State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

LOWER McCLOUD RIVER
WILD TROUT AREA

FISHERY MANAGEMENT PLAN

2004 through 2009

by

Michael Rode
1989

Revised and Updated
by

Michael Dean

Northern California – North Coast Region

2004

LOWER McCLOUD RIVER
WILD TROUT AREA

FISHERY MANAGEMENT PLAN

by

Michael Rode

and

Michael Dean

ABSTRACT

This plan describes the lower McCloud River and its history, including past, present and proposed fishery management activities with emphasis on data collected in the 10.5-mile reach below McCloud Reservoir. Angling regulations in the 7.3 mile designated Wild Trout Area (WTA) limit terminal fishing tackle to artificial lures with barbless hooks and allow a two-trout bag limit in the upper 5 miles and 0-trout limit in the lower 2.3 miles (upper portion of the Nature Conservancy Preserve). The fishery is noted for its relatively high average catch rate of more than one trout per-hour that includes mostly rainbow and some brown trout. The catch of brown trout varies from year to year. Weir operations and tagging indicate rainbow trout move little but brown trout move into the area from lower in the system and Shasta Lake, with the peak of upstream migration into the WTA in October. The peak of brown trout upstream migration in the lowest reaches of the McCloud appears to be April or earlier. The catchable rainbow trout population is between 3,000 and 4,000 fish per-mile. Management goals and recommendations are listed to maintain and improve the fishery and existing habitat.

TABLE OF CONTENTS

PREFACE

A segment of the angling public voiced concerns in the mid-1960's over the deteriorating quality of angling in some California trout streams. The stresses resulting from a century of habitat degradation and wild trout exploitation began to be apparent, and many anglers desired a change in fishery management strategy.

In 1966, the California Department of Fish and Game's (Department) California Fish and Wildlife Plan recommended altering trout management activities in certain waters to specifically "protect and enhance wild trout fisheries." The plan further recommended "initiation of a basic study of California trout streams, concentrating on outstanding waters capable of providing quality fishing for wild trout." The impact of non-game fish and the "potential of special regulations to enhance the amount and quality of recreation on such streams" were to be emphasized.

In response to the 1966 recommendations and concerns expressed by the angling public, the California Wild Trout Program (WTP) was established by the California Fish and Game Commission (Commission) in 1971. The primary goal of the WTP is to identify, enhance and perpetuate natural and attractive wild trout fisheries. Program objectives are to prevent degradation of wild trout fisheries resulting from diversion, channelization, inundation, pollution, incompatible development and over-harvest. Previously many of the State's accessible waters were stocked with hatchery strains of catchable-sized trout on a "put-and-take" basis and none were managed specifically for wild trout.

The WTP helps to provide diversity in angling opportunities, as required in the Department's mission and objectives. It also encourages the Department to introduce and evaluate various types of fisheries management activities such as population manipulation, habitat improvement and special angling regulations. Waters designated by the Commission as wild trout waters generally receive greater attention (esp., evaluation, monitoring and research) than undesignated waters.

Factors considered in the selection of wild trout waters include size, location, aesthetics, quality of angling, diversity of angling opportunity in the general area and the readiness of the local population to accept the program. All waters selected for the program must be:

1. Open to public angling.

2. Of sufficient dimensions to accommodate a significant number of anglers without overcrowding.

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

Designated wild trout waters are required to have a management plan and angling regulations that emphasize unique values and diversity of opportunity in the geographic area.

Specific management objectives for designated waters will be guided by the general objectives of the WTP. These objectives are:

1. To maintain wild trout populations at levels necessary to provide satisfactory recreational angling opportunities.

2. To maintain and enhance, where possible, the habitat required for optimum wild trout production.

3. To preserve the natural character of the lake or streamside environment.

In 1976, the Commission formally designated 7.3 miles of the McCloud River downstream of McCloud Dam as wild trout water. This fishery management plan is concerned with the wild trout management area especially, but also includes recommendations for areas downstream that may affect the continued quality of the current wild trout fishery.

THE RESOURCE

General Setting

The McCloud River, located in southern Siskiyou and northern Shasta counties, is a largely spring-fed, major tributary to the Sacramento River. It originates as Moosehead Creek at approximately 5,500 feet elevation in moderately steep volcanic terrain southeast of Mt. Shasta near Mushroom Rock. From its origins, the McCloud River flows 59 miles in a general southwesterly direction, draining more than 622 square miles (US Geological Survey, 1984) before entering Shasta Lake (Figure 1).

The McCloud River is a small to medium sized stream (about 40 cubic feet-per-second) until just downstream of Lower McCloud Falls where two large springs (Little Muir and Big Springs) transform the river into a large, very clear, cold river with summer water temperatures seldom exceeding 46°F. Summer base flow downstream of the springs is approximately 800 cubic feet-per-second (cfs). Lower McCloud Falls (about 35 miles upstream of Shasta Lake) was the upstream migration limit for anadromous fish prior to the construction of Shasta Dam. McCloud Reservoir is currently the upstream limit of trout movement within the lower river system. The character of the McCloud is substantially changed when it reaches McCloud Reservoir. Summer base flow below the reservoir is reduced to about 200 cfs and average water temperature increases by 6 to 10°F (US Geological Survey, 1984; US Geological Survey, unpublished data). The river is reduced to a moderate sized (30-75 feet wide in summer), boulder-strewn canyon stream. River flows are highly regulated by McCloud Dam and therefore are relatively stable throughout the year.

McCloud Reservoir is part of Pacific Gas and Electric Company's (PG&E) McCloud-Pit Project (Federal Energy Regulatory Commission (FERC) Project License No. 2106). The current operating license expires in 2011 and the re-licensing process will begin in 2006. The project diverts more than 75% of inflow to the Pit River for hydro-power generation. The McCloud River Wild Trout Area (WTA) includes the first 7.3 miles immediately downstream of McCloud Dam. The downstream boundary of the WTA is the downstream boundary of The Nature Conservancy (TNC) property, the western boundary of Section 13, T37N, R3W (Figure 2).

The WTA of the McCloud River is considered to be within the Klamath Mountains geomorphic province, an area characterized primarily by metamorphosed volcanic and sedimentary bedrock that has resulted in a steep, highly dissected and deeply entrenched landscape. Soils range in depth from 16 to 60 inches and have available water holding capacities from one to seven inches. Slopes within the main river canyon vary from two to 70%. Erosion potential is slight on gentle slopes but becomes severe on slopes that average 60% or greater (US Forest Service, 1974; Soil Conservation Service, 1974).

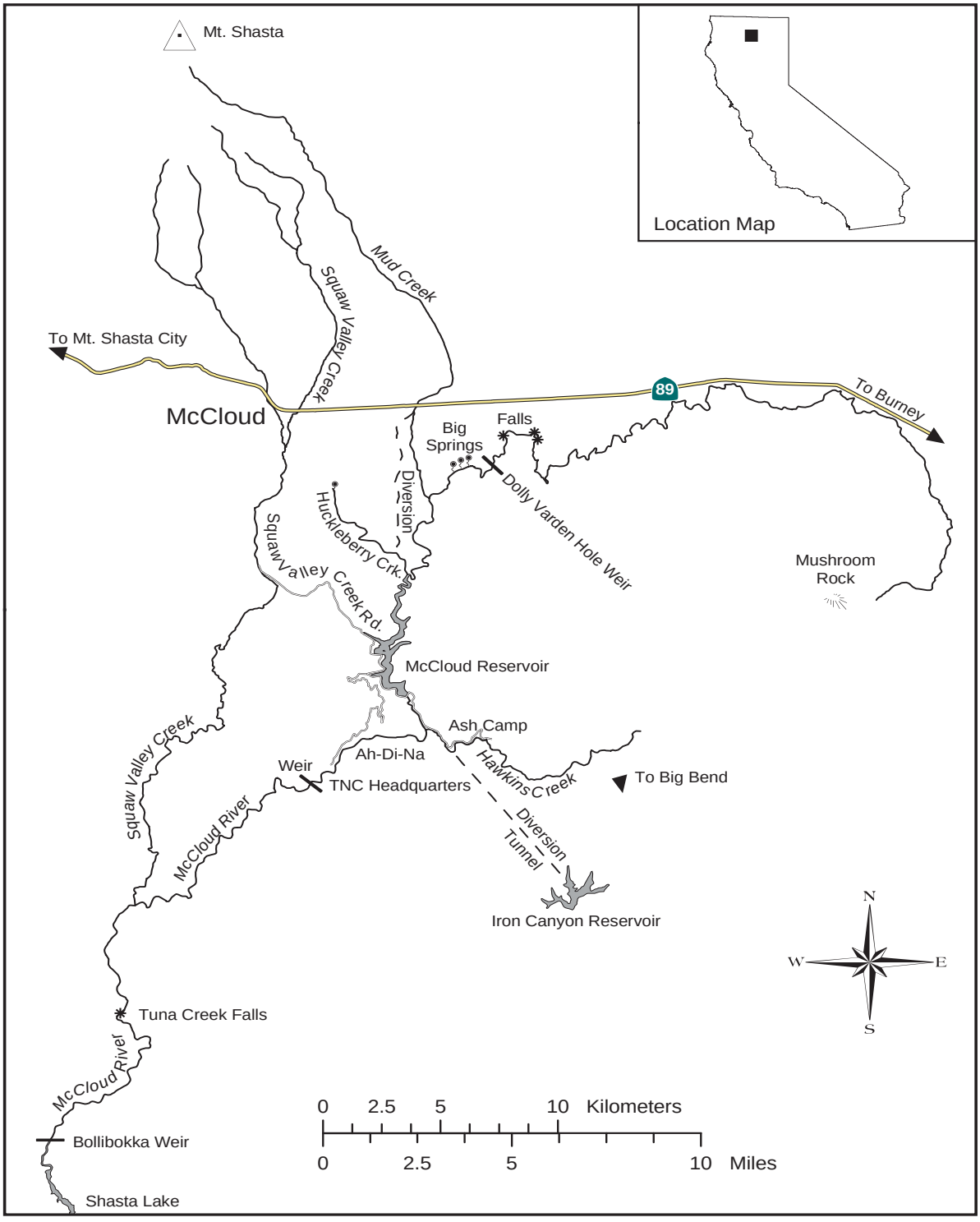


Figure 1. Map of the McCloud River from its headwaters to Shasta Lake, depicting prominent areas and relevant features.

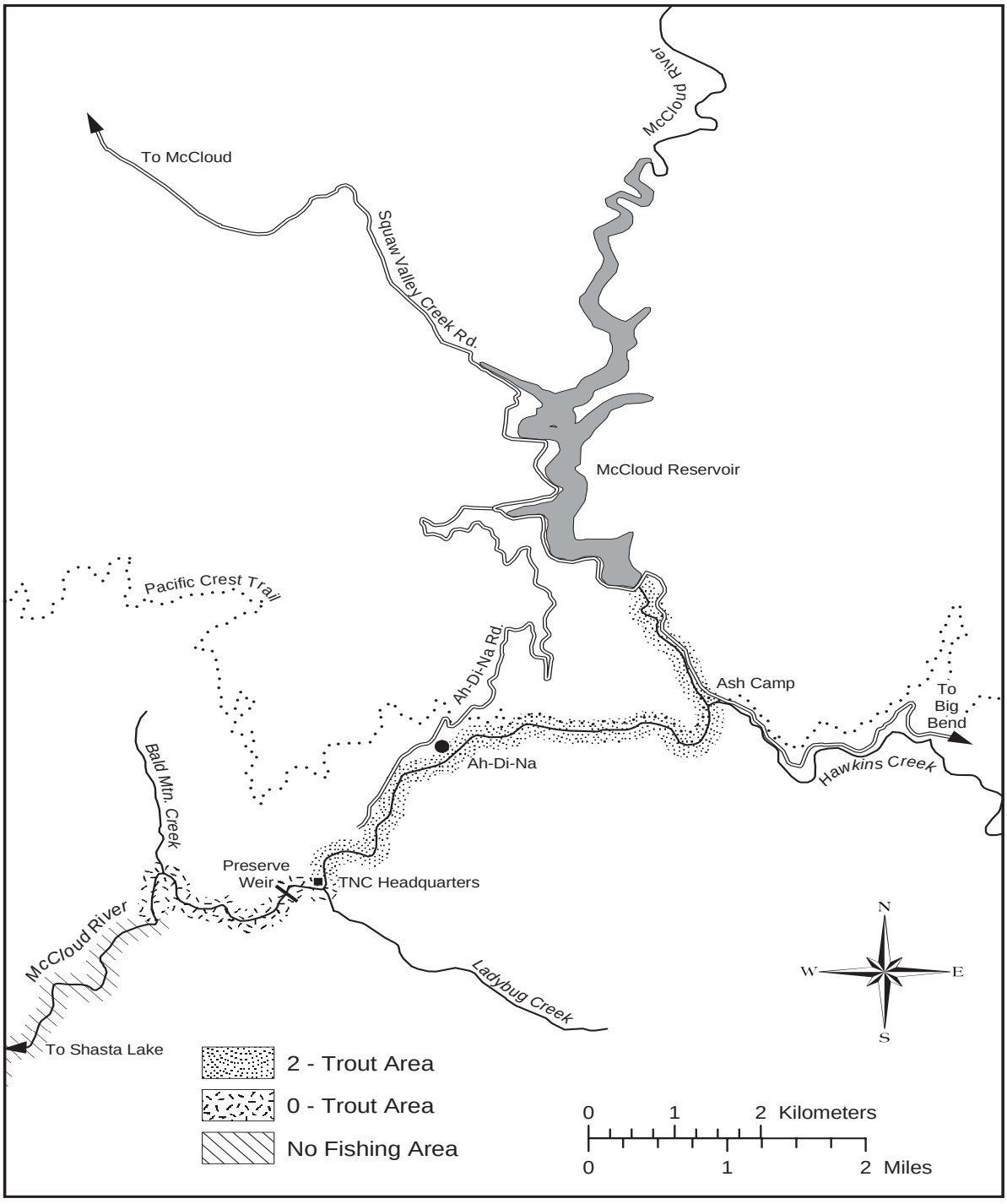


Figure 2. Map of the McCloud River Wild Trout Area, depicting local features including McCloud Reservoir. Current angling regulations are also shown.

The WTA ranges in elevation from 2,460 feet at the base of McCloud Dam to 1,680 feet at the downstream boundary and thus has a mean streambed gradient of 74 feet-per-mile.

The climate in the area is characterized by hot, dry summers and cool, moist winters. Annual precipitation typically ranges from 59 to 109 inches/year of which 15 to 25% may be in the form of snow. Maximum daily air temperatures range from 77 to 110°F in summer and from 19 to 70°F in winter (Moyle, 1976; T. Hesseldenz, Manager, McCloud River Preserve, personal communication). Temperature and precipitation are highly influenced by elevation and geographic orientation.

Vegetation in the WTA is composed mainly of mixed coniferous and deciduous forest and a well-developed riparian zone within the river corridor. The dominant tree species is Douglas fir (Pseudotsuga menziesii). Associated species include ponderosa pine (Pinus ponderosa), sugar pine (P. lambertiana), incense cedar (Libocedrus decurrens), black oak (Quercus kelloggii) and interior live oak (Q. chrysolepis). The understory consists mainly of vine and bigleaf maple (Acer sp.), dogwood (Cornus sp.), filbert (Corylus cornuta) and mock-orange (Philadelphus sp). Dense stands of alder (Alnus sp.) line the stream bank in many riparian reaches (Moyle, 1976). Non-native black locust (Robinia pseudoacacia) was planted in the Ah-Di-Na area around 1900 and has invaded several downstream areas. The United States Forest Service (USFS) and others are currently considering eradication efforts.

Land Ownership

Land ownership immediately adjacent to the WTA is a mix of public and private. All public land in the WTA is administered by the USFS, while TNC is, by far, the largest of the three private landowners. PG&E owns a small strip of project-related land immediately below the dam. The next 0.8 miles of river, to a point just upstream of Ash Camp, runs through land owned by the Hearst Corporation. The river then traverses USFS land for the next 4.0 miles to a point 0.2 mile upstream of Ladybug Creek. The remainder of the WTA, except for a 1.3-mile reach of USFS land in the "Forest Service Loop" near the mouth of Bald Mt. Creek, is bordered by land owned by TNC and managed as the McCloud River Preserve (Figure 2).

