

Red Clover Creek Fish Data Summary

Compiled in February 2013

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Introduction

This summary pulls together all known fisheries data collected on Red Clover Creek to date. The purpose of this compilation is to assist in developing fishery objectives for any planned or future restoration work in the Red Clover Creek watershed. This report summarizes and compiles fisheries monitoring data on Red Clover Creek starting in 1963 with fish population estimates conducted by the US Forest Service. Below is a short summary of each effort or study. The summary contains agency conducting the monitoring; dates, locations, and descriptions of each effort; and species, sizes, or weights of fish found during each effort. Reports, summaries, and excerpts follow the summary section. All documents are also available at the Plumas Corporation office.

Summary

Forest Service Fish Population Estimate 1963-1968

Agency: US Forest Service

Dates: September 1963, 1964, 1965, 1968

Location: On Red Clover Creek at 2, 8.5, and 10.5 miles above Indian Creek

Description: This data is from a stream habitat assessment and fish population survey.

Species Encountered: Rainbow Trout, Brown Trout, Dace, Sucker

Average Production: 2 mile station average= 34 lbs/acre, 8.5 mile station average= 21 lbs/acre, 10.5 mile station average= 19 lbs/acre

Forest Service stream surveys on mainstem Red Clover Creek as well as seven tributaries between 1973 and 1994

Agency: US Forest Service

Dates: Various dates in 1973, 1978, 1982, 1987, 1989, 1992, 1993, 1994

Location: On Red Clover Creek and tributaries in the Red Clover Valley watershed

Description: These surveys were hand written notes taken on various visual stream surveys as well as electroshocking surveys.

Species Encountered, number and size:

- McReynolds Creek- no trout ('87)
- Dixie Creek- Brown Trout 2-4" ('73), 1-2" ('93)
 - Redds ('92)
 - Rainbow Trout 4" or smaller ('92)
 - Rainbow Trout avg=7"('82), avg weight 9.2 no units ('94)
- Ross Canyon- Rainbow Trout 30 fish ('87)
 - Rainbow Trout 2-3" ('92)
 - Brown Trout 1-2" ('93)
- Crocker Creek- Cutthroat Trout 4-6" ('78)
 - 30 trout ('87)
- Dotta Canyon- no trout ('78)
 - Brook Trout ('89)
- Horton Creek- no fish ('78)
- Red Clover Creek- Lower Section: Brown Trout 2-8", Rainbow Trout 2-8" ('73)

- Middle Section: Brown Trout 1-7" ('73)
- Upper Section: Brown Trout 0.5-2" ('73)

Excerpt from Fishery Resources Report for Genesee Hydroelectric Project Jones and Stokes

Agency: CA Dept of Fish and Game and Jones and Stokes

Dates: 1965, 1976, 1985

Location: Powerhouse site near Genesee

Description: Electroshocking surveys on Red Clover Creek near Genesee Valley to determine fish populations near a proposed powerhouse site.

Species Encountered: 1965: Rainbow Trout Sucker, Dace 1976: Brown Trout, Rainbow Trout, Dace 1985: Rainbow Trout, Sucker

Productivity & Size: 1965: 129.6 lbs/acre of Rainbow Trout. 50%>5.5" <50% 1976: Rainbow Trout= 90% >4" 1985: 59.5 lbs/acre of Rainbow Trout ~60% less than 5.5"

California Department of Fish and Game Standing Stocks of Fishes Survey Reports on various sections of Red Clover Creek in 1976, 1988, 1990, 1991, and 1998

Agency: CA Dept of Fish and Game

Dates: 1976, 1988, 1990, 1991, 1998

Location: 1.5, 6, 6.4, 8.1 miles above confluence with Indian Creek (1988), 1.5 and 6 miles above confluence with Indian Creek (1990), 1.5, 6, 8.1, 9.2 miles above confluence with Indian Creek (1991), 1.5, 3.6, 6, 8.1 miles above confluence with Indian Creek (1998)

Description: Long term study of trout populations to look at the effect the proposed Abbey Bridge Dam would have on the Rainbow trout fishery in Red Clover Creek. The report from 1976 could not be located.

Species Encountered: Rainbow Trout, Brown Trout, Sucker, Dace

Size/Age:

Rainbow Trout 1988				
Age	Percent	Age	# of Fish	Average Length
0+	49	1	80	152
1+	40	2	15	202
2+	10	3	2	321
3+	1			

Rainbow Trout 1990				
Age	Percent	Age	# of Fish	Average Length
0+	22	1	61	142
1+	72	2	5	206
2+	6			

Rainbow Trout 1991				
Age	Percent	Age	# of Fish	Average Length
0+	5	1	33	153
1+	86	2	7	206
2+	9			

Rainbow Trout 1990				
Age	Percent	Age	# of Fish	Average Length
0+	46	1	57	133
1+	52	2	5	205
2+	2			

Excerpt from Red Clover Creek Erosion Control Demonstration Project Ten-Year Research Summary

Agency: Pacific Gas and Electric

Dates: 1985-1993

Location: Red Clover Creek in Red Clover Valley at the Feather River Coordinated Resource Management 1985 check dam project

Description: Summary of eight years of electroshocking surveys in the 1985 check dam project area.

