweetbriar downstream to Shasta Lake.
Trout limit two; artificial lures with barbless hooks required; Wild Trout and Catch-and-Release designation, pursuant to section 1726 of the Fish and Game Code (no stocking).

Tributary streams should have the same regulations as the zone with which they are confluent, except for Castle Creek and Soda Creek (see Angling Regulations discussed above).

This preferred alternative was chosen based on the overall biology of the trout population in the upper Sacramento River and the desires of a wide range of anglers with a vested interest in this water. Our willingness to expand the five-trout limit, put-and-take area is based on several observations indicating that some trout stocking is not severely detrimental to the wild trout population. Our decision not to return to more extensive stocking, but to instead manage more of the river for wild trout (compared to pre-spill), is based on a concern that return rates of stocked trout in lower areas of the river do not meet Commission policy, that more extensive stocking can be detrimental to the wild trout population and the wild trout fishery for various reasons, and the need to provide wild trout refugia. These refugia will provide a healthy, genetically robust wild trout population to assist in reestablishing the trout population should another catastrophic event occur, as well as provide excellent catch-and release fishing opportunities. Also, current data indicate that by encouraging catch-and-release angling while allowing limited harvest in Zone 3, the river will be capable of realizing its full potential as a world-class wild trout fishery benefiting both anglers and the local business community.

These regulations and management tools should be part of an adaptive management program requiring periodic evaluation to determine success. Success should be determined based on the stated objectives of this plan. However, this should not be construed to mean that angling regulations should be adjusted at each regulation cycle. Stated another way, it is best to set angling regulations that are appropriate and stable, which allow the trout population to undergo natural cycles, and that do not attempt to mirror trout population trends.

The ‘adaptive management program’ is intended to mean that based on monitoring results, some management or regulation changes may be necessary or appropriate. For example, if the harvest of trout in Zone 3 is found to be excessive, a recommendation for a one-fish limit may be made; or conversely, if the lower river is becoming over-populated, it may be appropriate to recommend elimination of the artificial lure regulation.

Wild Trout and Catch-and-Release Designation

In October 2000, the Department will recommend that the Commission adopt Zone1 and Zone 3 as both designated Wild Trout Water and Catch-and-Release Water, in conformance with Wild Trout Policy and sections 1726 and 1727 of the Fish and Game Code, respectively (see Attachment 1 and 2). This designation will encourage the Department to continue utilizing artificial lure regulations and reduced bag limits in these areas, and allow the consideration of minimum or maximum size restrictions to further enhance the quality of the wild trout fishery, if deemed necessary based on the adaptive management policy. For clarification, the Catch-and-Release designation allows a zero, one or two-trout bag limit, depending on the most appropriate management strategy.

Put-and-Take Area

During the next angling regulation cycle in late summer and fall of 2001, the Department will recommend the expansion of the existing Dunsmuir catch-and-keep area downstream to the county bridge at Sweetbriar (Zone 2). This will allow continued stocking of hatchery trout and provide for a diversity of angling opportunity. This reach will be managed as a put-and-take fishery and continue to allow the use of bait and a five-trout bag limit. This action will increase the size of the put-and-take area (from six) to 10 river miles (total).