Access

The WTA is most easily reached from the town of McCloud (Highway 89) by turning south on Squaw Valley Creek Road (paved) and traveling about 10 miles to McCloud Reservoir. To access the upper portion of the lower McCloud WTA, continue around the west shore of the reservoir, cross McCloud Reservoir dam and descend one mile to Ash Camp at the mouth of Hawkins Creek. Ash Camp has no facilities but is used informally as a primitive campsite and also serves as an angler parking area. The Pacific Crest Trail (PCT) crosses the river on a footbridge immediately upstream of Ash Camp. Downstream of Ash Camp, fishing trails parallel the river on both sides and the PCT provides access for about 1-1/2 miles, although it quickly rises several hundred

feet above the river. Access upstream of Ash Camp to McCloud dam is a scramble in very rough, steep terrain. The only other developed point of entry to the upper portions of the WTA is a maintenance road located at the base of the dam.

To reach the lower sections of the WTA, turn off the reservoir road at Battle Creek and follow the unpaved Ah-Di-Na Road over Skunk Hill for 6 miles, where it joins the river at the Ah-Di-Na Campground. Ah-Di-Na is an improved, fee campground maintained by the USFS. Flush toilets and running water are available. River access trails radiate along the river in both directions. There are no bridges crossing the river in this area, but much of the river is wadeable. Below Ah-Di-Na there are several primitive campsites and a number of trails between the road and river. The McCloud River Preserve is located about one mile below Ah-Di-Na campground. Drive past the campground, staying right, to roads end. Walk about 1/2 mile along the well-marked trail to the Preserve Headquarters cabins.

HISTORY OF THE FISHERY

Early historical accounts relate the importance of the McCloud River fishery to the life of the Wintu Indians. The Wintus relied heavily on fish as a source of protein and would congregate seasonally to harvest the plentiful runs of Chinook salmon (Oncorhynchus tshawytscha) that made their way up the river to spawn. Recognition of the lower McCloud's prolific salmon runs led to the establishment of the Baird Salmon Hatchery in 1872 on the McCloud River just upstream from its confluence with the Pit River (Wales, 1939).

Other species of fish prevalent in the McCloud River below Lower Falls during the late nineteenth century included: rainbow trout (Oncorhynchus mykiss [formerly Salmo gairdeni]), steelhead rainbow trout (Oncorhynchus mykiss [formerly Salmo gairdneri gairdneri]), bull trout (Salvelinus confluentus [formerly Dolly Varden (Salvelinus malma]), and riffle sculpin (Cottus gulosus) [not the prickly sculpin (Cottus asper) as noted by Wales (1939) according to Dr. Peter B. Moyle, UC Davis, personal communication]. The Sacramento pikeminnow (Ptychocheilus grandis), hardhead (Mylopharodon conocephalus) and Sacramento sucker (Catostomus occidentalis) were found in the lower reaches of the river including that area now inundated by Shasta Lake (Wales, 1939). Other anadromous species such as the white sturgeon (Acipenser transmontanus) may have had access to the lower McCloud River on an irregular basis (Moyle, 1976; A. Schilling, McCloud River Club, personal communication).

The lower McCloud's exceptional trout fishery became evident in 1879, when Livingston Stone established the first rainbow trout egg-taking station in California at Greens Creek, a McCloud River tributary now covered by Shasta Lake. The McCloud River rainbow became known as "the rainbow of the fish culturist," since eggs from this population accounted for transplants of rainbow trout in the 1880's to the eastern states as well as several countries throughout the world. There are many accounts stating most rainbow trout planted in foreign countries originated from the McCloud River, but this is simply not true (Behnke, 2002).

Early accounts attributed the excellent trout populations to large, cold flows of relatively constant volume and temperature, characteristics largely due to Big Springs and to a lesser extent Muir Springs (Wales, 1939). During normal years, these springs contribute over 700 cfs of flow at a constant temperature of 44-45°F during late summer. On August 19, 1981, during a low water year, Big Springs had a discharge of 615 cfs at a temperature of 44.6°F (Poeschel, Rowe and Blodgett, 1986).

By the turn of the century, most of the property along the lower McCloud River had been purchased for retreats or fishing clubs by wealthy, conservation-minded private groups or individuals. This private landownership and the rugged nature of the terrain is apparently why the McCloud Canyon was never extensively mined or, until recently, logged. Fishing pressure and associated fishing harvest on this private water was extremely low through the 1950's. Public access was limited to the lower reaches of the river, an area today covered by Shasta Lake. The completion of Shasta Dam in 1945 eliminated all runs of anadromous fish and inundated the lower 16 miles of river.

With the completion of McCloud Reservoir in 1965 and several land exchanges, access to the river below McCloud dam was increased dramatically. Lands bordering the first five miles of river downstream of Ash Camp were obtained by the USFS. In 1967, a 17-unit USFS campground was opened at Ah-Di-Na, 3.4 miles downstream from the dam. Increased fishing pressure, especially in the vicinity of Ash Camp and Ah-Di-Na, prompted the Department to initiate the planting of catchable hatchery trout in these areas in 1967.

In 1973, a 5.5-mile reach of river downstream from USFS property was donated to The Nature Conservancy (TNC) by the McCloud River Club. This reach is referred to as the McCloud River Preserve (Preserve). TNC's primary goal in management of the Preserve is to protect an example of the lower McCloud River wild trout ecosystem. Secondary objectives are to provide opportunities for scientific research and educational use. While fishing use was not initially permitted, public recreation, including fishing, is now allowed only if it does not conflict with these goals. Upon acquisition, TNC initiated a complete resource inventory and has since continued numerous biological investigations.

After the first 5 miles of river below McCloud Dam had been open to public fishing under a 10-fish limit for a few years, some anglers expressed concern that the quality of the wild trout fishery was deteriorating. Concurrently, negotiations were underway between the Department and TNC to allow public fishing on a stretch of river within the Preserve under restrictions that would ensure protection of the trout population. Accordingly, in 1976 the Commission formally designated 7.3 miles of the McCloud River as wild trout water. Special angling regulations were adopted and all hatchery-trout stocking ceased in the reach from McCloud Dam downstream through the "Forest Service Loop" (southern boundary of Section 36, T38N, R3W), a horseshoe-shaped bend in the river where about 1.3 miles of USFS land borders the river. The lower 3 miles of the McCloud River Preserve plus a 0.3 mile-reach bordered

by USFS land between the lower end of the Preserve and the upper boundary of the McCloud River Club was closed to all fishing (Figure 2). A two-trout limit was established for the reach from McCloud Dam to Ladybug Creek and a zero limit (catch-and-release only) for the section from Ladybug Creek downstream to the lower boundary of the Forest Service Loop. The method of take was restricted to artificial lures and TNC required single, barbless hooks on Preserve land. In 1982, the Fish and Game Commission required barbless hooks in all of the designated WTA. In addition, TNC has instituted a number of other regulations that pertain to the McCloud River Preserve portion of the WTA including:

A. Fishing is sign-in only, with no more than 10 anglers permitted on the stream at any one time. Up to five individuals are permitted per day via reservations through TNC's California Field Office (415-777-0487). The remaining anglers are permitted on a first-come, first-served basis.

B. All anglers are required to register at the visitor sign-in station and report fishing results upon leaving.

C. Fishing hours are sunrise to sunset (in the rest of the stream, under general regulations of the Sierra District, hours are one hour before sunrise to one hour after sunset).

All streams tributary to the lower McCloud River, most significantly Hawkins Creek and parts of Squaw Valley Creek, are subject to general fishing regulations of the Sierra District; five-trout limit with no special gear restrictions. At present, the only exceptions are portions of Squaw Valley Creek and Tom Dow Creek that allow a two-trout limit.

Present-day Aquatic Species and Populations

Six species of fish have been documented in the WTA over the past 20 years, although only three of these are well established (Table 1). The most common game fish present is the native rainbow trout. Genetic analysis indicates that lower McCloud rainbows (as well as rainbows from several tributary populations) are more closely grouped with the coastal rainbow and steelhead than to the "inland redband" type rainbow (O. mykiss newberri) found in streams of the great basin, or the "upper McCloud redband" found in the McCloud River above Middle Falls (Gall et al., 1981; Berg and Gall, 1988). However, Dr. Robert Behnke classifies the “native rainbow” as Sacramento redband, O. mykiss stonei and provides discussion of probable phylogenic relationships (Behnke, 2002). Our understanding of the phylogeny of the rainbow-redband complex is still incomplete.

Table 1. Status of fish species in the McCloud River Wild Trout Area.

Native Game Fish	Status
Rainbow trout (Oncorhynchus mykiss sp.)	Dominant trout species
Steelhead rainbow trout (Oncorhynchus mykiss sp.)	Extirpated
Bull trout (Salvelinus confluentus)	Extirpated
Chinook salmon (Oncorhynchus tshawytscha)	Extirpated
Introduced Game Fish	
Brown trout (Salmo trutta)	Common
Native Non-game Fish	
Riffle sculpin (Cottus gulosus)	Common
Sacramento pikeminnow (Ptychocheilus grandis)	Very rare
Sacramento sucker (Catostomus occidentalis)	Very rare

Bull trout, formerly known as the Dolly Varden (Cavender, 1978), were last confirmed from the lower McCloud River in 1975. This native char was found in the lower McCloud below Lower Falls. The McCloud River population was the only one known from California and represented the southernmost distribution of the species. Extensive survey efforts during the 1980's, both above and below McCloud Reservoir, failed to capture a single specimen. In 1976, the State Fish and Game Commission made it illegal to take or possess bull trout from the McCloud River drainage, and it was declared a State endangered species in 1980. Anglers occasionally report releasing bull trout (see section: The Current Fishery) but when investigated, such reports have always proven to be misidentified brown or rainbow trout.

Bull trout were apparently common during the early part of this century and were frequently found as recently as the early 1960's. Since the completion of McCloud Dam in 1965, bull trout numbers have declined to the point where the Department now considers bull trout to be extinct in California. McCloud Dam drastically reduced flows and increased water temperature in the lower McCloud River and physically isolated upstream spawning areas from prime holding habitat below the dam. Bull trout are known to migrate significant distances from holding areas to spawn around large springs. McCloud Dam effectively blocked these spawning migrations.

Brown trout are a non-native species introduced to the lower McCloud River in the 1920's. They have been more successful than bull trout under present conditions and their numbers have likely increased concurrent with the bull trout's decline. Today, brown trout occupy the degraded bull trout niche. Brown trout are resident throughout the length of the lower McCloud River but, based on 1977-78 surveys, are greater in number in downstream areas. Because of their large size (to 32 inches), brown trout add an exciting element to the wild trout fishing experience. An unknown proportion of the McCloud River brown trout population is adfluvial and migrates between the McCloud River and Shasta Lake; this is discussed in the "Fish Populations and Harvest" section.

Interestingly, brown trout numbers in the McCloud appear to increase following periods of drought and decrease following years with normal to above normal rainfall. One explanation for this observation is that dry years may improve brown trout spawning success. During such dry years, regulated flows from McCloud Reservoir create a stable environment for these fall-spawning fish. During wet years, the reservoir can spill in late fall and winter resulting in high flows that may dislodge incubating eggs and decrease survival of emerging fry.

Riffle sculpin seem to be abundant throughout the WTA. This species has not been studied in any detail, partly due to its secretive nature and small size.

Both Sacramento suckers and Sacramento pikeminnow are rare in the WTA. Only one sighting of suckers has been recorded: A school of juveniles was identified by Dr. Peter Moyle in the middle of the Preserve in 1974 (Moyle, 1976). Pikeminnow have been observed only on a few occasions. These have been sexually mature specimens caught by anglers as far upstream as 1/2 mile below McCloud Dam early in the fishing season, during an unusual spilling of McCloud Reservoir. This spill event resulted in higher flows and warmer water temperatures than usual (spring, 1983, T. Hesseldenz, Manager, McCloud River Preserve, personal communication). No other pikeminnow have been noted during a variety of field investigations.

Suckers and pikeminnow seem to increase slightly in numbers downstream from the WTA and are quite numerous in the lower 5 miles of the river, downstream of Tuna Creek Falls. It is likely that Tuna Creek Falls has been the historic upstream barrier for non-game fish. None have been recorded upstream of McCloud Dam suggesting non-game fish were not isolated there when the dam was constructed. However, drastically reduced flows caused by McCloud Dam may now occasionally allow non-game fish to pass the falls.

Several surveys document other aquatic species in the TNC Preserve and WTA: amphibians present include the Pacific tree frog (Hyla regilla), rough-skinned newt (Taricha granulosa), Pacific giant salamander (Dicamptodon ensatus), foothill yellow-legged frog (Rana boylei) and tailed frog (Ascaphus truei) (Brode and Sturgess, 1974; Hayes, 1975). Hajek (1975) and Resh (1976, 1977) identified 129 species of primarily aquatic insects from the Preserve including epibenthic fauna dominated by mayfly nymphs (Ephemerella spp. and Baetis spp.), stonefly nymphs (Paragnetina spp.) and immature Trichoptera (Arctopsyche spp.), and Diptera (Tipulidae, Blephariceridae, and Simuliidae). The drift was composed primarily of Baetidae nymphs (Ephemeroptera), larval Simuliidae, and chironomidae (Diptera) and flying aquatic and terrestrial adult insects (Tippets and Moyle, 1978).

Trout Habitat

Flows in the lower McCloud River are highly regulated by releases at McCloud Dam and are only about 25% of pre-dam volume. Uncontrolled flows (dam spills) are very rare and only occur during major storm (flood) events or periods of rapid snow

melt. PG&E hydro project licensing agreements have resulted in a complex arrangement of required seasonal minimum flows at both the McCloud Dam and Ah-Di-Na gauges (Table 2). Flows at Ah-Di-Na are met by a combination of releases at the dam and tributary accretions primarily from Hawkins Creek. When tributary accretion is high, flow releases at the dam are often at or near minimum (40 to 50 cfs). Ironically, this has resulted in flows in the upper 1-mile of river (between McCloud dam and Hawkins Creek) being low in early spring when, under unregulated conditions, they would normally be highest. This has created good early season fishing conditions compared to most other northern California streams plagued by high run-off. However, there is some concern that such low flows during trout spawning could result in inappropriate or excessive harvest.

Table 2. Required fishery flow releases for McCloud Dam (cubic feet per second).

Location	Time Period	Normal Year	Dry Year[a/]
Gauge No. 11367760	May 1 - Nov. 30	50	50
Below McCloud Dam	Dec. 1 - Apr. 30	40	40
Gauge No. 11367800	Jan. & Feb.	160	160
at Ah-Di-Na	Mar. & April	170	170
	May 1 - 15	170	160
	May 16 - Aug. 31	200	160
	Sept. 1 - Dec. 15	210	180
	Dec. 16 - Dec. 31	170	170

[a/] A dry year is one in which the California Department of Water Resources projected inflow to Shasta Lake from the McCloud River for the period April to July will be less than 300,000 acre-feet, except that not more than two years in succession will be considered dry, regardless of forecast.

Summer flows at Ah-Di-Na seldom exceed minimum fish release levels and average about 200 cfs. The highest flow recorded at Ah-Di-Na (gauge No. 11367800) since the construction of McCloud Dam was 31,700 cfs on January 1, 1997; the lowest daily discharge of 41 cfs occurred on December 18-20, 1971 (US Geological Survey, 1984), due to a valve malfunction at the dam. There have been several other malfunctions or operator errors that have caused below minimum flows for short periods of time, some resulting in fish stranding and mortality. As a result of dam operations, flood frequencies at the one to three year recurrence interval have decreased by as much as 50%. For example, the two-year flood recurrence interval was 11,500 cfs pre-dam but decreased to 6,500 cfs post-dam. Although project operations have drastically reduced base flow, they have had little impact on the recurrence of higher stream flows. This is largely due to limited storage capacity in the reservoir, and flood frequencies in excess of 12,000 cfs have similar recurrence intervals both pre- and post-dam.

Summer water temperatures in the WTA range from the high 40's to the high 50's°F. In June near the TNC Preserve cabin, water temperatures fluctuate about 10°F

daily from about 49° to 59°F (T. Hesseldenz, Manager, McCloud River Preserve, personal communication). The river is now approximately 10 to 20 degrees (F) warmer than pre-dam conditions. There is abundant, recent temperature data available.