Species Encountered: Rainbow Trout, Brown Trout, Brook Trout, Dace, Sucker

Number: In test reach (1985 project area) pre-project found zero rainbow trout, post-project found between 4-32 trout in 1986-1993

Excerpt from Resources Recreation Use Survey of Red Clover Creek

Agency: California Department of Water Resources

Dates: 1991

Location: Red Clover Creek for 25 miles from causeway (26N70) to the confluence of Last Chance Creek

Description: Creel Survey

Species Encountered: Rainbow Trout, Brown Trout

Size: Brown Trout average fork length= 9.13 inches, Rainbow Trout average fork length= 8.9 inches

DRAFT Red Clover Creek Fish Monitoring 2003, 2004, and 2005 Fish Sampling Efforts CA Department of Water Resources

Agency: California Department of Water Resources

Dates: June and July 2003-2005

Location: Red Clover Creek in Red Clover Valley. Three reaches in the Red Clover McReynolds project area and one reach at Chase Bridge

Description: Pre-restoration evaluation of fish assemblages in Red Clover Creek

Species Encountered: Rainbow Trout, Sucker, Dace

Number: Within the project- 2004: 1 trout/100 yards, 2005: 4 trout/100 yards

Chase Bridge- 2003: 1 trout/100 yards, 2005: 0 trout/100 yards

Red Clover McReynolds Post-Project Electroshocking 2007 and 2008 Efforts

Agency: California Department of Water Resources

Dates: June 2007-2008

Location: Red Clover Creek in Red Clover Valley. Three reaches in the Red Clover McReynolds project area and one reach at Chase Bridge

Description: Post-restoration evaluation of fish assemblages in Red Clover Creek

Species Encountered: Brown Trout, Sucker, Dace

Number: Within the project- 2007: 1 trout/100 yards, 2008: 0 trout/100 yards

Chase Bridge- 2007: 0 trout/100 yards, 2008: 4 trout/100 yards- average size 1.4"

Red Clover McReynolds Post-project Pond Electroshocking 2009

Agency: California Department of Water Resources

Dates: June 2009

Location: Red Clover Creek in Red Clover Valley. Three ponds in Red Clover McReynolds project area- Second pond from the top of the project, pond downstream of the constriction, and pond upstream of the constriction. Pond upstream from the constriction only had one quick pass made due to weather.

Description: Post-restoration evaluation of fish assemblages in Red Clover McReynolds project ponds.

Species Encountered: Rainbow Trout, Brown Trout, Dace

Size: - Second pond from top: Rainbow Trout average= 37.7 cm (14.8")

- Pond downstream from constriction: Rainbow trout (92%) average= 33.0 cm (13"), Brown trout (8%) average= 45.0 cm (17.7")

- Pond upstream from constriction: Rainbow trout average= 40.6 cm (16")

Red Clover McReynolds Volunteer Fish Monitoring Data 2008-2012

Agency: Plumas Corporation

Dates: June 2008-2012

Location: Red Clover Creek in Red Clover McReynolds project area

Description: Volunteer hook and line fishing data

Species Encountered: Rainbow Trout, Brown Trout

Average Size: 2008- Rainbow Trout= 14", Brown Trout= 16", 2010- Rainbow Trout= 13", 2011- Rainbow Trout= 13", 2012- Rainbow Trout= 9"

Red Clover Poco Volunteer Fish Monitoring Data 2010-2012

Agency: Plumas Corporation

Dates: June, July, September, October 2010-2012

Location: Red Clover Creek in Red Clover Poco project area

Description: Volunteer hook and line fishing data

Species Encountered: Rainbow Trout, Brown Trout

Average Size: 2010- Rainbow Trout= 8", 2011- Rainbow Trout= 7", 2012- Rainbow Trout= 12.5", Brown Trout= 4 lbs

Red Clover Poco Project Construction Fish Moving Data 2010

Agency: US Forest Service and Plumas Corporation

Dates: 2010

Location: Red Clover Creek in Red Clover Poco project area

Description: Electroshocking passes to move all fish prior to project construction

Species Encountered: Rainbow Trout, Brown Trout, Dace, Suckers

Average Size: Rainbow Trout= 84% of all trout caught. Average size= 21.7 cm (8.5"). Brown Trout= 16% of all trout caught. Average size= 31.8 cm (12.5")

Red Clover Poco Project Electrofishing Surveys 2012

Agency: US Forest Service, CA Department of Fish and Game, and Plumas Corporation

Dates: October 10, 2012

Location: Red Clover Creek below the Red Clover Poco project area in the Forest Service SCI reach

Description: Electroshocking survey

Species Encountered: Dace, Suckers

Average Size: No trout

2012 Bank Walk and Electroshocking Surveys

Agency: Plumas Corporation and US Forest Service

Dates: May- October 2012

Location: Red Clover mainstem and important tributaries

Description: Bank walk/visual surveys started in April to collect information on spawning and rearing activity in Red Clover Creek and tributaries. Bank walk surveys were conducted in May-October. One electroshocking survey in was October above the 1985 project in the SWAMP monitoring reach.

Species Encountered: Rainbow Trout, Brown Trout, Dace, Suckers

Average Size: Red Clover Creek- most adult and subadult trout were found above the causeway.