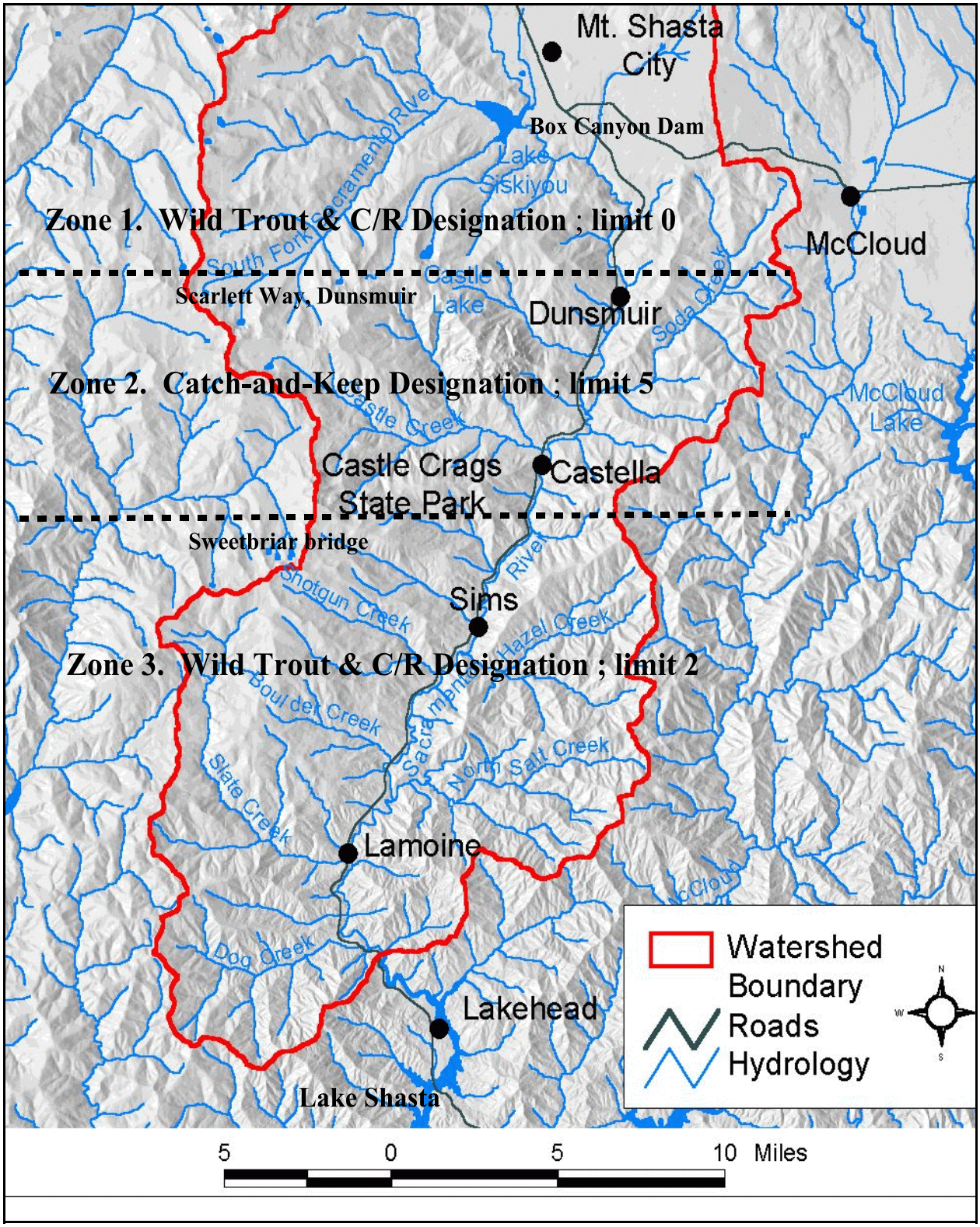

Figure 5. Upper Sacramento River, fishery management zone boundaries: Sweetbriar and Scarlett Way are demarcation points.

PROGRAM IMPLEMENTATION SCHEDULE

1999

- Make recommendation to the Fish and Game Commission that no angling regulation changes are made for this next two-year cycle.
- Mark all hatchery trout to be stocked in the upper Sacramento River (adipose fin-clip).
- Conduct a creel survey in the Dunsmuir area.
- Request that the Cantara Trust Council continue funding the snorkel survey to count trout, using the same methodology and contractor (TRPA), for 1999, 2000 and 2001.
- Attempt to use existing staff to re-survey (snorkel) some of the reaches surveyed by TRPA to establish index reaches that existing Wild Trout Project personnel could realistically repeat in future years, considering funding and other workload constraints.
- Continue with electrofishing surveys at locations as conducted since 1992.
- Evaluate the effectiveness of existing fish ladders on tributary streams, and the desire to spend some remaining Cantara funds to build new ladders (CalTrans proposal).
- Continue to work with UP to insure everything is being done to minimize the risk of another chemical spill.