Water clarity ranges from excellent to highly turbid. Much of the turbidity is generated by glacial mud and volcanic ash contributed by Mt. Shasta's Konwakiton Glacier via Mud Creek, a tributary to the McCloud River just above McCloud Reservoir. This gives the lower McCloud River its characteristic milky-green color, a condition common to glacially fed rivers. Turbidity episodes occur regularly and often unpredictably, but commonly during summer hot spells. They are most severe when the previous winter has left little snow on the slopes of Mt. Shasta. During the 1920's and 1930's, large mud slides in upper Mud Creek Canyon brought about by the partial break-up of Konwakiton glacier created such turbid conditions in the river that fishing was impossible for prolonged periods (Wales, 1939; Hill and Engenhoff, 1976). The turbidity problem today is chronic but much less severe: While turbidity is sometimes severe enough to preclude successful fishing, it does not appear to be adversely affecting trout health.

A second source of turbidity is associated with operation of McCloud Reservoir. After the reservoir is drawn down at the end of the summer (this is a general PG&E operating practice), the river erodes the exposed sediments deposited at the head of the reservoir. This erosion problem may be exacerbated when runoff increases during the fall-winter period. The sediments become re-suspended, often causing prolonged bouts of turbidity in the lower river.

A third source of turbidity is the testing (sluicing) of the McCloud Dam bypass valve. This discharges sediment from the reservoir and causes high turbidities of relatively short duration in the lower river.

A fourth source of turbidity is the dirt roads in the wild trout drainage area. During heavy storms, especially the first storms of the season (after much dust has accumulated), these roads contribute large amounts of turbid run-off to the river.

When the river is running clear, it is low in total dissolved solids (97 ppm), soft (38 ppm CaCO3) and slightly basic (pH 7.5-7.8) (Tippets, 1976). Dissolved oxygen levels range from 10-16 mg/l. Water conductivity (specific conductance) ranges from about 78 -106 microsiemens/cm. Turbidity generally ranges from 1-75 nephalometric units (NTU). Increases above 10 NTU are usually associated with sporadic plumes of glacial silt originating in Mud Creek and ‘stored’ in McCloud Reservoir (TNC data).

The lower McCloud River WTA is noted for being a classic "pocket water" trout stream. It is characterized by long boulder strewn runs ranging from 1-1/2 to 3 feet deep and 150 to 1,200 feet in length, alternating with large bedrock pools 6 to 12 feet deep and 60 to 300 feet long (Tippets, 1976). Instream cover for fish is provided by boulders, cobble, turbulent water, deep pools, runs, some undercut banks and occasional downed trees and other debris. The McCloud River Coordinated Resource

Management Planning Group (CRMP) partially funded a complete habitat typing of the lower McCloud in 2001. The TNC, USFS and the Department provided personnel and materials to complete this task. A copy of this report is available from the McCloud River CRMP.

Rainbow and brown trout reproduction and recruitment appear adequate in the WTA under present fishing pressure and harvest rates. However in many areas of the river, spawning gravel is compacted with sediments and often covered with a fine layer of surface silt. This condition is especially acute in the reaches just below McCloud Dam and in most pools. The main source of this sediment appears to be Mud Creek and valve testing at the dam. McCloud Dam has also eliminated most of the natural flushing flows that formerly occurred during the winter and spring periods. Previously these higher flows cleaned the streambed and recruited new gravel.

Trout Growth

Sturgess and Moyle (1978) reported relatively slow growth of rainbow trout and young age class brown trout collected from the Preserve in 1974, at a time when this stretch of river was not open to public fishing. Simpson (1982) reported similarly slow growth rates for both species collected during 1981 in the upstream two-trout limit area from Ladybug Creek to McCloud Dam (Table 3).

Sturgess and Moyle (1978) noted that after year three, brown trout growth accelerates (Table 3). They attributed this growth increase to the fact that many brown trout migrate to Shasta Lake and exploit forage fish. Tippets (1976) found no evidence of piscivory in brown trout from the river to explain this growth increase.

Tippets and Moyle (1978) speculated slow growth in both species may be a result of predominant epibenthic foraging rather than drift feeding. The peculiar habit of McCloud River rainbow trout to graze along the stream bottom was noted as early as the 1880's (Campbell, 1882; Stone, 1885). Epibenthic feeding may not be as energy efficient as drift feeding in swift waters and may be an adaptation of McCloud River trout to high turbidities. Poor water clarity reduces the ability of trout to see drift prey during low light conditions (e.g., morning and evening) when most drift occurs (Tippets and Moyle, 1978). Thus, trout are forced to feed during mid-day hours when drift prey are typically at their lowest numbers. General observations support this theory, since fishing on the McCloud River, unlike most trout streams, is often best at mid-day.

Slower trout growth may also be due to lowered primary productivity resulting from chronic turbidity. Low productivity along with sedimentation may be limiting aquatic insect production. It has also been speculated that because much of the lower McCloud River has a relatively un-harvested fish population, dominant older fish may be suppressing the growth of younger year classes through behavioral interactions (Sturgess and Moyle, 1978).

Snider and Linden (1981) (Table 4) reported rainbow trout grow somewhat faster in the McCloud River than indicated by Simpson (1982) and Sturgess and Moyle (1978). This difference may be due to either sampling bias (scales were taken only from angler-creeled fish in 1977 and 1978) or real differences in river conditions that affected growth during sample years.

Snider and Linden (1981) also reported slower growth rates for brown trout greater than age three. They indicated that growth patterns do not strongly suggest a Shasta Lake migratory history. This may be due to sampling bias, since most of the scales they collected were taken from brown trout captured early in the fishing seasons of 1977 and 1978 in the upper reaches of the WTA. Most of these fish were probably resident and reflect slower growth rates than migratory brown trout (see section: Fish Populations and Harvest). Analysis of age and growth characteristics of migratory brown trout caught at the Preserve Weir in 1985 (Mundy, 1988) showed patterns similar to those reported by Sturgess and Moyle, and Simpson, but growth rates were slightly higher (Table 3).

According to available data, rainbow and brown trout in the WTA are at least four years old before reaching a length of 14 inches (fork length, FL). Rainbow trout probably reach 17 inches (FL) by age five plus (sixth year of life) and brown trout by age five. However, there appears to be much variability in brown trout growth based on whether they are fluvial, adfluvial or resident. Trout growth appears to be somewhat slower in the wild trout portion of the McCloud than in four other popular trout waters in the Sacramento River system (Table 4).

Table 3. Fork length at annulus formation for rainbow and brown trout from the McCloud River Wild Trout Area; 1974, 1981 and 1985.

Annulus Average length at age		I in (mm)	II in (mm)	III in (mm)	IV in (mm)	V in (mm)	VI in (mm)	VII in (mm)
Location	Year	**Rainbow Trout**						
Preserve	1974/*	3.8 (97)	6.6 (168)	9.4 (239)	11.9 (302)	13.7 (348)	----------	----------
Ladybug Creek to McCloud Dam	1981/**	3.4 (86)	6.6 (167)	9.6 (244)	12.6 (321)	16.6 (423)	----------	----------
		Brown Trout						
Preserve	1974/*	3.9 (99)	6.7 (170)	10.7 (272)	16.0 (406)	19.5 (495)	19.7 (500)	22.4 (569)
Ladybug Creek to McCloud Dam	1981/**	4.1 (104)	7.9 (200)	12.3 (312)	15.8 (402)	18.2 (463)	----------	----------
Preserve Weir	1985/+	4.9 (125)	8.5 (217)	13.2 (336)	17.5 (444)	19.2 (487)	20.1 (511)	----------

/* From Sturgess and Moyle, 1978.
/** From Simpson, 1981.
/+ From Mundy, 1988.

Table 4. Fork length at annulus formation for rainbow and brown trout in streams of the upper Sacramento River and Pit River drainages. *

		Average Length at Annulus Formation				
	Annulus	I	II	III	IV	V
		in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
Stream	Year	**RAINBOW TROUT**				
McCloud River	1977	3.8 (97)	8.9 (226)	11.9 (302)	14.5 (368)	16.9 (429)
	1978	3.7 (94)	7.8 (198)	11.4 (290)	15.0 (381)	16.9 (429)
	Average	3.8 (96)	8.3 (212)	11.7 (296)	14.8 (375)	16.9 (429)
Upper Sacramento River	1978	4.0 (102)	8.2 (208)	12.0 (305)	14.7 (373)	----------
Hat Creek	1972	5.3 (135)	10.2 (259)	13.2 (355)	17.0 (432)	19.3 (490)
	1978	5.5 (140)	9.7 (247)	12.7 (323)	15.2 (385)	----------
	1979	5.2 (131)	10.0 (255)	12.6 (320)	----------	----------
	Average	5.3 (135)	10.0 (254)	12.8 (326)	16.1 (408)	19.3 (490)
Fall River	1978	6.7 (170)	10.2 (258)	13.1 (333)	15.2 (386)	17.6 (447)
	1982	4.8 (122)	9.2 (234)	12.2 (310)	14.6 (371)	16.9 (429)
	Average	5.7 (146)	9.7 (251)	12.7 (322)	14.9 (379)	17.2 (438)
		BROWN TROUT				
McCloud River	1977	3.6 (91)	7.9 (201)	12.0 (305)	14.5 (368)	17.0 (432)
	1978	3.8 (97)	6.8 (173)	10.0 (254)	12.6 (320)	15.0 (381)
	Average	3.7 (94)	7.4 (187)	11.0 (279)	13.6 (344)	16.0 (407)
Hat Creek	1972	5.6 (142)	11.0 (279)	14.0 (356)	15.3 (389)	----------
	1978	5.4 (138)	9.3 (237)	12.8 (326)	15.3 (388)	17.9 (455)
	Average	5.5 (140)	10.2 (258)	13.4 (341)	15.3 (389)	17.9 (455)

*From Snider and Linden, 1981.

THE CURRENT FISHERY

Methods

Fishing activity on the McCloud River Preserve portion of the WTA has been monitored each year since this section of the river was first open to public use in 1976 (data for 1977, 1987 and 1993 are missing). There is only one entrance to the Preserve and all individuals entering are directed to register at the headquarters cabin and indicate the activity they plan to pursue that day (i.e., fishing, birding, hiking, etc.). Upon leaving, anglers are requested to record number, species and size of fish caught, hours fished, type of gear used and county of residence. This data provides angler use and catch statistics that make it possible to monitor trends in the Preserve fishery.

Fishery data obtained at the Preserve can be considered representative of a relatively unaffected fish population and, as such, can be used as a control for monitoring the fishery upstream of the Preserve where fishing pressure is greater and harvest rates are higher under the two-fish limit. Limitations of Preserve fishery data are that it is fully angler self-reported (data collected by census clerks may be more precise) and a percentage of anglers fail to record their fishing results.

Upstream of the Preserve in the two-fish limit area, the Department conducted roving creel checks in 1976-1978 and again in 1998 on a sporadic schedule when personnel were available. Anglers were surveyed primarily in the Ash Camp and Ah-Di-Na areas. Survey clerks drove along roads near the stream and looked for parked cars. When anglers or vehicles were seen, clerks attempted to contact anglers for interviews. In 1976 and 1977, the survey was limited to the spring and early summer. No attempt was made to estimate total use or catch.

In 1981 and 1982, TNC conducted a walk-through angler creel survey in the upper portion of the WTA. Survey clerks walked the stream from Ladybug Creek to the dam, checking all anglers encountered. Survey days were selected on a random basis. Creeled fish were examined and measured, and anglers were asked to estimate the size of the fish they released. A similar effort was conducted again in 1998.

In 1991, the Department ‘s Wild Trout Program installed angler survey boxes at the start of the Preserve trail, at Ah-Di-Na Campground and at Ash Camp. These boxes are stocked with survey forms and pencils, and anglers are asked to self-report their fishing effort and catch on a daily basis. The length frequency of trout caught, species caught and catch-per-hour are determined. This effort is ongoing. About 150 survey forms are received each season. It should be noted that anglers voluntarily complete these forms and data is sometimes slightly skewed by more successful anglers. Results of these surveys between 1991 and 2002 are provided in Appendix 1.

Due to the difficulty of electrofishing the lower McCloud River, generating fish population, harvest rate and migration data has been difficult. In response to this and in an effort to capture possible migrating bull trout, a fish weir and trap were established

seasonally several hundred yards downstream from the Preserve headquarters cabin from 1984 through 1987. Operation of this trap started as early as 7 April 1987 and continued as late as 16 February 1987.

In 1986 and 1987, a weir was also established on the lower McCloud River on Bollibokka Club property about 1 mile upstream of Shasta Lake. It was operated from 17 June to 14 November1986 and again from 4 April to 7 May 1987.

All fish entering the traps were identified, measured and most trout tagged with a $5 reward Carlin tag (Nicola and Cordone, 1969). In 1986 a few trout were tagged with non-reward Carlin tags; most were released in the direction originally trapped. The weir and tagging data were presented in a separate report.

In 1998, a Mark-Recapture study was conducted by Department personnel and volunteers to estimate the catchable trout population (trout five inches in length or greater) in the closed area of the river (lower TNC section). Ten fly anglers (using primarily nymphs) and two spinner anglers were utilized to catch and mark trout in a 0.65 mile-long section of the river. The study section was bounded at each end by very large pools and contained representative habitat types, including smaller pools, pocket water, runs and riffles. On 10 September 1998, 233 trout were caught and given a small caudal fin clip. All fish caught were measured, marked and released. Some trout were weighed to calculate condition factor and numerous scale samples were taken. On 8 October 1998, the same anglers fished the same reach with the same effort catching 252 trout, 20 of which were marked. Notably, two of the marked trout were caught again later in the same day, indicating the marking process was not unduly stressful.

RESULTS and DISCUSSION

Angler Use

Total angler use on the Preserve has steadily increased over the years from a low of 2,048 angler hours in 1978 to more than 6,700 hours in 1991 (Table 5 and Appendix 1). Angler use from 1991 through 1998 averaged about 6,500 hours (TNC Preserve data, Appendix 1). Preserve angler use is not only controlled by the "not more than ten anglers on the stream at one time" restriction but, like the rest of the stream, is influenced by weather patterns, spring run-off conditions and water quality. For example, in the spring and early summer of 1983 and 1998, high run-off (and spilling at the dam) from an abnormally deep snow pack and wet winter caused poor fishing and reduced early season use. In 1986, the Preserve recorded 1,387 angler visits. Anglers represented 76% of total use (T. Hesseldenz, Manager, McCloud River Preserve, unpublished data). More than 1,200 anglers fished the Preserve in both 1997 and 1998 (Preserve data).

Angler use of the upper, two trout-limit portion of the WTA also appears to have increased steadily over the years. This conclusion is based on general observations by Department and Preserve staff, the number of angler survey forms received and comments from anglers. Unfortunately no formal use data has been obtained.

Although turbid water conditions occur each year, turbidity is more intense and prolonged in some years than others. At times, turbidity reduces water clarity to only a few inches and fishing success to near zero. Such conditions can also significantly lower angler use. However, these events are usually of short duration (one to several days) and occur sporadically during the summer.

Angler Success and Catch

Angler success, measured by the average number of trout reported caught per-hour (trout/hour), has been outstanding at the Preserve. Trout/hour has ranged from 0.81 in 1983 to 1.80 in 1976 and averaged 1.29 during the eleven-year period (Table 5). However, a sizeable portion (average of 26%) of anglers who signed into the Preserve during this same period did not record their results and these anglers may have been less successful than those who reported their catch. Even if it is assumed these anglers caught no fish, the average trout/hour for the eleven-year period would be a respectable 1.05 trout/hour. Since not all of the non-reporters would be expected to be fishless, this latter rate is probably low and the true catch rate is most likely somewhere in between the two.

Fluctuations in the catch rate for the Preserve seem to parallel those in the two-trout area; 1.29 trout/hour (Table 5) compared to 1.14 trout/hour in the area upstream of the Preserve (Table 6). The somewhat higher catch rate in the Preserve may be a reflection of 1) a larger trout population in the Preserve because of the zero limit, 2) a bias related to angler self-reported data at the Preserve versus survey clerk personal interview data

above the Preserve, or 3) superior skill of anglers fishing the Preserve. Anglers fishing the Preserve must walk-in and be willing to fish under a zero rather than two-trout limit; these anglers may be more dedicated, experienced or skillful compared to those fishing the more accessible upstream areas.