Adults averaged 5.5". Crocker Creek and Dixie Creek- most trout averaged <7".

Electroshocking survey found 1 rainbow trout 55mm (2.2").

USFS Fish Population Estimates 1963-1968

Station Number	Location	Date	Survey Section Length*	Trout Per Mile	Adult Trout per Mile	Lbs per Acre	Species	Other Species
C3	2 mi above Indian Cr	Sept 1963	130	800	240	19	93% RT, 7% BT	SKR, DC
C2	8.5 mi above Indian Cr	Sept 1964	230	8050	230	39	34% RT, 66% BT	SKR, DC
C3	2 mi above Indian Cr	Sept 1964	172	2340	120	14	94% RT, 6% BT	SKR
C4	10.5 mi above Indian Cr	Sept 1964	377	590	140	20	95% RT, 5% BT	SKR, DC
C2	8.5 mi above Indian Cr	Sept 1965	164	1928	63	8	RT	SKR, DC
C3	2 mi above Indian Cr	Sept 1965	165	2112	256	30	RT	SKR, DC
C4	10.5 mi above Indian Cr	Sept 1965	200	290	218	18	91% RT, 9% BT	SKR, DC
C2	8.5 mi above Indian Cr	Sept 1968	175	3120	90	55	98% RT, 2% BT	SKR, DC

RT- Rainbow Trout

BT- Brown Trout

SKR- Sucker

DC-Dace

* Units not noted on file document

USFS Fish Data Summary (1973-1994)

Red Clover Watershed

McReynolds Cr

1987:

Aug 10- Stream Survey: No trout seen. ~50 non-game fish seen.

Nov 10- Electroshock: No trout

Dixie Cr

1973:

Aug- Stream Survey: 6.5 miles long broken up into three sections.

Section	Species	Avg # per 100 ft	Length (in)
Lower	Brown Trout	6	2-4
Mid	Brown Trout	10	2-4
Upper			

1982:

May- Electroshock: 600 ft reach. Rainbow trout caught

Size (in)	Number	lb/acre
1-4	0	
4-6	4	4
6-8	11	33
8-10	3	21.7
10-12	0	
12+	0	

1992:

Apr- Stream Survey: 3 redds ~200 yds upstream of confluence with Ross Canyon. No redds downstream of confluence. Other trout seen mostly ~4in or smaller. 3 larger than 6" and 1 dead 7" trout.

1993:

Aug- Electroshock: Brown trout. Population estimate= 127 ± 88 (77% of the biomass) sizes one 8.5" fish and 55 1-2" fish.

1994:

Dixie Creek Allotment Dixie Unit

7/5/94: 57 Rainbow Trout (24% of biomass) avg weight= 10.2 (weight units not mentioned)

7/10/94: 64 Rainbow Trout (34% of biomass) avg weight= 7.8

Dixie Creek Allotment Riparian Unit- July 1994

Site 1: 23 Rainbow Trout (89% of biomass) avg weight= 10.8

Site 2: 2 Rainbow Trout (11% of biomass) avg weight= 7.8

Ross Canyon

1987:

Aug 5- Stream Survey: ~30 Rainbow Trout

1992:

Apr, May, Jul- Stream Survey: No redds. Rainbow Trout 2-3" long in East Fork Ross Cr. A few large fish. One 8" Rainbow Trout.

1993:

Electroshock: Brown trout (species later questioned by Mink, but she was not present on survey)
Pop estimate= 163 ± 40 , 21 lbs/acre, size 1-2", 100% trout biomass

Crocker Creek

1978:

Sept- Stream survey: 2.6 miles to headwaters. Cutthroat Trout found ~0.3 fish per 100 ft. Size= 4-6"

1987:

Aug- Stream survey: Saw ~30 trout

Dotta Canyon

1978:

Sept- Stream Survey: No trout observed. No habitat available.

1989:

Stream Survey: Brook Trout seen

Horton Cr

1978:

Sept- Stream Survey: No fish

Red Clover Creek

1973:

Aug- Stream Survey: 15.25 miles from Clover Valley to Indian Creek broken up into three sections.

Section	Species	Avg # per 100 ft	Length (in)
Lower	Brown Trout	10	2-8
	Rainbow Trout	4	2-8
Mid	Brown Trout	8	1-7
Upper	Brown Trout	20	0.5-2

Excerpt from Fishery Resources Report for Genesee Hydroelectric Project Jones and Stokes

REPORT ON FISHERY RESOURCES

A. Existing Resources

1. Fish Populations

a. Red Clover Creek

Red Clover Creek was sampled by the California Department of Fish and Game (CDFG) in 1976 (Brown 1976). Only one of four sampling stations, however, was located within the project area. Fish biomass at this station was estimated at 11.6 pounds/acre for rainbow trout (Salmo gairdneri) and brown trout (Salmo trutta), and 0.9 pounds/acre for Sacramento sucker (Catostomus occidentalis). Although site-specific data are not presented in Brown (1976), a total of 57 (84 percent) rainbow trout and 11 (17 percent) brown trout were caught at the four sampling stations. Nearly 90 percent of captured rainbow trout were less than 100 millimeters (mm) in length. Captured brown trout were all less than 120 mm in length. The largest sampled fish was a 268-mm-long rainbow trout. Speckled dace (Rhinichthys osculus) were also sampled.