2000

- Mark all hatchery trout to be stocked in the upper Sacramento River (left-ventral fin-clip).
- TRPA will conduct snorkel survey to estimate present trout population, as above.
- Repeat and refine the attempt to use existing staff to re-survey (snorkel) some of the reaches surveyed by TRPA to establish index reaches that existing Wild Trout Project personnel could realistically repeat in future years, considering funding and other workload constraints.
- Recommend the Commission formally designate Zones 1 and 3 as both Wild Trout and Catch-and-Release Waters.
- Continue electrofishing surveys at locations as conducted since 1992.
- Continue to evaluate the effectiveness of existing fish ladders on tributary streams, and the desire to spend some remaining Cantara funds to build new ladders (CalTrans proposal).
- Insure existing fish ladders are functional and adequately maintained.
- Continue to work with UP to insure everything is being done to minimize the risk of another chemical spill.

2001

- Following an analysis of the fishery, based on the most current information, consider the following angling regulation recommendations to the Commission;
  - Angling regulations in Zone 1 should remain unchanged; that is, zero trout bag limit, artificial lures with barbless hooks required. Associated tributary streams should have the same regulations.
  - Formally expand the Dunsmuir catch-and-keep area four miles downstream to the county bridge at Sweetbriar (Zone 2), allowing for a five-fish bag limit with no special gear restrictions. Stocking should continue at 1999 stocking densities. Associated

tributary streams should have the same regulations, except for Castle Creek and Soda Creek (zero limit, artificial lures).

- Angling regulations in Zone 3 should be modified to increase the bag limit from zero to two trout. Artificial lure, barbless hook restrictions should be maintained. Associated tributary streams should have the same regulations.
- Discuss and consider a maximum or minimum size limit for wild rainbow trout in conjunction with the established bag limit in order to enhance the "blue ribbon" or trophy trout aspect of the fishery.

- Conduct snorkel survey of established index reaches.
- Expand public education effort to increase angler participation in the volunteer angler survey box program.

2002

- Conduct snorkel survey of established index reaches.
- If Cantara funds are approved (requested in spring, 2000), conduct full creel survey for the river downstream of Scarlett Way. A harvest estimate for Zone 3 will be a priority.
- Repeat electrofishing surveys at historic locations, or equivalent.
- Evaluate the effectiveness of any new fish passage structures installed on tributary streams.
- Review work UP has completed to insure the risk of another chemical spill is minimized.
- Review any CalTrans proposals to minimize risk of chemical spills into the river.

2003

- Continue to monitor the status of the fishery, primarily with volunteer angler survey box and electrofishing data.
- Evaluate the effectiveness and utility of the three-zone management strategy based on wild trout population size and condition factor, and angler satisfaction.

2004

- Continue to monitor the status of the fishery, primarily with volunteer angler survey box data.
- Repeat electrofishing survey and other fishery monitoring deemed necessary.

2005

- Revise and update this management plan considering all available information.

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Attachment 1. Fish and Game Commission Wild Trout Policy

COMMISSION DESIGNATED WILD TROUT WATERS

It is the policy of the Fish and Game Commission to:

I. Designate certain state waters to be managed exclusively for wild trout. Commission 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.

Waters designated by the Commission for wild trout management shall meet the following criteria:

A. Angler Access:

1. Open for public angling with unrestricted access when of sufficient dimensions to accommodate anglers without overcrowding.

or,

2. Open for public angling with controlled access under a plan approved by the Commission setting forth the number of anglers and the method of distribution.

B. Able to support, with appropriate angling regulations, wild trout populations of sufficient magnitude to provide satisfactory trout catches in terms of number or size of fish.

II. Wild trout waters shall be managed in accordance with the following stipulations:

A. Domestic strains of catchable-sized trout shall not be planted in designated wild trout waters.

B. Hatchery-produced trout of suitable wild and semi-wild strains may be planted in designated waters, but only if necessary to supplement natural trout reproduction.