Although minor variations in the annual trout/hour may be due to changes in flow or turbidity, the more significant variations are probably related to variability in trout year-class strength. The Preserve data exhibit significant annual variation in the catch (Table 7) and catch/hour for trout under 10 inches but little for those 14 inches or larger. Since trout under 10 inches make up, by far, the majority of fish reported by anglers, the abundance of this size class from year to year appears to have a great influence on annual catch rates. Further, there appears to be little or no correlation between the abundance of trout under 10 inches and those 14 inches or larger in the same year. Patterns suggesting that strong year classes of small trout affect the number of larger trout are not evident. Variations in the catch rate of the upper section of the WTA are harder to evaluate because survey time periods have varied, were less complete and fewer in number. Adult trout holding habitat may be a limiting factor for larger fish. A study of the relationship between flow and available adult habitat is needed.

The average catch-rate for the McCloud WTA from 1976 through 1986 (Table 5) was about 1.3 trout/hour. The average catch-rate over the last 12 years (1991-2002) was about 1.1 trout/hour. While the present average catch-rate is comparable with most other WT waters in the north state, it is slightly lower than ‘historic data’. The apparent difference is there are no recent years with catch-rates higher than 1.4 trout/hour. Whether this is a reflection of higher use (resulting in more weary, “educated” fish) or a smaller catchable trout population is unclear.

Rainbow trout have constituted an average of about 85% of the reported catch at the Preserve, with brown trout contributing the remainder. This figure has fluctuated during the past 20 years. For example, in 1985 the percentage of rainbow trout dropped to 80% and in 1992 and 1994 more browns were caught than rainbows (Preserve data). These were very dry water years. Catch data most likely over-represent the percentage of rainbow trout actually occurring in the Preserve fish population. Almost 88% of anglers fishing the Preserve used flies (Table 5), a technique more selective for rainbow than brown trout. Upstream of the Preserve, rainbow trout have accounted for 79% of fish caught (Table 6). The lower representation of rainbow trout may be due to a large portion of anglers fishing with lures (44%) or a small number illegally using bait (5% in 1981 and 6% in 1982). These differences in angling methods favor catching more brown trout. The portion of brown trout caught in the upper area ranged from 13 to 30% (Table 6). Further, Department angler survey box data has never shown (including 1992-1994) more browns than rainbows in the catch.

Table 5. Angler voluntary report summary for the McCloud River Preserve (0 trout-limit area), 1976-1986.

	YEAR*										
PARAMETER	1976	1978	1979	1980	1981	1982	1983	1984	1985	1986	Average
Angler Questionnaire Responses	693	502	565	759	845	976	899	1313	1122	1028	870
Hours Fished	2206	2048	2429	3456	3949	4018	3638	5163	4909	4249	3606.5
Total Trout Caught	3977	2561	3302	5033	5617	4988	2940	4407	7540	5161	4553
Rainbow Trout Caught	3274	2190	2967	4613	4986	4554	2660	3983	6064	4672	3996
(% of total catch)	(82.3)	(85.3)	(89.9)	(91.7)	(88.8)	(91.3)	(90.5)	(90.4)	(80.4)	(90.5)	(88.1)
Brown Trout Caught	697	370	334	417	617	427	271	423	1455	480	549
(% of total catch)	(17.5)	(14.4)	(10.1)	(8.3)	(11.0)	(8.6)	(9.2)	(9.6)	(19.3)	(9.3)	(11.7)
Bull Trout Reports	6	1	1	3	14	7	9	1	21	9	7
(% of total catch)	(0.2)	(0.0)	(0.0)	(0.0)	(0.2)	(0.7)	(0.3)	(0.0)	(0.3)	(0.2)	(0.1)
Total Catch Per Hour	1.80	1.25	1.36	1.46	1.42	1.24	0.81	0.85	1.54	1.21	1.29
% Fishing Method											
Fly	N/A**	N/A	83.9	87.4	87.6	90.0	88.9	89.6	87.6	85.9	87.6
Lure	N/A	N/A	16.1	12.6	12.4	10.0	11.1	10.4	12.4	14.1	12.4

* 1977 data not available
** N/A = not available

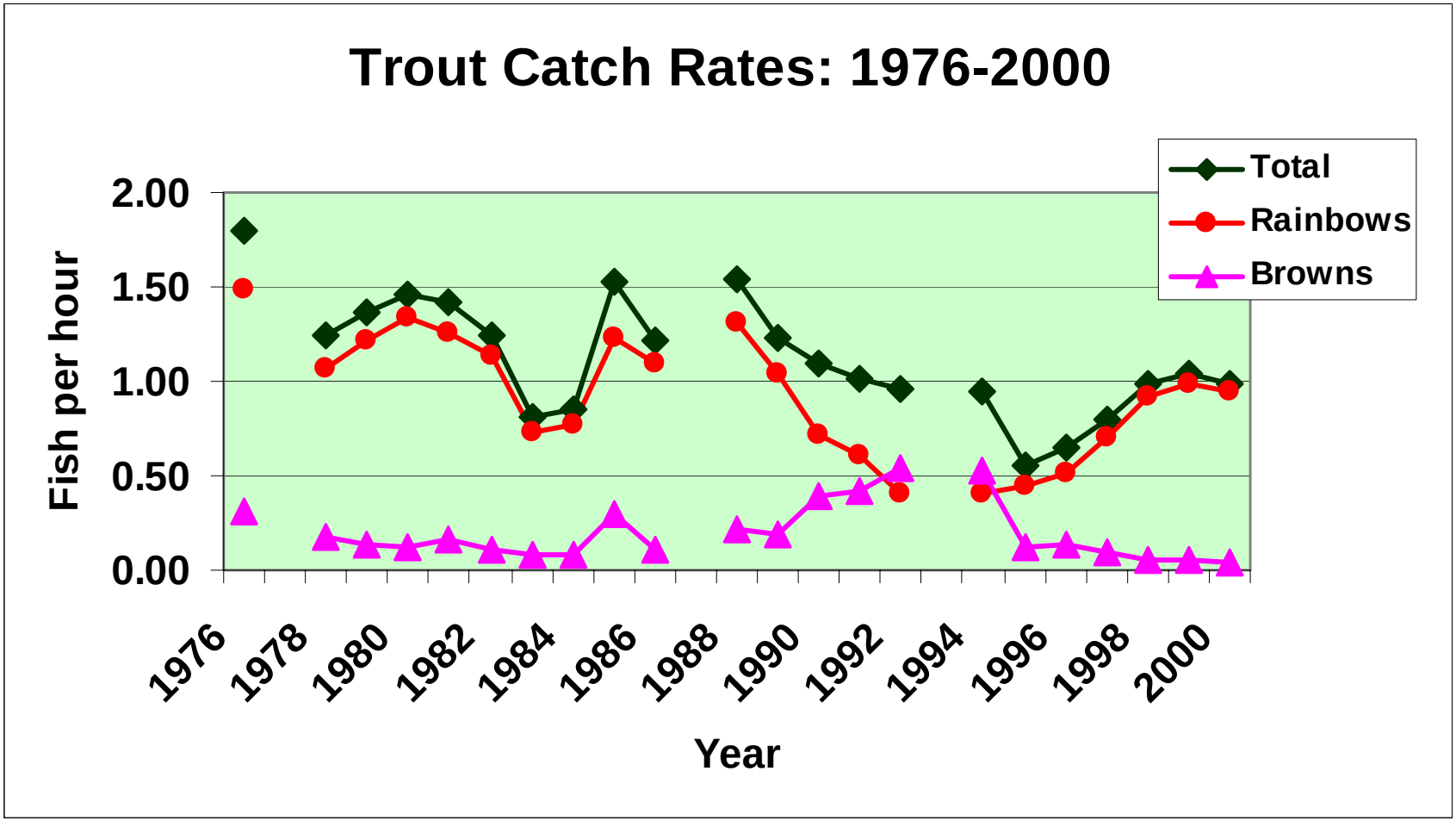


Figure 3. Summary of catch data from The Nature Conservancy Preserve (TNC data; 1977, '87 and '93 data is missing).

Table 6. Creel survey summary* for McCloud River two-trout limit area (McCloud Dam to Ladybug Creek) 1976-1982.

PARAMETER	1976	1977	1978	1981	1982	Average
Survey Period	4/24 to 7/24	4/30 to 7/28	4/29 to 8/20 and 9/3, 11/1	6/23 to 11/13	4/24 to 11/6	
Days Sampled	7	12	44	83	81	45
Anglers Interviewed	95	92	513	630	420	350
Hours Fished	326	239	1353	664	586	634
Total No. Trout Caught (kept and released)	417	431	947	737	469	600
No. Rainbow Trout (%)	363 (87.1)	316 (73.3)	746 (78.8)	504 (68.4)	408 (87.0)	467.4 (78.9)
No. Brown Trout (%)	52 (12.5)	111 (25.8)	197 (20.8)	219 (29.7)	61 (13.0)	12.8 (20.4)
No. Bull Trout Reports (%)	2 (0.4)	4 (0.9)	4 (0.4)	14 (1.9)	0 (0.0)	4.8 (0.7)
Total Catch Per Hour	1.28	1.80	0.70	1.11	0.80	1.14
% of Trout Released	88.0	88.1	76.8	85.1	85.9	84.8
Fishing Method (%)**						
Fly	N/A+	62.0	48.4	44.0	57.6	53.0
Lure	N/A+	38.0	51.6	51.0	36.1	44.2
Angler Residence (%)						
Shasta/Siskiyou Counties	27.4	12.0	24.4	18.4	17.0	19.8
Other Counties	72.6	88.0	75.6	81.6	83.0	80.2

* Sample data only; total use estimates not made.
** 5% of anglers checked in 1981 and 6% in 1982 were illegally using bait.
\+ N/A = not available: Some data not collected in certain years.

Table 7. Size distribution of angler reported catch for McCloud River at McCloud River Preserve, 1979*-1986.

	Number Fish Reported Caught									
Year	1979	1980	1981	1982	1983	1984	1985	1986	Mean	% less Than 12 inches
Rainbow Trout										
Length (inches, TL)										
< 10	1930	2681	3496	2613	1117	2203	4436	2670	2643	
10-11.9	512	933	761	971	679	763	776	875	784	79.5%
12-13.9	261	521	328	504	403	420	364	526	353	
14-15.9	126	257	222	222	230	266	210	324	232	
16-17.9	71	122	113	158	151	202	172	165	144	
> 18	67	99	66	86	80	129	101	112	93	
Total	2967	4613	4986	4554	2660	3983	6064	4672	4312	
Brown Trout										
Length (inches, TL)										
< 10	110	294	485	252	61	186	1268	278	367	75%
10-11.9	70	33	59	40	29	36	66	57	49	
12-13.9	26	26	20	22	17	32	35	36	27	
14-15.9	19	13	10	12	25	11	12	29	16	
16-17.9	32	10	9	22	48	31	12	29	16	
> 18	77	41	34	79	91	127	62	63	72	
Total	334	417	617	427	271	423	1455	480	553	

* Data collected prior to 1979 not included because size classifications used were incompatible with later years.

An examination of the seasonal distribution of angler-caught brown trout from two representative years at the Preserve indicates brown trout, including large spawning-sized fish (≥ 18 in) are caught throughout the fishing season (Table 8). The presence of large brown trout early in the season indicates some portion of the adult brown trout population is resident in nature. The number of large brown trout caught increases from September through November 15, suggesting these spawning-sized fish are more abundant, more vulnerable, or both, in the WTA during the last part of the season (Table 8). Weir studies (see Section: "Fish Populations and Harvest") confirm that a large number of mature brown trout migrate into the Preserve area in the fall.

Table 8. Seasonal distribution of McCloud River angler caught brown trout, McCloud River Preserve, 1982-1986.

	Brown Trout Caught			
	Year		Year	
	1982	1986	1982	1986
	Total Number		Number > 18 inch	
Time Period				
Opening Day - June (9 weeks)	79	121	14	13
July - August (9 weeks)	156	105	26	5
September - November 15 (10 weeks)	192	254	39	45

In the early 1980's, a small number of bull trout were reported caught in both sections of the WTA (Tables 5 and 6). None of these reports have been confirmed. In 1984 under special permit, TNC attempted to substantiate bull trout reports. Large fish cages were placed at most major pools along the river within the Preserve and buckets with instructions were located at strategic points. Anglers catching suspected bull trout were directed to carry their fish via bucket to the nearest cage. A $50 reward was offered to the angler catching the first positively identified bull trout. Only one fish was placed in a cage during 1984, a misidentified rainbow trout. Based on this exercise and discussions with anglers, it is believed all recent bull trout reports were misidentifications. The Department now considers bull trout extinct in California.

Trout release rates between 1976 and 1982 in the 2-trout area of the McCloud averaged 84%. Interestingly, trout release rates between 1991 and 2002 averaged about 95% (Angler Survey Box data). This most likely reflects a change in angler attitudes away from an interest in harvesting fish to a catch-and-release ethic.

About 80% of anglers fishing the 2-trout area (Table 6) and 85% of those fishing the Preserve (T. Hesseldenz, pers. comm.) were from outside the local Shasta-Siskiyou County area. A recent angler survey on the upper Sacramento River found similar results (Sacramento River Angler Creel Survey, 2002).

Fish Populations and Harvest

Weir Operations

Weir operations (Tables 9 and 10) were primarily aimed at brown trout, and possibly bull trout, expected to be migrating to spawning areas. For practical reasons the spacing

between bars in the weir and traps was about one inch, which was too wide to capture trout less than 12 inches in length. Therefore, weir trapping likely overestimated the relative abundance of brown trout compared to rainbow trout. Further, the weir data cannot be expected to give an accurate account of trout size or general species composition.

Only rainbow trout and brown trout were captured at the Preserve Weir and no bull trout were observed. Further, relatively few rainbow trout passed either weir. At the Preserve, fewer than 10 per month were captured moving either up or downstream. At the Bollibokka Weir, the rainbow counts were substantially higher except during July and August. From April through June, about 30 rainbow trout were trapped per month moving upstream, and during October and November about 65 were counted upstream per month. However, downstream counts approached or exceeded the upstream counts and about 35% of these were dead. These dead fish appeared to be those counted while moving upstream, indicating the weir and fish handling were contributing to the observed mortality.

At the Bollibokka Weir, the largest brown trout count occurred in April when 419 upstream migrating fish were captured in only 23 days. Upstream counts declined during May through July and then remained near 30 during August and September. Surprisingly, the upstream count was only 55 in October, when peak brown trout spawning migrations are normally expected. Downstream brown counts were about 20% of the upstream counts but about 75% of these were dead fish that previously passed the weir going upstream.

Only about 10 brown trout per-month were counted at the Preserve Weir until fall. In 1986 and 1987 when complete counts were made throughout the three fall months, the upstream count averaged 25 in September, 329 in October and 450 in November. Downstream movement and mortality was not substantial until the first major storm and flow increase of each winter season, which occurred in February 1987 and November 1987. Rainbow trout trapped at the Preserve Weir averaged nearly 14 inches and generally ranged up to 18 inches in all four years. At the Bollibokka Weir in 1986, rainbow ranged from 8.3 to 21.0 inches and averaged 15.1 inches. Of 333 brown trout tagged (upstream) at the Bollibokka Weir in 1986, only 30 were recaptured in the upstream trap at the Preserve Weir. For recaptured fish, those passing the Bollibokka Weir in June took about 128 days to reach the Preserve. Each succeeding month, the median travel time between weirs was less: Those fish passing the Bollibokka Weir in September took only about 42 days to reach the upper weir. Therefore, later migrating fish tended to reach the Preserve Weir with the peak migration. Brown trout captured at the Preserve Weir averaged 18.9 inches (FL) in 1984, 21.2 in 1985 and 19.6 in 1986. At the Bollibokka Weir, brown trout averaged 17.7 inches in 1986.

Tag Reports

Angler reports of recaptured tags from the Preserve Weir are of little use in evaluating harvest rates in the WTA because they only represent capture of fish that moved past the weir during part of the year. They are not representative of fish that are

resident in various portions of the WTA. Further, since most of the trout caught are released, even in the two-trout area (Table 6), many tags are probably not reported. The primary value of angler reports of these tags is to show movement of trout and harvest in other areas (e.g., Shasta Lake).

Angler tag reports indicate brown trout are highly migratory compared to rainbow trout. Of 453 brown trout tagged at the Preserve Weir in 1984 and 1985, 13 (3%) were reported from the zero trout area (near where they were tagged), 29 (6%) from the two-trout area and 53 (12%) from Shasta Lake. Of the 46 rainbow trout tagged at the Preserve Weir in 1984 and 1985, 10 (22%) were reported from the zero limit area, 2 (4%) from the two-trout limit area, one from the Bollibokka Club area and none from Shasta Lake.