A reach near the proposed powerhouse site was sampled by CDFG in 1965 (CDFG 1965). Thirty rainbow trout greater than 127 mm and 36 rainbow trout less than 127 mm were caught, as well as six sucker and two speckled dace. Brown trout were not sampled. Standing crop estimates of trout greater than 127 mm, total trout, and sucker were 28.8, 30.6, and 129.6 pounds/acre, respectively. Several suckers greater than 300 mm in length were caught.

Jones & Stokes Associates biologists sampled Red Clover Creek near the proposed powerhouse site in late August 1985. Seines were used to block off two 50-meter stream reaches. Fish were caught with a direct current, backpack electroshocker during three passes, timed to assure equal fishing effort. A total of 320 rainbow trout and 10 speckled dace were caught. Standing crop estimates of trout greater than 127 mm and total trout were 35.5 and 59.5 pounds/acre, respectively. These values are much higher than those estimated in 1965, especially for smaller trout. In addition, sucker were not sampled in 1985. Habitat differences between the study reaches may be responsible for these discrepancies; 1965 and 1976 sampling efforts were conducted downstream of the 1985 study in a lower gradient reach more conducive to sucker populations.

Length-frequency data from the 1985 study show that most trout within the project area are relatively small

(Figure 1); only 1 percent of the captured fish exceeded 200 mm (approximately 8 inches) in length. Previous studies contained similar results.

Red Clover Creek, including the lower 1 mile of the project area, may provide spawning habitat for brown and rainbow trout residing in Indian Creek. Large gravel areas present downstream of the project area, however, are not apparent within the project area. Brown trout abundance is very low in this area of Indian Creek (Brown and Haines 1979) and with the lack of brown trout fry in lower Red Clover Creek, brown trout probably do not spawn in Red Clover Creek to any significant degree, if at all.

Rainbow trout may migrate into lower Red Clover Creek to spawn; rainbow trout spawning runs up tributary streams are common in the area (CDFG 1984). Rainbow trout typically begin moving into tributaries in mid-March with peak spawning in mid-April. Spawning is over by early May. High flows can delay spawning 1-2 weeks.

Lower Red Clover Creek contains a surprisingly large rainbow trout population given the poor watershed conditions. The upper watershed has been subjected to severe land-use practices resulting in significant sedimentation problems. Large quantities of silt limit food production and cover in many areas of the stream. Salmonid populations generally decrease in the upper watershed where the disturbances are most pronounced. While the stream segment potentially affected by the proposed project is 3.3 miles long, trout moving upstream from Indian Creek to spawn have access only to the lower 1.25 miles of the project area. Consequently, good habitat in this lower reach may be seeded to carrying capacity each year and not be indicative of trout populations throughout the project area. The lack of large trout may be caused by overharvest of catchable-sized fish.

b. Last Chance Creek

Last Chance Creek was sampled by the CDFG in 1976 (Brown 1976). Only one of five sampling stations was located within the project area. Fish biomass was estimated at 24.2 pounds/acre for rainbow trout (derived from 5.2 g/m³) and 18.8 pounds/acre for Sacramento sucker/Sacramento squawfish (*Ptychocheilus grandis*) (derived from 4.1 g/m³) at this station, located near the mouth of Last Chance Creek. Rainbow trout size composition data show that Last Chance Creek supports trout somewhat larger than does Red Clover Creek.

Jones & Stokes Associates biologists sampled lower Last Chance Creek using the methodology employed on Red Clover Creek. Only 15 trout were captured in the two, combined 50-meter reaches. The only brown trout captured was 401 mm in length. Unlike in Red Clover Creek, most rainbow trout exceeded 127 mm in length (78 percent). Standing crop estimates of rainbow trout

greater than 127 mm and total rainbow trout were 23.5 and 23.7 pounds/acre, respectively; small rainbow trout were a small portion of the total biomass. The total biomass value compares favorably with the previous estimate of 24.2 pounds/acre (Brown 1976). A juvenile sucker was caught as well as several hundred juvenile Sacramento squawfish (less than 127 mm in length).

Last Chance Creek has watershed problems similar to those of Red Clover Creek. Unlike Red Clover Creek, however, Last Chance Creek contains large quantities of granitic sand that have covered any available spawning gravels and limited food production. The lower 0.25 mile of Last Chance Creek provides spawning and juvenile rearing habitat for squawfish. Trout spawning is limited due to a scarcity of spawning gravels. The large brown trout that was captured was probably foraging on the abundant juvenile squawfish.

2. Angler Use

Creel census data were not found for the project area in Red Clover or Last Chance Creeks. The powerhouse site and lower project area in Red Clover Creek are readily accessible and fishing pressure is assumed to be moderate. The remaining project area on Red Clover Creek lies within a fairly steep canyon that minimizes angling opportunities; angler use of this area is assumed to be light. The powerhouse site and lower project area on Last Chance Creek are not readily accessible because of private property. Fishing pressure is light throughout the project area, especially in the steep, upper reaches.

3. Threatened, Endangered, and Sensitive Species

Threatened, endangered, or sensitive aquatic species are not recorded in the project area. In addition, anadromous fish do not occur in either creek due to the presence of downstream dams.