C. Habitat protection is of utmost importance for maintenance of wild trout populations. All necessary actions, consistent with State law, shall be taken to prevent adverse impact by land or water development projects affecting designated wild trout waters.

III. The Department shall prepare and periodically update a management plan for each water designated as a wild trout water.

{A List of Designated Waters follows in original text}

Attachment 2. Fish and Game Code Section 1725-1728 : 'Catch-and-Release Law'

1725. This act shall be known as the Trout and Steelhead Conservation and Management Planning Act of 1979.

1726. The Legislature hereby finds and declares that it is the policy of the state to:
(a) Establish and maintain wild trout stocks in suitable waters of the state which are readily accessible to the general public as well as in such waters in remote areas.
(b) Establish angling regulations designed to maintain the wild trout fishery in such waters by natural reproduction.

1726.4. It is the intent of the Legislature that the Department, in administering its existing wild trout program, shall conduct a biological and physical inventory of all California trout streams and lakes to determine the most suitable angling regulations for each stream or lake. A determination shall be made for each stream or lake regarding whether it should be managed as a wild trout fishery, or whether its management should involve the planting of trout. In making such inventory, priority shall be given to those streams and lakes where public use is heaviest, which have the highest biological potential for producing sizeable wild trout, which are inhabited by rare species, or where the quality of the fishery is threatened or endangered. Biological and physical inventories prepared for each stream, stream system, or lake shall include an assessment of the resource status, threats to the continued well-being of the fishery resource, the potential for fishery resource development, and recommendations, including necessary changes in the allowed take of trout, for the development of each stream or lake to its full capacity as a fishery.
This section does not furnish any public entity or private party with any new or additional authority to affect the management of, or access to, any private land without the written consent of the owner.
Privately owned lakes and ponds not open to the use of the general public shall be subject to the provisions of this section only with the written consent of the owner. This chapter shall not be construed as authorizing or requiring special treatment of adjacent land areas or requiring land use restrictions. It is the intent of the Legislature that this chapter shall not diminish the existing authority of the Department, nor shall it interfere with the Department's existing fisheries management planning process.

1726.5. The Legislature further finds and declares that activities and programs mandated by this chapter are a continuation and perpetuation of the Department's existing wild trout program and other programs, and as such they shall be funded from existing budgetary resources.

1727. In order to provide for a diversity of available angling experiences throughout the state, it is the intent of the Legislature that the commission maintain the existing wild trout program, and as part of such program develop catch and release fisheries in the more than 20,000 miles of trout streams and approximately 5,000 lakes containing trout in California. As part of this program, beginning in 1980:

(a) The Department shall establish an ongoing program to determine the viability of various forms of catch and release regulations for trout streams and lakes. A zero-limit catch and release fishery means that all trout must be released by the angler. A one-trout-limit catch and release fishery means that only one trout may be kept by the angler, and a two-trout-limit catch and release fishery means that only two trout may be kept by the angler. In conjunction with determining the best management tools

for the one-or two-trout-limit fisheries, the Department shall consider imposing minimum and maximum size limits.

(b) In administering its existing wild trout program, the Department shall each year prepare a list of no less than 25 miles of stream or stream segments and at least one lake that it deems suitable for consideration as catch and release trout fisheries. This list shall be submitted to the commission for its consideration at the regular October commission meeting. Such recommendations by the Department shall give highest priority to designating trout waters as zero-limit fisheries, even if on a temporary basis. The Department shall also consider making proposals for zero-limit trout fisheries during seasons otherwise closed by the commission.

(c) The commission may remove any stream or lake which it has designated as a catch and release fishery from the program at any time. If any such waters are removed from the program, another stream or lake of a comparable size may be added to the program.

(d) The commission shall in January of each year submit a report to the Legislature regarding progress in implementing this chapter. In such report, the commission shall state its reasons why any stream or lake listed by the Department as suitable for consideration as a catch and release fishery was or was not included in the program. The commission shall also state its reasons for removing and replacing any waters within the program.

(e) The Legislature shall review the progress of this program in 1986.