Anglers reporting tags were asked if they kept or released their fish and if they would have released their fish had it not been tagged. This information indicated most of the trout caught in the WTA were or would have been released, while all of the fish caught outside the WTA would have been kept whether they were tagged or not.

Angler tag returns and weir data indicate a substantial exchange of brown trout between Shasta Lake and the McCloud River. Tag-return information revealed that many of the brown trout passing the Preserve Weir were caught by anglers in Shasta Lake. However, most of the fish passing the Preserve Weir appeared to be migrating river fish rather than lake fish. Therefore, the large, spawning-sized ($\geq$ 18 inches) brown trout found in the WTA appear to be a mix of resident, fluvial (lower river dwelling) and adfluvial (from Shasta Lake) fish.

Population Estimate

During the Mark-Recapture study conducted in the closed reach in 1998, we marked 233 rainbow trout and caught 252 during the recapture phase. Twenty rainbow trout in the recapture sample were marked. The Peterson estimate for this data is the 3,806 ($\pm$ 1,496) catchable rainbow trout per-mile. Too few brown trout were caught to generate a valid estimate.

Table 9. Upstream trap summary for Preserve weir operated on the McCloud River, 1984-1987.

Year	1984		1985		1986		1987	
Trapping Period*	7/6 to 10/15		6/17 to 11/9		5/13/86 to 2/16/87		4/5 to 12/2/87	
Species Trapped**	Bn	Rt	Bn	Rt	Bn	Rt	Bn	Rt
Number Tagged (Preserve Weir)	188	36	253	10	4	75	7	0
Number Untagged (Passed)	6	25	13	4	13	15	1003	92
1984 Tags Recaptured	0	0	17	0	21	0	5	0
1985 Tags Recaptured	---	---	69	2	17	0	---	---
1985 McCloud River Club Tags Recaptured	---	---	0	0	2	0	0	---
1985 McCloud Tags Recaptured	---	---	0	0	1	0	1	---
1986 Preserve Tags Recaptured				50	56	---		
1986 Bollibokka Club Tag Recaptured	---	---	---	---	30	0	18	---
Total Captured	194	61	283	14	661	24	1100	92
Mean Fork Length (in.)	18.9	13.4	21.2	14.8	19.6	13.9		
Fork Length Range (in.)	10.5-27.0	11.4-18.1	12.4-31.5	11.6-18.5	12.8-31.0	7.1-17.5		

* During some trapping periods the weir was occasionally open and data is incomplete (---).
** Bn = brown trout, RT = rainbow trout.

Table 10. Upstream Trap Summary, McCloud River, Bollibokka Weir; 10 June to 13 November 1986, and 1 April to 20 July 1987.

Species Trapped	Brown Trout		Rainbow Trout		Chinook Salmon		Smallmouth Bass		Sacramento Sucker		Sacramento Pikeminnow		Channel Catfish	
Year	1986	1987	1986	1987	1986	1987	1986	1987	1986	1987	1986	1987	1986	1987
Number Tagged at Bollibokka	326	0	40	0	1	0	2	0	19	0	35	0	0	0
Number Passed Untagged	29	1113	104	32	6	0	10	0	4	57	5	7	0	1
1986 Bolli-Weir Tags Recaptured	---	28	---	1	0	0	0	0	0	0	0	0	0	0
1986 Preserve Weir Tags Recaptured	---	50	---	0	0	0	0	0	0	0	0	0	0	0
1985 Preserve Weir Tags Recaptured	6	24	0	0	---	---	---	---	---	---	---	---	---	---
1984 Preserve Weir Tags Recaptured	0	3	0	0	---	---	---	---	---	---	---	---	---	---
1985 Pt. McCloud Recaptured	1	0	2	0	---	---	---	---	---	---	---	---	---	---
1985 McCloud Club Recaptured	0	0	0	0	---	---	---	---	---	---	---	---	---	---
Total Captured	362	1167	146	33	7	0	12	0	23	57	40	7	---	1
Mean Fork Length	17.7	---	15.1	---	26.8	---	11.5	---	16.9	---	18.1	---	---	---
Fork Length Range	10.4-30.6	---	8.3-21.0	---	22.7-29.5	---	8.0-13.0	---	12.0-19.9	---	12.0-28.1	---	---	---

MANAGEMENT PROGRAM

Management Goals

The goals of the wild trout management program in the McCloud River WTA and associated tributaries are:

1. Protect the aquatic environment, including maintenance or improvement of existing optimal habitat conditions for trout. Habitat characteristics deemed most critical are:
    a. Plentiful and stable summer flows.
    b. Winter and spring flows that mimic the natural hydrograph.
    c. Cool water temperatures (40-55°F).
    d. High water transparency and low suspended sediments.
    e. Absence of harmful pollutants.
    f. Ample and clean spawning gravels.

2. Perpetuate all native aquatic species.

3. Prevent or minimize the incursion of undesirable non-game fish into the WTA.

4. Maintain a trout population and size structure capable of producing outstanding wild trout angling.

5. Maximize the opportunity to catch trophy trout ($\geq$l4 inches).

6. Preserve the natural character of the stream characterized by:
    a. an attractive, wilderness-like setting with natural appearing viewsheds,
    b. a minimum of developed conveniences other than those needed for access, safety, sanitation and protection of the land and water,
    c. an absence of incompatible encroachments.

7. Provide for recreational use of wild trout while minimizing uses not compatible with wild trout angling.

Wild trout management objectives on the lower McCloud River are based on the following assumptions:

1. The demand for wild trout angling opportunities in California will continue and likely increase. Wild trout are those fish that are spawned naturally in the wild. Non-native brown trout are wild trout by definition. The Department includes all wild trout in this program.

2. Wild trout anglers will continue to be more interested in the pleasure of fishing and the challenge of catching wild trout in attractive surroundings than in either angling convenience or the potential for harvesting many trout.

3. The Department will continue to manage the McCloud River WTA for self-sustaining wild trout populations and hatchery trout will not be stocked.

Management Objectives

1. Maintain minimum angler catch-rates of at least 0.75 wild trout per-hour, with a five-year average of more than 1.0 trout/hour (based on Angler Survey Box (ASB) data).
2. Maintain at least three data collection points in the ASB program.
3. Maintain a catch of at least 3.5 wild trout/angler (ASB data).
4. Maintain the average size of rainbow trout caught at least nine inches (TL).
5. Maintain the catch of trout $\geq$12 inches in length at least 20% of the total catch (ASB data).

Fishery Management

In spite of drastically reduced stream flows resulting from hydro-project operations, the McCloud River WTA supports one of the premiere wild trout fisheries in California. During the past decades, catch rates have been consistently high. The average size of both creeled and released trout has remained large and a significant portion of the catch has consisted of trophy-sized trout ($\geq$ l4 inches).

Anglers fishing the two-trout limit area release most of their fish. The release rate between 1976 and 1982 ranged from 77% to 88% and averaged almost 85% (Table 6), and between 1991 and 2002, averaged about 95% (Appendix 1). This ethic should be encouraged in accordance with Wild Trout Program policy where the act of fishing has little or no effect on the trout population.

The quality of the wild trout fishery has been maintained even though trout growth is lower than in most other northern California streams (Table 4) and fishing pressure has increased over the years (Table 5). This can be attributed to restrictive angling regulations and the possibility that trout are recruited into the WTA from un-fished and lightly fished downstream areas and Shasta Lake.

The McCloud River WTA offers a wide diversity of angling opportunities. Anglers can gain relatively easy vehicular access to the river at Ash Camp or Ah-Di-Na, or hike and scramble between Ash Camp and Ah-Di-Na or at the Preserve. Fishing can be day use only or can entail a stay of several days. Anglers have the option of fishing under strictly controlled catch-and-release regulations (Preserve, 0-limit area) or harvest a couple of fish (two-trout area).

The McCloud River WTA has been managed under a mix of regulations that have adequately protected the fishery while providing angling diversity. Angling regulations at the Preserve appear compatible with TNC's primary goal of protecting an example of an

intact wild rainbow trout ecosystem, while the two-trout limit area has had stronger appeal for anglers who are slightly more consumptive and often combine fishing with other outdoor pursuits (e.g., camping at Ah-Di-Na). Even though there continues to be an increase in angling pressure and interest in catch-and-release fishing, more restrictive angling regulations will be only considered if the goals and objectives of this plan are not met.

The high harvest-rate of large brown trout in Shasta Lake (that have migrated to/from the river) has been documented (weir-tagging studies). However, this harvest does not appear to have adversely affected the McCloud fishery. Further, these brown trout have contributed to the trophy-trout aspect of both fisheries for many years. The McCloud River appears to be the most important spawning tributary for these fish, since they are only seldom seen in other Shasta Lake tributaries (Rode; Dean, unpublished data).

The current fishery management program at McCloud Reservoir involves the stocking of catchable-sized rainbow trout (7500 pounds, about two trout/pound) under general trout angling regulations that include five trout-per-day bag limits. Naturally spawned (wild) brown trout and rainbow trout also contribute to the fishery. The reservoir offers angling opportunity for those interested in harvesting trout, in contrast to the catch-and-release emphasis offered in the WTA. Providing angling diversity is a Department goal. There has been no indication hatchery trout stocked in the reservoir move downstream to contribute to, or compete with, the fishery in the WTA.

The Department and the California Fish and Game Commission have determined that the native McCloud River bull trout is extinct. It has been more than 25 years since the last confirmed report of a live fish. However, we cannot rule out the remote possibility that remnant individuals may still exist somewhere in the McCloud system. If an extant, native population is discovered, the Department will actively pursue propagation of these fish and a subsequent population recovery effort.

In 1964 and 1965, Department personnel captured bull trout in the lower McCloud River near Chatterdown Creek and they were documented during angler creel surveys in McCloud Reservoir until 1972 (Rode, 1990). Shortly after completion of McCloud Reservoir, bull trout were no longer seen in the lower river. The Department should pursue the goal of restoring conditions to the lower river (downstream of McCloud Reservoir) that will favor all endemic aquatic species. This action could include increasing base flows, restoring maximum water temperatures, insuring adequate coldwater refugia, especially downstream of the WTA, and providing seasonal flushing flows. A modeling effort should be required as part of the FERC re-licensing process to provide information to evaluate various scenarios involving comparative bioenergetics of rainbow, bull and brown trout and various flow regimens.

The existing and differing angling regulations on the McCloud tributaries (e.g., Hawkins Creek and Ladybug Creek), the WTA and lower river tributaries (esp., Squaw

Valley Creek) have not caused an enforcement problem, but have resulted in confusion for many anglers. Based on the lower McCloud's emphasis on a catch-and-release oriented fishery and angling regulation simplification sought by the Department, we should strive to obtain a regulation common to all lower river waters (excepting the TNC property). The two-trout limit and artificial lure (barbless hooks) requirement appear to have served the fishery and the angling community well. This should serve as a model for future management of the lower McCloud River.

Based on past and recent studies, it appears Squaw Valley Creek is an important spawning and rearing area for lower McCloud rainbow trout. Early in the fishing season, anglers report numerous large trout, but during mid-summer angling as well as sampling studies, few large fish are observed. It appears many McCloud rainbow trout exhibit a fluvial life history, moving from the mainstem into Squaw Valley Creek (and possibly its tributaries) to spawn. The resulting offspring appear to rear to eight to 10 inches in length before moving to the mainstem McCloud River to become resident or fluvial fish. This has important implications for fishery management and angling regulations.

Recommendation 1: Retain existing angling regulations within the WTA unless problems are identified, and seek support for a 2-trout limit for all the lower McCloud River and its tributaries (including Squaw Valley Creek), but excluding the 0-trout and "closed area" of TNC.

Recommendation 2: Enforcement of angling regulations should be continued and periodically intensified (special details) to obtain a reasonable level of compliance in conformance with overall Department priorities.

Recommendation 3: Fishery management programs at McCloud and Shasta reservoirs should continue unless changes detract substantially from the river's wild trout emphasis fishery.

Recommendation 4: A method and funding for estimating total angler use at Ash Camp and Ah-Di-Na should be explored and implemented. Any major change in use patterns might indicate a need to more closely examine the fishery. This issue should be considered for funding by PG&E during the re-licensing process.

Environmental Problems and Land Use Management

Mud Creek

Mud Creek has probably been a major and chronic contributor of turbidity and sediment to the McCloud River for at least the past 1,000 years (Hill and Egenhoff, 1976). Depending on the snow pack on Mt. Shasta and summer weather conditions, variable amounts of turbidity and sediment are generated each year. Major mudflows have not occurred since the 1920's and early 1930's. During the worst year (1924) mudflows

almost inundated the town of McCloud and blocked what is now Highway 89. It was estimated between one million and three million cubic yards of debris entered the McCloud River (Hill and Egenloff, 1976). Effects on aquatic life from this episode were not documented but must have been severe.

Several attempts have been made to divert Mud Creek's bedload, most notably in 1935-36 when a major diversion works was constructed by the State above the town of McCloud at a cost of $330,000. This structure, however, was short-lived as it quickly became filled with debris.

It appears little can be done to control major mud flow outbreaks on Mud Creek such as those that occurred in the 1920's and 1930's. Thankfully, such events occur very infrequently. The less intense year-to-year turbidity and sedimentation contributed by Mud Creek, however, may be controllable but studies regarding the feasibility of this have not been conducted. Downstream siltation and turbidity are exacerbated by the operation of McCloud Reservoir, particularly during reservoir drawdown periods and valve testing at the dam.

Chronic turbidity and sedimentation may be affecting the aquatic productivity in the lower McCloud River (see Trout Growth) and certainly detract from the angling experience. Many pools are silted-in and much of the gravel is compacted with fines. Sedimentation is particularly heavy just above Hawkins Creek. Flushing flows that historically occurred and cleaned the river of sediment and recruited new gravel have been almost entirely eliminated since the construction of McCloud Dam. Major exceptions occurred in January 1974 and again January 1997, when intensive rain-on-snow events combined with operation of McCloud Reservoir resulted in extremely high flows that may have scoured much of the stream gravel from below the dam.

The feasibility of controlling Mud Creek turbidity and sedimentation would require an engineering study to explore alternatives. The failure of the initial attempt to divert Mud Creek could suggest such an alternative may not be practical. However, major mudflow events occurring during that period probably contributed to the failure and similar events have not occurred since. Further, lower Mud Creek has been successfully diverted to Huckleberry Creek in more recent years. This suggests a diversion alternative may now be feasible. If such an alternative is considered in upper Mud Creek, there could be a conflict with the USFS Mud Creek Research Natural Area established to study mudflow ecology of the area. At present, projects such as a new diversion are prohibited. Other alternatives such as settling basins, diversion of Mud Creek to a central McCloud Reservoir location (so reservoir fluctuation does not re-suspend the material) should also be considered.

Recommendation 5: Explore the feasibility of controlling Mud Creek-related turbidity and sedimentation, and formalize a model to predict turbidity events affecting the WTA.

Water Development

The needs of aquatic life in the river (especially fish) were not seriously considered when project operational criteria were developed for both Federal and State licensing of the McCloud-Pit Hydropower Project in the early 1960's (DFG files). The State Water Resources Control Board (Board) determined that, because public fishing access to the lower McCloud River was limited, there was no justification for requiring fish release flows that would sustain fish populations at close to pre-dam levels (DFG files). With respect to minimum fish release flows, the Board used as its strongest criteria the amount of flow needed to support salmonid spawning runs from Shasta Lake (mainly kokanee salmon and rainbow trout). No concerns were discussed or addressed for the needs of resident wild trout, including bull trout (DFG files).

The completion of McCloud Dam in 1965 had an enormous impact on the river. The fishery potential of the river may have benefited from a reduction in Mud Creek generated sediment and related-turbidities (esp. in summer months) since much of the turbidity settles-out in the reservoir. However, when the reservoir is drawn down in the fall and winter, some of the turbidity is re-suspended and, under some conditions, discharged downstream. Testing the release valve may also result in the discharge of silt and turbidity downstream. If such testing is done when downstream flow releases are low and high flushing releases do not occur, impacts on aquatic production may be substantial. This is obviously most critical immediately below the dam where minimum flow releases are very low and where no tributaries contribute flushing flows. This adversely impacts invertebrate production and spawning trout that sometimes concentrate in this reach as they migrate upstream and encounter the dam.