4. Summary

Within the project area, Red Clover Creek is much more important than Last Chance Creek in terms of trout production and angling opportunities. Red Clover Creek has a trout biomass more than double that for Last Chance Creek. More trout are present per unit of stream length in Red Clover Creek, due to the greater width of Red Clover Creek, than is shown by biomass comparisons. The large biomass of trout less than 127 mm indicates that Red Clover Creek maintains good spawning and rearing conditions, and may be an important stream for rainbow trout recruitment into Indian Creek. Angling opportunities are readily available on lower Red Clover Creek and many anglers fish in this part of the stream.

Although both creeks have severe watershed problems, Last Chance Creek has suffered the greatest damage. Granitic

sand has covered the creek bottom and severely reduced fry, juvenile, and food production habitat. These poor habitat conditions are reflected in the low fish biomass estimates, especially for smaller fish. Since stream access is only available through private property, angling opportunities for the general public are reduced. Consequently, Last Chance Creek within the project area receives only light angling pressure from property owners.

B. Habitat Analysis

1. Methods

Methods used to determine the quantity of water necessary to meet the ecological requirements of aquatic biota are numerous and use different approaches (Fraser 1972; Stalnaker and Arnette 1976; Wesche and Rechar 1980). The CDFG has recommended investigations using the Instream Flow Incremental Methodology (IFIM) for this project. This methodology allows for an incremental (range of values) approach in determining instream flow requirements for aquatic resources (Bovee 1982). The IFIM is designed to predict changes in fish habitat due to incremental flow changes. The ability to integrate habitat impact analyses into IFIM makes this methodology a tool for quantifying potential project impacts.

a. Project Scoping

It was assumed that the stream channel maintains a dynamic equilibrium for the purposes of this study. Consideration of potential study sites was limited to the stream sections between the proposed intake and powerhouse sites. Rainbow trout was selected as the target species for both streams since brown trout were rare within the project area.

b. Segment, Study Site, and Transect Selection

The segmentation procedure of Bovee (1982) was applied to the project area prior to the selection of study sites. The characteristic feature of a selected stream segment is homogeneity of channel structure and flow regime.

Two segments were identified on Red Clover Creek during a field visit on October 10, 1984. Stream gradient was the primary factor influencing stream channel characteristics. Stream gradient generally increases from the powerhouse site to the intake site. The project area near the proposed intake site is steep and resembles a "boulder field." Hydraulic measurements in this segment were determined to be difficult due to the high gradient, nonlaminar flow conditions, and uneven water surface elevations.

Ca Department of Fish and Game Standing Stocks of Fishes Data 1988

State of California

The Resources Ager

Memorandum

To : Files

Date : March 26, 1990

From : Department of Fish and Game

Subject: Results of Sampling Fish in Sections of Red Clover Creek,
Plumas County, 1988.

INTRODUCTION

A previous study of standing stocks of fishes in Red Clover Creek established stations for long-term studies of trout populations in this and other major tributaries to Indian Creek (Brown, 1976). Red Clover Creek is the site of a proposed and authorized dam (Abbey Bridge) that would be part of the State Water Project. The creek is an important source of rainbow trout (Oncorhynchus mykiss) in the Indian Creek system. It is also the site of projects designed to reduce quantities of granitic sand flowing into Indian Creek and the Feather River.

The purpose of this investigation is to monitor status of trout populations as relative abundance, age and growth, length, weight, and condition.

METHODS

Standing stocks of fishes were estimated at four stations in Red Clover Creek Plumas County (Figure 1). Sampling of Red Clover Creek took place previously in 1976. Stations sampled on September 21-23, 1988 were located as close to older stations as access allowed. The length, average width, and average depth of each station was measured. Fish were captured with a battery-