1728. For purposes of this chapter, "trout" includes steelhead trout.

Attachment 3. Fish and Game Commission General Trout Policy

It is the policy of the Fish and Game Commission that:

I. Natural reproduction and rearing of trout will be encouraged to the greatest extent possible by protecting and improving habitat and by affording protection from disease, predators and competing fish species.

II. Populations of wild trout shall be sustained in suitable waters to provide a diversity of angling opportunities. In some waters it may be necessary to restrict angler harvest to the extent that such harvest has virtually no long-term effect on numbers and sizes of fish in the populations.

III. Artificial propagation and rearing of trout is a major Department program, but will be utilized only when necessary to augment natural production. Stocking fingerling and sub-catchable-sized trout shall take priority over planting catchable-sized trout in the hatchery stocking program when the smaller fish will maintain satisfactory fishing.

Hatchery trout shall not be stocked in waters where they may compete or hybridize with trout which are threatened, endangered or species of special concern. Exceptions may be made for stocking waters which are not part of a species recovery program.

IV. Catchable-sized trout shall be stocked only:

> A. In lakes, reservoirs and streams where natural reproduction and growth are inadequate to maintain populations capable of supporting fishing; and
>
> B. When it is reasonable to expect at least 50% by number or weight will be taken by anglers.
>
> In stocking catchable-sized trout, lakes and larger streams shall have priority over smaller streams. Suitable waters with heavy fishing pressure compared to the size of planting allotments shall have priority. Trophy fish, weighing one pound or more may constitute up to 10% by weight of each load of catchables stocked, if they replace an equivalent poundage of catchables in the allotment for the water stocked.

V. Subcatchable-sized trout may be stocked in lakes, reservoirs and streams where appropriate to augment trout populations in such waters, and to increase fishing opportunities and success. Fingerlings shall be stocked primarily in waters where reproduction is limiting and satisfactory angling can be supported with fingerling stocking, where the population has been destroyed, and in lakes where they will establish a new fishery or augment the existing fishery.

VI. Water companies, utility districts and other public or private agencies in control of urban lakes shall be encouraged to finance put-and-take trout fishing in such waters when suitable for such purposes. The Department shall provide technical advice and otherwise assist in the development and maintenance of such programs.

Attachment 4. Listing of Cantara Trust Council Grants Awarded.

1996 Grant Program

Restoration, Rehabilitation and Enhancement Projects

Restoration projects formed the single largest category funded by the Trustee Council in 1996. Six projects totaling more than $450,000 were funded this year, approximately 30% of the Council's total 1996 expenditure.

Alan Pardee, Landscape Architect - Cantara/Ney Springs Enhancement - $39,500
The project will restore habitat, protect resources, improve public access, and promote community stewardship at the Cantara and Ney Springs fishing access points.

Shasta River CRMP and Great Northern Corp. - Freeman Ranch Cattle Exclusion Fencing - $61,531
This will create a 32-acre cattle exclusion on the Shasta River, replant riparian vegetation, and conduct research to develop compatible grazing prescriptions within the riparian zone.

Deixis Consultants - Mollusc Recovery Monitoring - $36,820
The project will continue recovery monitoring for molluscs on the upper Sacramento River, and evaluate the feasibility of establishing satellite populations from donor sites within the watershed.

Thomas R. Payne and Associates - Riffle Sculpin Population Study - $75,531
This is a two-year continuation of monitoring to assess recovery of riffle sculpin in the upper Sacramento River and will relocate sculpin to enhance recovery.

Wildlife Conservation Board and Siskiyou RCD - Scott River Riparian Restoration - $200,000
The project includes fencing, bank stabilization, revegetation and screening structures to restore fisheries and riparian habitat along a 4.5-mile section of the upper Scott River.

Shasta-Trinity National Forest, U.S. Forest Service - South Fork Fish Habitat Improvement - $40,899
This instream project will improve habitat, cover, and pools on an aproximately 2,000-foot section of the South Fork Sacramento River.

Habitat Acquisition and Resource Protection Projects

Approximately 13% of the 1996 grant funding was allocated to habitat acquisition projects. Two projects were funded: a gap analysis study of the upper Sacramento River watershed and an off-site property acquisition along Battle Creek in Tehama County. A single resource protection project was funded to provide a water quality monitoring and enforcement program for the upper Sacramento River over a multi-year period.