McCloud Dam has had a radical impact on the flows of the lower McCloud River, especially in the WTA. Over the 19-year period from 1967 to 1985, an average of 981 cfs has been diverted out of the McCloud drainage into the Pit River. Mean monthly flows at Ah-Di-Na for this period have ranged from 198 to 220 cfs from June through October when they would have ranged from 924 to 1245 cfs. Mean winter period flows are similarly much lower (USGS, 1967 to 1985). The 40 to 50 cfs minimum releases required below the dam allow river flows to be very low (3-4% of pre-dam averages) until tributaries between the dam and Ah-Di-Na augment the flows to levels required at the Ah-Di-Na gauge (Table 2). This situation has remained essentially unchanged since completion of the Project.

Water flow through the WTA area is greatly diminished. Numerous low-gradient riffles contain large boulders and were once likely excellent pocket-water habitat. Additional flow through the lower river could return many of these shallow low-gradient riffles to pocket water, which would likely increase the population of larger trout. This issue should be thoroughly explored in the coming re-license process.

In the WTA, dam construction and project operations have raised the average water temperature by nearly 8°F and caused substantial diurnal temperature fluctuation, thus

eliminating the cold, constant water temperature that previously existed. Water temperature in the lower river reaches (e.g., near the Bollibokka Club) has also changed dramatically: Average water temperatures have been raised 10°F and daily maxima have increased 20°F (California Department of Fish and Game, unpublished file data).

Post-project changes in flow and water temperature adversely impacted bull trout while favoring brown trout. The dam blocked spawning migrations and the reservoir has inundated critical bull trout habitat. The higher temperatures in the lower river are also more favorable for non-game fish. Further, the reduced flows may make the river upstream of Tuna Creek Falls more accessible to non-game fish. McCloud Dam has also nearly eliminated gravel and large woody debris (LWD) recruitment into the WTA and severely reduced flushing flows. A thorough understanding of spawning gravel recruitment, movement and distribution is very important in maintaining and improving the current fishery. This is also true for LWD.

Recommendation 6: The Department will seek cooperation, participation and funding from the PG&E in organizing and conducting biological and hydrologic investigations into the impacts of project operation on the McCloud River wild trout fishery. Project operations, as they affect downstream water temperatures, flows, turbidity, sedimentation and gravel transport, will be studied and mitigation measures such as flow alteration and augmentation, temperature regulation, turbidity and sediment control and habitat modification will be considered. Specific studies to be conducted during the re-licensing process should include; 1) Flow vs. habitat relationship study (appropriate modeling), 2) Sediment budget, transport and spawning gravel study (sources of gravel, channel degradation/aggradation, gravel storage capacity of current channel, spawning gravel embeddedness, etc., this should include LWD element), 3) Recreation assessment and monitoring angler use and preferences, 4) Determine the relationship between catch data (average catch-per-hour) and actual trout abundance, 5) Determine cause(s) for apparent fluctuation in the brown trout population, and 6) Possible Black Locust eradication (threat to native riparian vegetation).

Recommendation 7: The Department should encourage private landowners to assist in conducting habitat monitoring activities on private lands associated with the river. This could include partial funding of ongoing or planned monitoring activities, conducting citizen based monitoring of water quality and benthic macroinvertebrates using the Departments Rapid Bioassessment technique, and establishing index reaches (based on recent habitat typing) to monitor these and other parameters.

Recreation Management and Development

Meeting management goals for the McCloud River WTA is dependent on compatible recreational development both in the WTA and, to a lesser extent, adjacent areas. At present, recreational activity is most highly concentrated in three places within the WTA; Ash Camp, Ah-Di-Na Campground vicinity and the Preserve. Ah-Di-Na

Campground is the only location within the WTA providing overnight camping facilities. Therefore, it attracts many people including anglers who have come from outside the local area. The river near Ah-Di-Na appears to have the highest fishing pressure of any section within the WTA. Although most of the campers have come to the area primarily for the unique fishing opportunity, some consider fishing a secondary activity to other pursuits and are less aware of the special fishing regulations; regulation violations are relatively high near Ah-Di-Na. At present, Ah-Di-Na's 17 campsites receive, on average, approximately 75% utilization. The USFS has no plans to increase capacity (District Ranger Mike Hupp, USFS, personal communication).

Visitor use at the Preserve has shown a steady increase over the years. However, use patterns are spotty and at times use is very low. Current limits on angler numbers may discourage fishing on the Preserve. More angler use could be accommodated if more of the Preserve was open to angling and/or the angler daily limit was increased. This could, however, prove incompatible with TNC's primary management goal of environmental preservation. In addition, many anglers fishing the Preserve consider un-crowded conditions the most important attribute of their Preserve fishing experience.

Ash Camp, located one mile below McCloud Dam, provides the best access to the upper reaches of the WTA. It is used for parking by day users and as an informal, primitive campsite. The Pacific Crest Trail crosses the river at Ash Camp, so there may also be overnight use by backpackers. Facilities are limited to a vault toilet and some trash receptacles. The USFS currently services this facility numerous times during the fishing season.

Recommendation 8: The USFS and TNC should consult with the Department and consider potential recreational fishery impacts before changes are made in recreational facilities and policies in or near the WTA.

Recommendation 9: The Department will encourage the USFS to keep Ash Camp open as a primitive camping/day-use area.

Recommendation 10: Where appropriate, the Department should encourage the USFS and PG&E to provide additional recreational facilities, including campgrounds, at McCloud Reservoir so those users are not attracted to facilities on the McCloud River; deed restrictions should be renegotiated if necessary.

Plans for Management of Adjacent Lands

The success of the McCloud River wild trout fishery and the aesthetics of the angling experience are highly dependent on compatible land management practices in the area. Land management practices can affect access to the river, productivity of the aquatic habitat through erosion, siltation and loss of riparian canopy and the aesthetics of the recreational experience through alteration of the viewshed. At present, the upper river (about one mile) is bordered by private land owned by the Hearst Corporation. At the

downstream end of the WTA, TNC lands are largely old growth timber and TNC plans to preserve the land in this condition.

The Shasta-Trinity National Forest adopted a Land Management Plan and accompanying Environmental Impact Statement in 1992 that guide management in the forest. Further, the USFS is working with all adjacent landowners and concerned agencies to reduce the risk of catastrophic fire, using various fuel reduction techniques including controlled burning. This effort should be encouraged.

The privately owned reaches of the McCloud River between McCloud Dam and Ash Camp and downstream river sections have great potential for management in the public interest, including public recreation. If they become available for public ownership, the Department should seek to purchase these lands. Management of these adjacent areas should be compatible with the management of the present WTA and offer the possibility of complimentary programs.

The 22-mile reach of the McCloud River between the Preserve and Shasta Lake is privately owned and receives relatively light angler use resulting in low trout harvest. However, if ownership or policies should change, harvest may increase. Angling for adfluvial brown trout in both the WTA and Shasta Lake could suffer as a result. If these lands should be offered for sale or trade in the future, acquisition by the Department or the USFS, and the development of a compatible fishery management program would be in the public interest.

In 1989, section 5093.542 of the California Public Resources Code, Wild and Scenic Rivers Chapter was passed by the legislature and signed by the Governor. This code section affords the lower McCloud River many of the protections of Wild and Scenic status, without formal Wild and Scenic designation. Further water development is prohibited. This statute will assist in preserving habitat and scenic values consistent with the objectives in this plan. (see Appendix 1)

In 1991, all interested agencies and private landowners formed The McCloud River Coordinated Resource Management Planning Group (McCloud CRMP) to coordinate and review all activities proposed within the drainage. This CRMP has been very active and has developed a recreation plan to help guide private and public activities in the lower watershed. This group has developed signage to encourage use of the river corridor in a manner sensitive to private property rights, partially funded a complete habitat typing of the lower river and has been instrumental in coordinating land management and various recreational activities. The Department will continue to work with the McCloud CRMP to insure public interests and private property rights are protected.

The McCloud CRMP Recreation Committee determined that non-commercial boating (primarily kayaking) in the lower river was not in conflict with CRMP goals or private property rights. Non-commercial rafting and kayaking is now allowed from Ah-Di-Na to Shasta Lake. However, boat camping sites are extremely limited.

Recommendation 11: The USFS should consult with the Department and the McCloud CRMP on road building, timber harvest and grazing plans affecting the lands surrounding the WTA to ensure such activities will not adversely affect wild trout management.

Recommendation 12: The Department will consult with the McCloud CRMP, Siskiyou County Fish & Game Commission and angling organizations prior to any change in management activity in the WTA.

Recommendation 13: Department and USFS planning staff should consider the acquisition of private lands bordering the river between McCloud Dam and Shasta Lake if they become available.

Recommendation 14: Only non-commercial boating (rafts and kayaks) should be allowed in the lower McCloud River.

Department Evaluation and Monitoring Program

The McCloud River WTA should be monitored to determine if changes in management are necessary:

1. The angler reporting system used at the Preserve should be continued as an index of angling quality and use.

2. The existing voluntary angler survey boxes at the TNC trail, Ah-Di-Na and Ash Camp should be maintained.

3. USFS records of use at Ash Camp and Ah-Di-Na should be monitored for noticeable changes in use patterns or user demographics.

4. Consider establishing index reaches, using recent habitat typing data, to monitor physical parameters (channel width, depth, embeddedness, etc.), as well as water quality and reliable biological parameters.

Changes in use, habitat and water quality data, along with angler reports (including angler survey box data), observations of increased numbers of non-game fish, or environmental or habitat changes may require more intensive evaluations. Additional evaluations could include but would not be limited to: 1) Angler creel surveys, 2) Angler opinion surveys, 3) Trout age-growth re-evaluations, 4) Additional weir operation, 5) Population sampling (if more adequate sampling methods are devised), 6) Fish tagging to evaluate harvest or migration and 7) Further habitat evaluation.

Evaluation of water quality and aquatic habitat was conducted by the USFS for two years on Bald Mountain and Ladybug Creeks, but they have not repeated this work. TNC monitored the effects of peak flows on water quality and aquatic habitat on Ladybug, Bones Gulch and Bald Mountain Creeks between the winter of 1985-86 and 1996. TNC has discontinued this program. TNC is conducting ongoing benthic macroinvertebrate sampling using California's Rapid Bioassessment technique to establish baseline conditions for future reference and comparison.

COORDINATION CONSIDERATIONS

There are numerous agencies and private landowners involved in the McCloud River WTA. Prior to any recommended action or activity in the area, the following should be considered for consultation.

McCloud River CRMP
: Any action or activity in the WTA

Pacific Gas and Electric Company
: Hydropower project operation, water quality, Mud Creek problems, access.

The Nature Conservancy
: Fishery data, land use, recreational use, water quality, biological inventory.

Shasta-Trinity National Forest
: Recreational use, timber harvest, public access, road construction and maintenance, water quality, sanitation, habitat management, Mud Creek problems.

Central Valley Regional Water Quality Control Board
: Water quality, Mud Creek problems.

Natural Resources Conservation Service
: Soil and erosion related issues.

State Water Resources Control Board
: Water rights.

California Department of Forestry and Fire Protection
: Private lands timber harvest review and forest fuels reduction.

California Department of Water Resources
: Mud Creek problems, water development projects.

Local Fish and Game Advisory Groups, Angling Organizations, County Government
: Management goals, regulation changes, habitat improvement, litter clean up, volunteer projects, angling and habitat observations.

Federal Energy Regulatory Commission
: Power project licensing conditions and review.

Colleges and Universities: Biological data collection and special projects.

ACKNOWLEDGEMENTS

A great number of individuals have contributed to this management plan. It is not possible to name them all, but their assistance has been greatly appreciated. Dave Hoopaugh initiated the first creel census and fish population studies and was instrumental in coordinating WTA designation. Many thanks go to TNC and TNC intern Tom Hesseldenz for providing Preserve fishery and angler use data, supervising the weir studies, conducting the 1981 and 1982 upstream creel censuses and participating in much of the fisheries research. Thanks also to the numerous seasonal aids and other TNC interns whose help was critical to the completion of important fieldwork, especially Curtis Knight and Amy Haas for their assistance in the 1998 Mark-Recapture Study and Steve Tussing for providing the most recent Preserve fishery catch data. W. D. Weidlein contributed greatly to study design, data analysis, report editing and field work. T. Healey assisted with the Bollibokka weir operation and weir data entry. M. Buntjer and M. Berry assisted with data entry and compilation.

REFERENCES

Behnke, Robert. 2002. Trout and Salmon of North America. Chanticleer Press, Inc. 360 pp.

Brode, J.M. and J. Sturgess. 1974. Reptiles and amphibians from the McCloud River survey of 1974. Office report, Calif. Dept. Fish and Game, 2pp.

Berg, W. J. and G.A.E. Gall. 1988. Gene flow and genetic differentiation among California Coastal rainbow trout populations. Canadian Journal of Fisheries and Aquatic Resources, 45(1): 122-131.

California Department Fish and Game. 1965. California Fish and Wildlife Plan, vol. 1, Summary. State of Calif. Dep. Fish & Game. 110pp.

Campbell, J.B. 1882. Notes on McCloud River, California and some of its fishes based upon a letter of J.B. Campbell of the United States Fish Commission. Bulletin, 1881, Vol. 1, pp.44-46.

Cavender, T.M. 1978. Taxonomy and Distribution of the Bull Trout, Salvelinus confluentus (Suckley), From the American Northwest. Calif. Fish and Game, 64(3): 139-174.

Dean, Michael B. and T. Moore. 2002. Sacramento River angler creel survey. Final Report to Cantara Trustee Council. Department of Fish and Game, 601 Locust, Redding, CA 96001. 52 pp.

Gall, G.A.E., M. Bannon, R.C. Smith and B. Bently. 1981. Progress report, native trout of California. Report to Calif. Dept. of Fish and Game, Threatened Trout Committee, 7pp. June 20, 1981.

Hajeck, A.E. 1975. Invertebrate Fauna Study. McCloud River Preserve. TNC (unpublished). 35pp.

Hayes, M.P. 1975. Report on Avifauna and Herpetofauna. McCloud River Preserve, TNC (unpublished). 28pp.

Hill, M. and E.L. Egenhoff. 1976. A California Jokulhlaup. California Geology. 154-158.

Moyle, P.B. 1976. McCloud River Preserve: Biology and Management. TNC (unpublished). 21pp.

Mundy, P.G. 1988. Age and Growth of Brown Trout (Salmo trutta L.), McCloud River, Shasta County, California. Unpublished M.S. Thesis, Humboldt State University, 34 pp.

Nicola, S.J. and A.J. Cordone. 1969. Comparisons of Diskdangler, Trailer and Plastic Jaw Tags. Calif. Fish and Game 55(4):273-284.

Poeschel, K.R., T.G. Rowe, and J.C. Blodgett. 1986. Water Resources Data for the Mount Shasta Area, Northern California. US Geological Survey open-file report. 86-65.

Resh, V.H. 1976. Aquatic Entomology Investigations. McCloud River Preserve, TNC (unpublished). 68pp.

------ . 1977. Aquatic Entomology Investigations. McCloud River Preserve, TNC (unpublished). 118 pp.

Rode, M. 1990. Bull Trout, Salvelinus confluentus Suckley, in the McCloud River, Status and Recovery Recommendations. Calif. Department of Fish and Game, Inland Fisheries Admin. Report No. 90-15. 43pp.

Simpson, S.M. 1982. The relatively slow growth rate of rainbow trout (Salmo gairdneri) and young brown trout (S. trutta) in the McCloud River, California. TNC (unpublished), 12pp.

Snider, W.M. and A. Linden. 1981. Trout growth in California's streams. California Department of Fish and Game, Inland Fisheries Administrative Report 81-1.

Soil Conservation Service. 1974. Soil and Capability Map Summary (unpublished). 1pp.

Stone. 1885. Report of operations at the United States trout-breeding station on the McCloud River, California, during the year 1883. US Commission of Fish and Fisheries. Report, 1883: 1003-1005.

Sturgess, J.A. and P.B. Moyle. 1978. Biology of rainbow trout (Salmo gairdneri), brown trout (S. trutta), and interior dolly varden (Salvelinus confluentus) in the McCloud River, California, in relation to management. Cal-Neva Wild Life: 239-250.

Tippets, W. 1976. Epibenthic feeding by rainbow trout (Salmo gairdneri) in the McCloud River, California. Unpublished M.S. Thesis, University of California, Davis. 39pp.

Tippets, W.E. and P. B. Moyle. 1978. Epibenthic Feeding by Rainbow Trout (Salmo gairdneri) in the McCloud River, California. Journal of Animal Ecology (47):549-559.