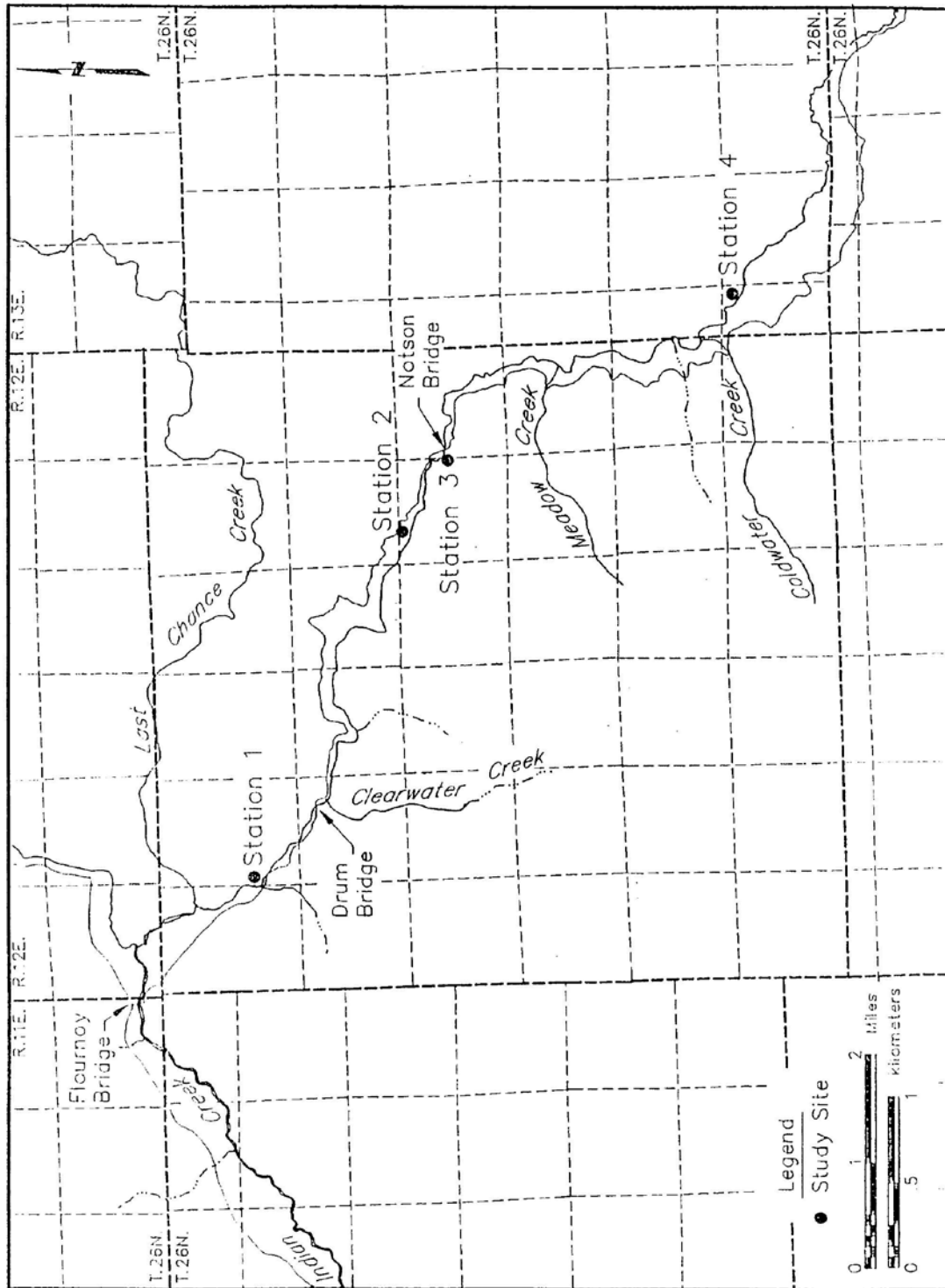


Figure 1. Stations Sampled to Estimate Standing Crop of Trout in Red Clover Creek, Plumas County, 1988.

powered backpack electroshocker (Smith-Root, Type VII) in stream sections blocked by seines. Captured fish were removed from the net-enclosed section after each pass. Standing stock estimates were developed using the two pass method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by Delury (1951).

The weights of rainbow trout, brown trout (Salmo trutta), Sacramento sucker (Catostomous occidentalis) and speckled dace (Rhinichthys osculus) were determined by displacement. Weights were measured for all fish caught. Fork length of each fish caught was measured to the nearest millimetre.

Scale samples were taken from all rainbow trout over 100 mm fork length. Scale samples were taken from the six brown trout captured but not from the suckers or speckled dace. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimetre along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker 1975). Estimation of true mean growth rate (G) was calculated using methods of Ricker (op. cit).

Distribution of all fish caught is listed according to location. Standing crops of rainbow trout and brown trout were calculated for individual

stations where the species of interest were caught and combined for the entire creek. Age and growth were calculated for the population. Mean individual and length-weight relationships were determined only for rainbow trout in Red Clover Creek. The coefficient of condition and 95% confidence intervals were calculated only for rainbow trout.

RESULTS

Distribution

Rainbow trout were caught at all stations except Notson Bridge. Brown trout were caught in the lower creek and mid creek sections. Speckled dace and suckers were caught at all but the lowermost station (Table 1).

Table 1. Distribution of fishes in sections of Red Clover Creek, Plumas County, 1988

Distance above creek mouth (km)	Station			
	2.4	9.7	10.3	13.0
Rainbow trout	X	X		X
Brown trout	X		X	
Speckled dace		X	X	X
Sacramento Sucker		X	X	X

Standing Crop

Rainbow trout were the most common game fish caught in Red Clover Creek. Biomass averaged 5.6 g/m² at three stations. Biomass for rainbow trout large enough for fisherman to catch and keep (127mm FL) averaged 5.5 g/m² (Table 2). Brown trout biomass averaged 0.16 g/m² at two stations with no catchables caught (Table 3).

Speckled dace and Sacramento sucker were the only non-salmonid fish caught in Red Clover Creek. Biomass was 1.2 g/m² for speckled dace and 0.8 g/m² for Sacramento sucker (Table 4).

Table 2. Estimate of Rainbow Trout Standing Crop in Red Clover Creek, Plumas County, 1988.

Distance (km)	Population Estimate	95% Confidence Interval	Biomass g/m ²	Estimate of Catchable Trout (≥127mm FL)	Biomass of Catchable Trout g/m ²
2.4	118	69-200	10.2	47	9.2
9.7	30	29-32	6.4	26	6.2
13.0	48	44-56	0.2	-	-

Table 3. Estimate of Brown Trout Standing Crop in Red Clover Creek, Plumas County, 1988.