ENPLAN, Environmental Scientists and Planners - Upper Sacramento River Gap Analysis - $32,490
A gap analysis using Geographic Information Systems will identify priorities for acquisition and resource protection within the upper Sacramento River watershed.

California Department of Fish and Game, Region 1 - Battle Creek Wildlife Area Acquisition - $166,000
This 47.7-acre addition to Battle Creek Wildlife Area will connect state lands, protect and existing riparian corridor, and provide improved public access.

Central Valley Regional Water Quality Control Board - Upper Sacramento River Pollution Control - $200,400
The two-year project will establish a comprehensive water quality monitoring program for the upper Sacramento River and identify sources of pollution for enforcement action.

Study and Research Projects

Research projects made up the third largest funding category in 1996 at $382,950, or 26% of the total grant program expenditure. These projects focus on continuing recovery monitoring for fisheries, aquatic insects, and riparian bird species between Cantara Loop and Shasta Lake. Results from these studies will provide information needed to make future restoration and management decisions for the upper Sacramento River.

Department of Water Resources, Northern District - Aquatic Invertebrate Recovery Assessment - $40,000
This one-year project will collect stream insects in the upper Sacramento River and analyze their recovery.

Point Reyes Bird Observatory - Monitoring the Recovery of Riparian Birds - $45,000
The study continues monitoring riparian bird recovery on the upper Sacramento River.

Department of Water Resources, Northern District - Fall River Aquatic Assessment - $75,000
A one-year project will evaluate the movement of coarse sediment and its effects on the wild trout fishery of the upper Fall River.

Pacific Southwest Research Station, U.S. Forest Service - Rainbow Trout Genetics - $59,996
This study will assess the degree of genetic similarity between wild trout from the upper Sacramento River watershed and hatchery strains planted in Shasta Lake.

Thomas R. Payne and Associates - Upper Sacramento Fishery Monitoring - $162,950
This two-year project continues dive count surveys to monitor recovery of wild trout and other fish species in the upper Sacramento River.

Public Information and Education Projects

The Council funded three public information and education projects in 1996 for a total of $258,709. This represents approximately 17% of the 1996 grant program expenditure.

Siskiyou County Superintendent of Schools - Siskiyou Watershed Education Project - $50,000
The program will educate teachers about the recovery and restoration of the upper Sacramento River ecosystem and develop a local watershed education curriculum.

Shasta-Trinity National Forest, U.S. Forest Service - South Fork Sacramento Cooperative Education - $8,709**.** Natural resource interpretation for local schools in conjunction with instream restoration work on the South Fork Sacramento River will be provided by this program.

City of Dunsmuir - Upper Sacramento River Exchange Project - $200,000
This project will support the development of a river exchange drop-in center and a volunteer program for improved public relations and public education with links to local schools.

1997 Grant Program

Restoration, Rehabilitation and Enhancement Projects

Four restoration projects totaling more than $102,000 were funded this year in Siskiyou, Modoc, and Shasta Counties. This represents approximately 12% of the Council's total 1997 expenditure.

Siskiyou Resource Conservation District - Scott River Riparian Restoration, Siskiyou Co. - $50,000
Objectives are streambank stabilization and fencing to restore fisheries and riparian habitat along a 3-mile section of the Scott River. The project is situated next to a 4.5-mile reach restored with funds from the Council in 1996.

Goose Lake Resource Conservation District - Lassen Creek Restoration Design, Modoc Co. - $15,000
A restoration plan will be developed for a portion of lower Lassen Creek. Goals are to restore a natural channel, eliminate erosion, improve fish habitat, and protect the riparian corridor.

Ducks Unlimited, Inc. - Willow Creek Riparian Restoration Project, Modoc Co. - $10,500
Fencing, revegetation, and non-native plant species eradication will improve riparian habitat on a 6-mile reach of Willow Creek.