US Forest Service. 1974. Soils Resource Inventory Report, Reconnaissance Level: McCloud - Squaw Creek Planning Unit. USDA. 84pp.

US Geological Survey. 1967 to 1985. Water Resource Data for California, Part 1, Vol. 2, and water data report series for Calif.

------- . 1974. Water Resource Data for California, Part 1, Vol. 2. Dept. Interior. 509pp.

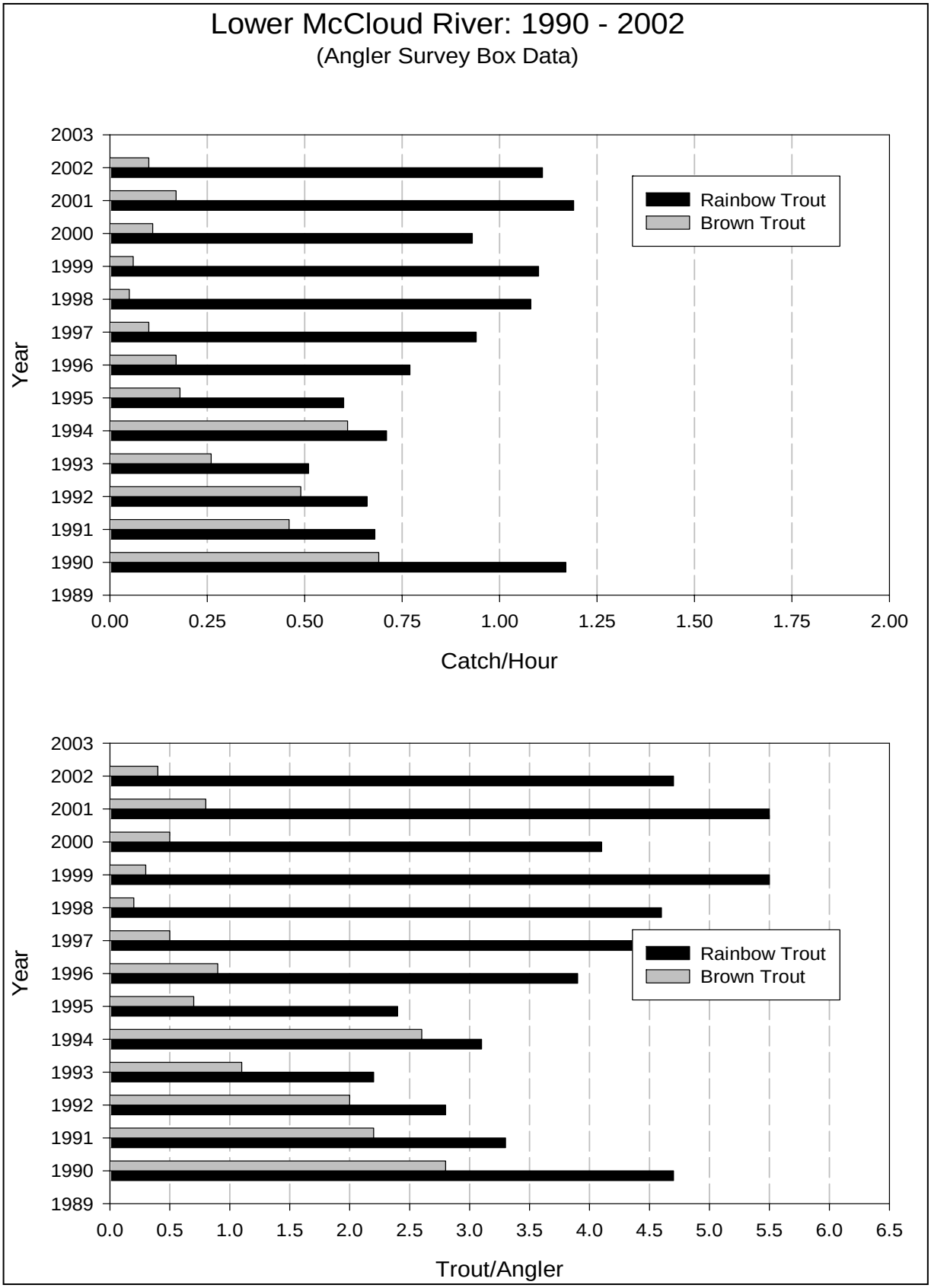
------ . 1984. Water resource data, California, water year 1984. Dept. Interior Geological Survey water data report Calif. 84-4.

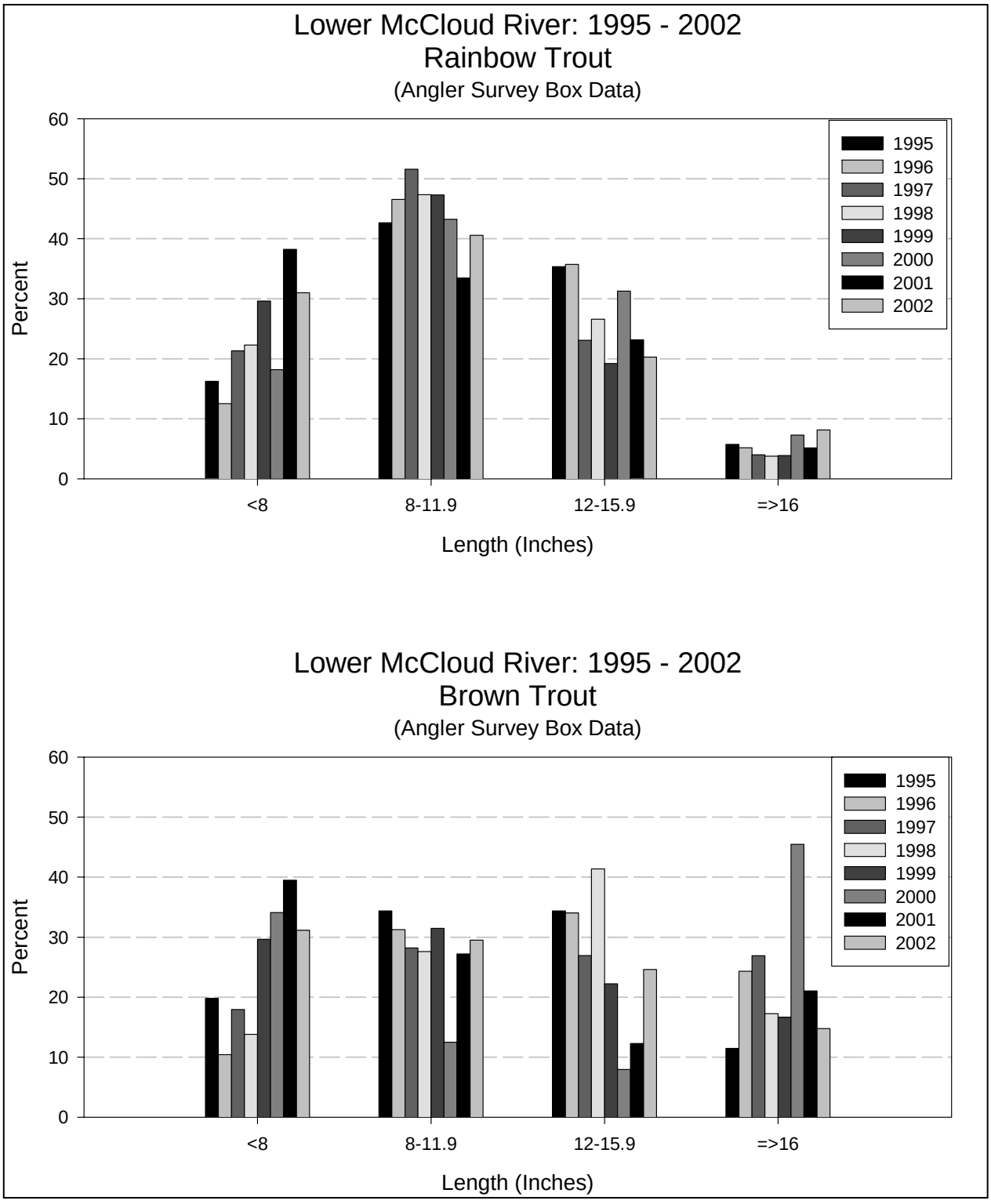
Wales, J.H. 1939. General report of investigations on the McCloud River drainage in 1938. Calif. Fish and Game, 25, (4): 272-309.

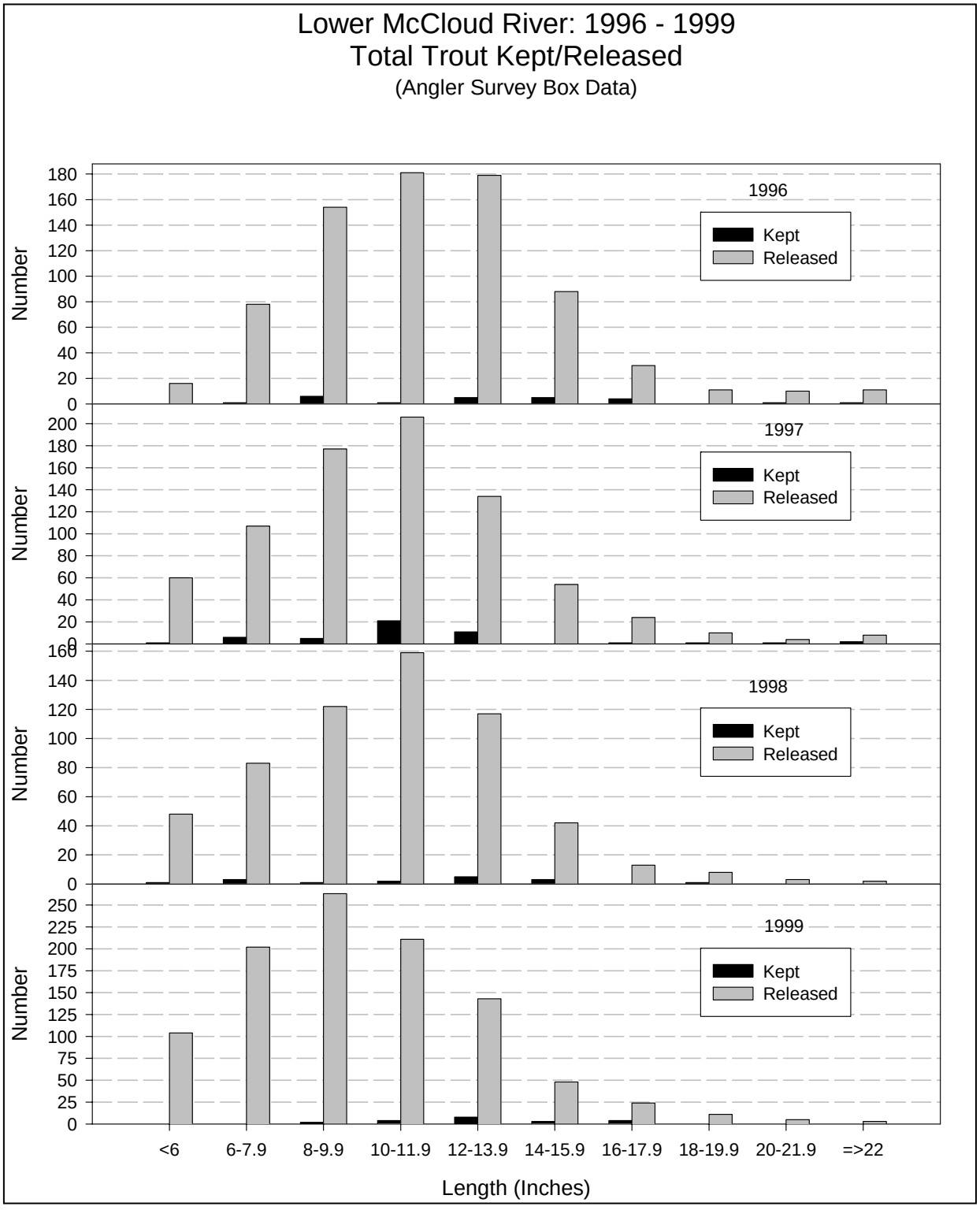
APPENDIX 1.

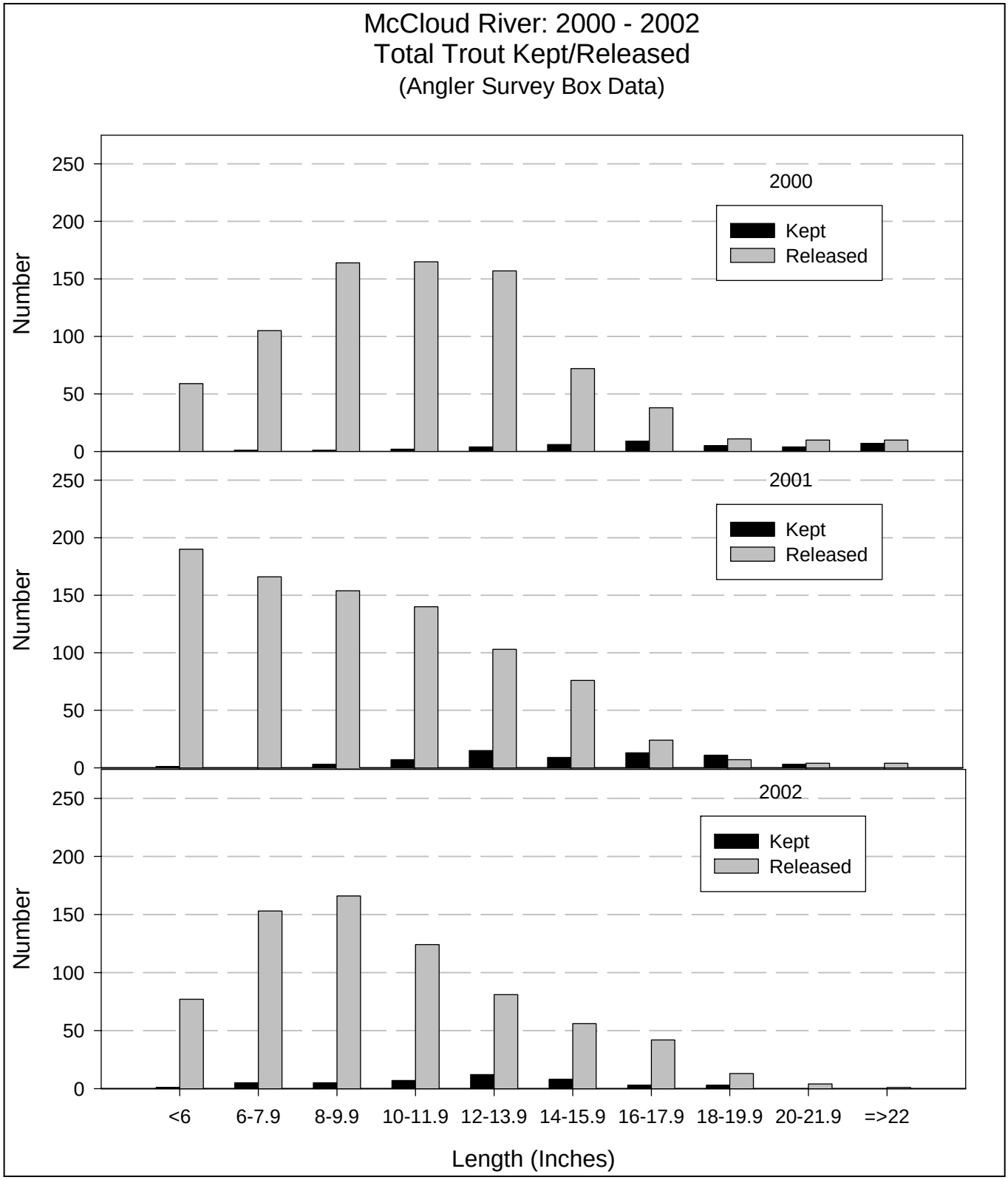
Summary of Department Angler Survey Box data from 1991 through 2002 and Nature Conservancy Preserve catch data from 1976-1997 for the McCloud River Wild Trout Area (un-numbered Figures and Tables).