Distance (km)	Population Estimate	95% Confidence Interval	Biomass g/m ²	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout g/m ²
2.4	5	3-7	0.3	-	-
13.0	1	1-1	0.02	-	-

Table 4. Estimates of Standing Crop of Nongame Fishes in Red Clover Creek, Plumas County, 1988

Distance (km)	Species	Population Estimate	95% Confidence Interval	Biomass g/m ²
9.7	Speckled dace	1058	94-9432	1.8
9.7	Sacramento sucker	12	11-14	1.3
10.3	Speckled dace	2433	494-5812	1.4
10.3	Sacramento sucker	2	2-2	0.04
13.0	Speckled dace	406	141-914	0.5
13.0	Sacramento sucker	124	106-144	1.0

Age and Growth

The formula $L=14.5 + 4.5S$ describes the relationship between the fork length (L) and enlarged scale radius (s) of 80 rainbow trout caught in Red Clover Creek. The coefficient of correlation (r^2) is 0.66. Age and growth analysis for brown trout was not possible because all six trout caught had regenerated scales.

Population growth rate and mean individual growth of age 1+ rainbow trout was faster than age 2+ (Table 5). Age 1+ rainbow trout averaged 152 mm, 2+ averaged 202 mm, and 321 mm for 3+ fish. (Table 6).

Table 5. Growth Rates For Rainbow Trout Caught in Red Clover Creek, Plumas County, 1988

Age Interval	<u>Population Growth</u>			<u>Mean Individual Growth</u>		
	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	64-161	0.923	7.89	63-161	0.938	0.802
2-3	161-248	0.432	0.59	142-248	0.558	0.761

Table 6. Calculated Fork Length in Millimetres of Rainbow Trout from Red Clover Creek, Plumas County, 1988.

Age	No. of Fish	Length at Capture (mm)	<u>Calculated Lengths at Successive Annuli</u>		
			1	2	3
1	80	152	64	-	-
2	15	202	63	161	-
3	2	321	60	142	248
Number of back-calculations			97	17	2
Weighted Means (mm)			64	159	248
Increments (mm)			64	95	89

Length and Weight

Age group 0+ rainbow trout represented 49% of the catch. Ages 1+ and 2+ fish represented 40 and 10 percent respectively, while 3+ fish made up 1 percent (Figure 2). (Appendices 2 and 3). Brown trout length and number, and length and weight data can be found in Appendices 4 and 5.

The relationship between length (L) and weight (W) of rainbow trout is:

$$\text{Log}_{10}W = -4.79 + 2.92 \text{ Log}_{10}L$$

$$r^2 = 0.99$$

N=152 (Figure 3).

Coefficient of Condition

The coefficient of condition and 95% confidence limits for 154 rainbow trout were calculated (Table 7). There is no significant difference between the coefficient of condition for any age group of rainbow trout that were tested ("t" test, 0.05 level).

Table 7. Condition of Rainbow Trout in Red Clover Creek, Plumas County, 1988.

<u>Age Group</u>	<u>Number of Fish</u>	<u>Coefficient of Condition</u>	<u>95% Confidence Interval</u>
0+	76	1.3975	1.081-1.225
1+	62	1.1270	1.091-1.163
2+	15	1.1390	1.086-1.192
3+	1	1.0546	-
Combined	154	1.1795	1.086-1.193