Sacramento Watershed Action Group - Sulphur Creek Watershed Assessment and Action Plan, Shasta Co. - $27,000**.** Assessing the condition of the Sulphur Creek watershed, defining watershed problems, and recommending actions to improve fisheries and riparian habitat will lead to restoration of the watershed.

Habitat Acquisition and Resource Protection Projects

Public access and resource protection projects received the largest percentage of grant funds: 55% of the Council's total expenditure. Two projects totaling more than $450,000 were funded this year.

Shasta-Trinity National Forest - Pollard Flat Access Project, Shasta Co. - $175,000
Public access at Pollard Flat on the upper Sacramento River will be improved. Enhancements will be made to the existing road and a river access trail. In addition, picnic and parking areas will be developed and a restroom will be installed.

KEA Environmental, Inc. and University Foundation, California State University Chico - Plant Community Mapping within the upper Sacramento River Watershed - $277,260
This project will develop a vegetation map of the upper Sacramento watershed to use in wildlife habitat restoration and resource protection planning at the watershed scale.

Study and Research Projects

One project in the Study and Research category, the upper Sacramento River Angler Survey and Recreation Survey, was funded. This category received fewer dollars in 1996, in keeping with the Council's expenditure plan. The results from the angler survey will help establish angling regulations for the upper Sacramento River in 1998 and 1999.

California Department of Fish and Game - Upper Sacramento River Angler Survey and Recreation Survey, Shasta and Siskiyou Cos. - $120,000
This study is an angler survey conducted on the upper Sacramento River during the 1997 fishing season. Recreational use counts, conducted along with the angler survey, will continue through April 1998.

1998 Grant Program

Restoration, Rehabilitation and Enhancement Projects

Four restoration projects totaling more than $287,000 were funded this year in Shasta and Modoc Counties. This represents approximately 65% of the Council's total 1998 expenditure.

Ms. Maria J. Ellis
Spring Creek Culvert and Crayfish Project, Shasta Co. - $130,000
This project will provide for the replacement of four culverts at the Spring Creek Road crossing in the Fall River valley to protect the largest population of the federally and state-listed endangered Shasta crayfish. It also will eradicate the non-native signal crayfish.

Goose Lake Resource Conservation District
Lassen Creek Restoration, Modoc Co. - $116,570
This project consists of carrying out the restoration plan for Lassen Creek which was developed using funds from the Council in 1997. The project will relocate Lassen Creek into a stable channel which will connect with the floodplain, thereby restoring the watertable to the pre-disturbance elevation.

Fall River Resource Conservation District
Fall River Restoration, Shasta Co. - $7,500
This project will develop GIS maps on wetlands, existing and proposed fencing, soil erosion profiles and streambank erosion conditions for a restoration project on Fall River and watercourses in the Bear Creek watershed.

CA Department of Parks and Recreation
Castle Crags State Park Invasive Plant Control, Shasta Co. - $33,000

This three-year project will remove Himilaya berry and scotch broom from five acres of riparian habitat. This will serve as a demonstration project for future rehabilitation projects in montane riparian habitats.

Public Information and Education Projects

The Council funded three public information and education projects for a total of $157,000, representing 35% of the 1998 grant program expenditures.

Dunsmuir Elementary School District
Dunsmuir Schools Watershed Education Project, Siskiyou Co. - $55,932
This is a three-year project that will provide students of Dunsmuir Elementary School and Dunsmuir High School with a comprehensive cross-curricular program designed to raise awareness and promote stewardship of the upper Sacramento River by educating students and their families about their watershed and the Cantara Spill.

CA Department of Parks and Recreation
Castle Crags Interpreter, Shasta Co. - $27,595
A seasonal interpreter will be hired to work six months per year over a two-year period at Castle Crags State Park. The interpreter will expand public education and coordinate efforts of various groups to educate the public within the park about the Cantara Spill.

Ms. Helen Chambers-Aria
Resource Radio, Shasta Co. - $73,735
Twelve scripted, recorded 60-second radio public service announcements will be produced and distributed per year during three years. Project will reinforce Council messages to audiences in Shasta and Siskiyou Counties.