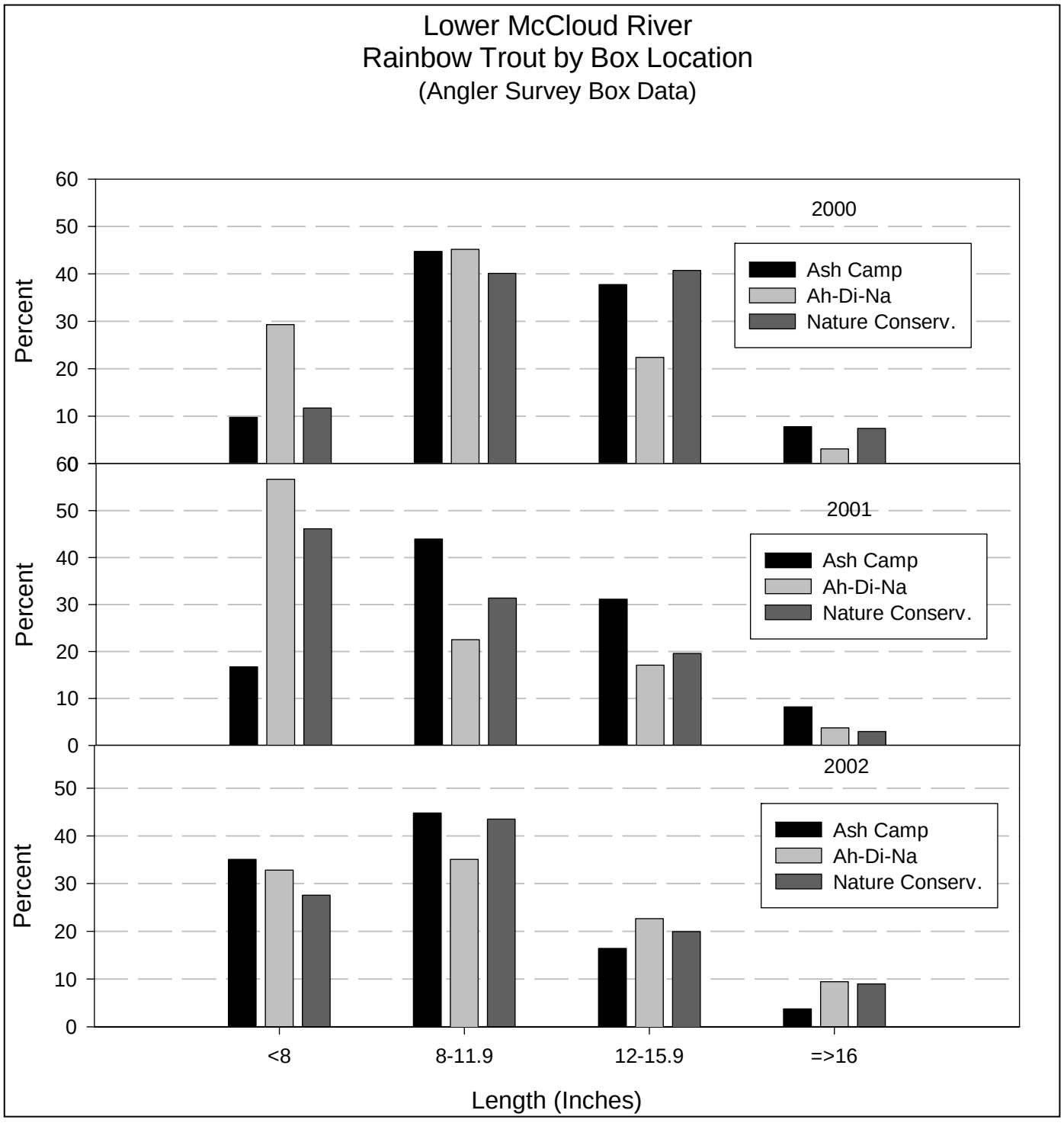
California Public Resources Code, Wild and Scenic Rivers Chapter, section 5093.542

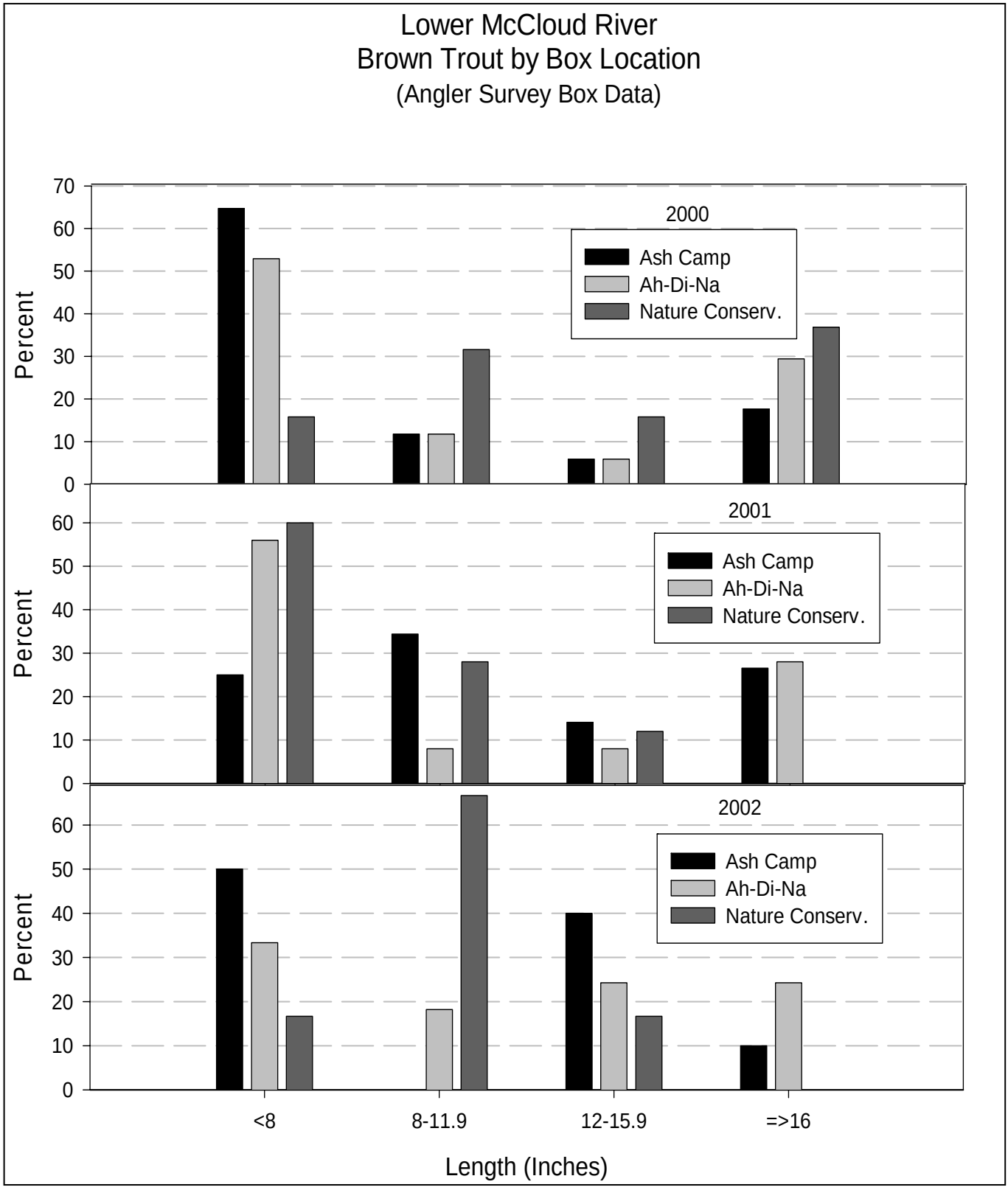

Lower McCloud River: 1990 - 2002
(Angler Survey Box Data)
Year
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
Rainbow Trout
Brown Trout
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Catch/Hour
Year
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
Rainbow Trout
Brown Trout
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
Trout/Angler


Lower McCloud River: 1995 - 2002
Rainbow Trout
(Angler Survey Box Data)
Percent
60
50
40
30
20
10
0
1995
1996
1997
1998
1999
2000
2001
2002
<8
8-11.9
12-15.9
=>16
Length (Inches)
Lower McCloud River: 1995 - 2002
Brown Trout
(Angler Survey Box Data)
Percent
60
50
40
30
20
10
0
1995
1996
1997
1998
1999
2000
2001
2002
<8
8-11.9
12-15.9
=>16
Length (Inches)


Lower McCloud River: 1996 - 1999
Total Trout Kept/Released
(Angler Survey Box Data)
1996
1997
1998
1999
Kept
Released
Number
Length (Inches)
<6
6-7.9
8-9.9
10-11.9
12-13.9
14-15.9
16-17.9
18-19.9
20-21.9
=>22


McCloud River: 2000 - 2002
Total Trout Kept/Released
(Angler Survey Box Data)
2000
2001
2002
Kept
Released
Number
0
50
100
150
200
250
<6
6-7.9
8-9.9
10-11.9
12-13.9
14-15.9
16-17.9
18-19.9
20-21.9
=>22
Length (Inches)


Lower McCloud River
Rainbow Trout by Box Location
(Angler Survey Box Data)
2000
2001
2002
Ash Camp
Ah-Di-Na
Nature Conserv.
Percent
0
10
20
30
40
50
60
<8
8-11.9
12-15.9
=>16
Length (Inches)


Lower McCloud River
Brown Trout by Box Location
(Angler Survey Box Data)
2000
2001
2002
Ash Camp
Ah-Di-Na
Nature Conserv.
Percent
0
10
20
30
40
50
60
70
<8
8-11.9
12-15.9
=>16
Length (Inches)

Angling Success on the McCloud River, for 2001 and 2002, by Angler Survey Box (ASB) location, from ASB Data.

Survey Box Location	Ash Camp		Ah-Di-Na		Preserve	
	2001	2002	2001	2002	2001	2002
Surveys received	57	39	47	62	44	49
Hours fished	250	150	228	218	210	264
Rainbow trout kept	19	9	22	20	0	2
Rainbow trout released	286	125	218	245	271	299
Total rainbow trout	305	134	240	265	271	301
Brown trout kept	12	1	9	12	0	0
Brown trout released	52	9	16	21	25	18
Total brown trout	64	10	25	33	25	18
Overall catch/hour	1.5	0.9	1.2	1.4	1.4	1.2
Mean trout/angler	7	4	6	5	7	7
% of anglers with NO catch	3.5	15.4	6.4	0	2.9	2.0

Angling Success on the McCloud River for 1990 through 2002 from Angler Survey Box data.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Surveys received	135	110	75	120	131	165	167	128	179	183	148	150
Hours fished	658.0	463.5	317.5	516.3	524.5	837.5	797.0	537.5	889.5	797.0	688.5	632.5
Rainbow trout kept	18	8	17	10	17	15	36	11	18	26	41	31
Rainbow trout released	427	299	145	358	279	630	714	572	961	716	775	669
Total rainbow trout	445	307	162	368	314	645	750	583	979	742	816	700
Brown trout kept	6	3	12	14	13	9	8	4	3	13	21	13
Brown trout released	294	222	71	302	83	137	70	25	51	75	93	48
Total brown trout	300	225	83	316	96	146	78	29	54	88	114	61
Overall catch/hour	1.1	1.2	0.8	1.3	0.8	0.9	1.0	1.1	1.2	1.0	1.4	1.2
Mean trout/angler	6	5	3	6	3	5	5	5	6	4	6	5
% of anglers with **N0 catch**	-	13.6	25.3	8.3	19.8	10.3	8.4	16.4	15.6	13.7	5.4	4.7

Month	Apr-May	June	July	Aug	Sep	Oct	Nov	Combined
Surveys received	21	30	20	15	14	41	9	150
Hours fished	88.5	126.0	67.5	64.0	71.5	172.5	42.5	632.5
Rainbow trout kept	8	1	0	3	2	16	1	31
Rainbow trout released	78	216	94	54	46	157	24	669
Total rainbow trout	86	217	94	57	48	173	25	700
Brown trout kept	1	0	0	0	0	1	11	13
Brown trout released	1	9	11	5	8	8	6	48
Total brown trout	2	9	11	5	8	9	17	61
Overall catch/hour	1.0	1.8	1.6	1.0	0.8	1.1	1.0	1.2
Mean trout/angler	4	8	5	4	4	4	5	5
% of anglers with NO catch	0	0	10.0	0	14.3	7.3	0	4.7

Angling Success on the McCloud River by Month, from 2002 Angler Survey Box data.

Angler Survey Summary: TNC, 1976-1997							
Year	Angler Hours	Total Caught	Total Rainbows (RT)	Total Browns (BN)	Total RT/hr	Total BN/hr	Total Catch/hr
1976	2206	3971	3274	697	1.5	0.3	1.8
1977							
1978	2048	2560	2190	370	1.1	0.2	1.3
1979	2429	3301	2967	334	1.2	0.1	1.3
1980	3456	5030	4613	417	1.3	0.1	1.4
1981	3949	5603	4986	617	1.3	0.2	1.5
1982	4018	4981	4554	427	1.1	0.1	1.2
1983	3638	2931	2660	271	0.7	0.1	0.8
1984	5163	4406	3983	423	0.8	0.1	0.9
1985	4909	7519	6064	1455	1.2	0.3	1.5
1986	4249	5152	4672	480	1.1	0.1	1.2
1987							
1988	6447	9918	8491	1427	1.3	0.2	1.5
1989	5958	7357	6234	1123	1.0	0.2	1.2
1990		6082	3941	2141	0.7	0.4	1.1
1991	6750	6883	4086	2797	0.6	0.4	1.0
1992		4568	1975	2593	0.4	0.5	0.9
1993							
1994		4416	1925	2491	0.4	0.5	0.9
1995		2651	2064	587	0.4	0.1	0.5
1996		2544	2030	514	0.5	0.1	0.6
1997	6533	5242	4633	609	0.7	0.1	0.8
1998	6363	6274	5868	406	0.9	0.1	1.0
Average Catch-per-Hour over the entire period:							**1.1**

Summary of angler use (total hours) and catch data from **The Nature Conservancy Preserve*** (**TNC** data; 1977, 1987 and 1993 data are missing).

* Additional data is available from TNC upon request.

Wild and Scenic Rivers Chapter, CA Public Resources Code

§ 5093.542. McCloud River; Legislative findings and declarations

The Legislature finds and declares that the ***McCloud River possesses extraordinary resources*** in that it supports one of the finest wild trout fisheries in the state. Portions of the river have been appropriately designated by the Fish and Game Commission, pursuant to Chapter 7.2 (commencing with Section 1725) of Division 2 of the Fish and Game Code, as wild trout waters, with restrictions on the taking, or method of taking, of fish. The Legislature has determined, based upon a review of comprehensive technical data evaluating resources and potential beneficial uses, that potential beneficial uses must be balanced, in order to achieve protection of the unique fishery resources of the McCloud River, as follows:

(a) The continued management of river resources in their existing natural condition represents the best way to protect the unique fishery of the McCloud River. ***The Legislature further finds and declares that maintaining the McCloud River in its free-flowing condition to protect its fishery is the highest and most beneficial use of the waters*** of the McCloud River within the segments designated in subdivision (b), and is a reasonable use of water within the meaning of Section 2 of Article X of the California Constitution.

(b) ***No dam, reservoir, diversion, or other water impoundment facility shall be constructed on the McCloud River*** from Algoma to the confluence with Huckleberry Creek, and 0.25 mile downstream from the McCloud Dam to the McCloud Bridge; nor shall any such facility be constructed on Squaw Valley Creek from the confluence with Cabin Creek to the confluence with the McCloud River.

(c) Except for participation by the Department of Water Resources in studies involving the technical and economic feasibility [only] of enlargement of Shasta Dam, ***no department or agency of the state shall assist or cooperate*** with, whether by loan, grant, license, or otherwise, any agency of the federal, state, or local government in the planning or construction of any dam, reservoir, diversion or other water impoundment facility ***that could have an adverse effect on the free-flowing condition of the McCloud River, or on its wild trout fishery.***

(d) All state agencies exercising powers under any other provision of law with respect to the protection and restoration of fishery resources shall continue to exercise those powers in a manner to ***protect and enhance the fishery*** of those segments designated in subdivision (b). In carrying out this subdivision, any exercise of powers shall be consistent with § 5093.58.

(e) Nothing in this section shall prejudice, alter, affect in any way, or interfere with the construction, maintenance, repair, or operation by the Pacific Gas and Electric Company of the existing McCloud-Pit development (FERC 2106) under its license, or prevent Pacific Gas and Electric from constructing a hydroelectric generating facility by retrofitting the existing McCloud Dam if the operation of the facility does ***not alter the existing flow regime*** below the dam.

(Added by Stats. 1989, c. 215, § 2.) (emphasis added)