RAINBOW TROUT

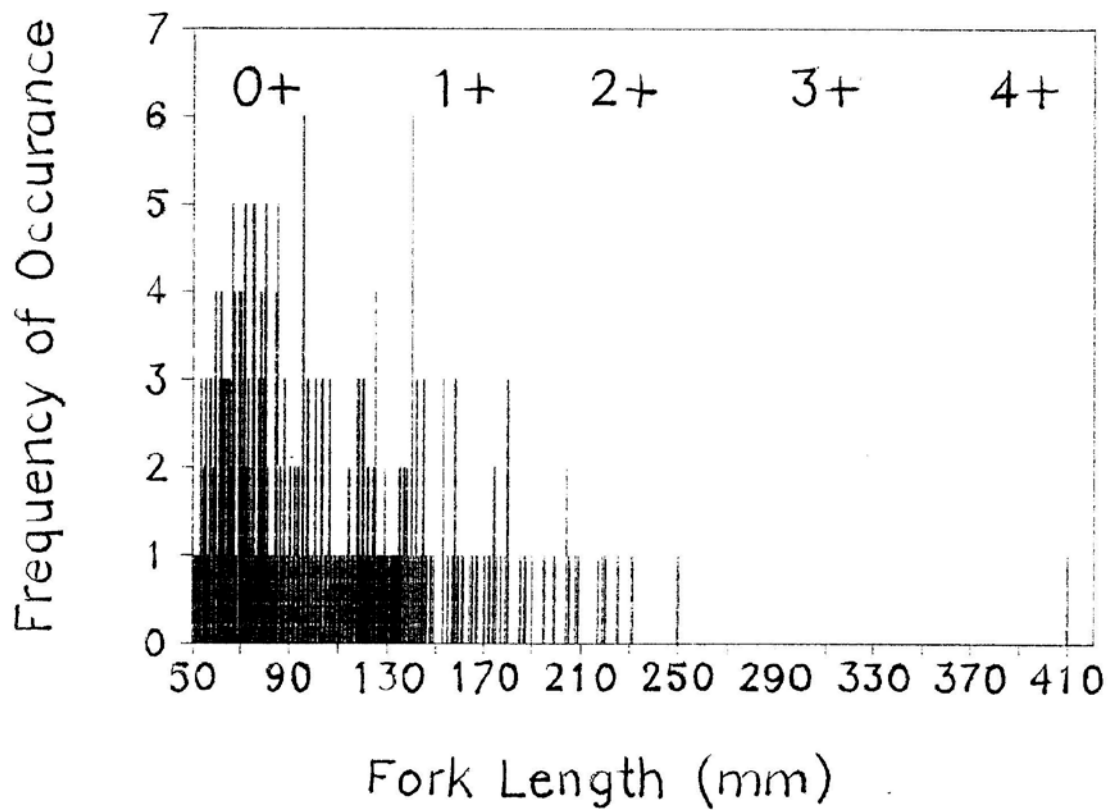


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Red Clover Creek, Plumas County, 1988.

RAINBOW TROUT

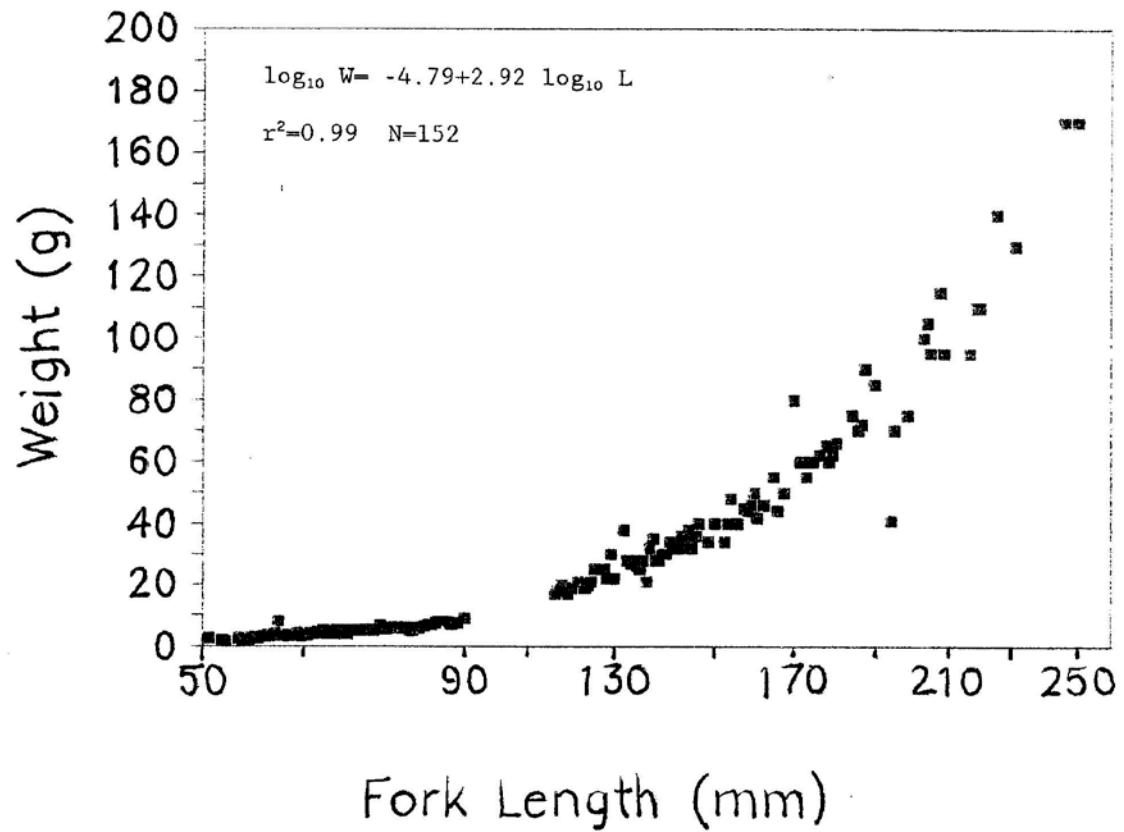


FIGURE 3. The relationship between length and weight of rainbow trout in sections of Red Clover Creek, Plumas County, 1988.

DISCUSSION

Stations were not identical to those sampled in Brown (1976); however, two stations were located near previous stations. The lower is located 2.4 km above the confluence of Red Clover Creek and Indian Creek and the upper station is 13.0 km above the confluence. Biomass of trout (rainbow and brown trout) in the lower station increased from 1.3 g/m² in 1976 to 10.5 g/m² in 1988. Few nongame fish were caught either year. Trout biomass at the upper site was similar in 1976 and 1988. The upper site trout biomass was 0.3 g/m² in 1976 and 0.2 g/m² in 1988. Biomass of nongame fish was 0.5 in 1976 and 1.5 in 1988 (Table 8).

Table 8. Biomass of fishes caught in Red Clover Creek, 1976 and 1988.

<u>Station</u>	Biomass (g/m ²)			
	1976		1988	
	Trout	Non-game	Trout	Non-game
Lower canyon	1.3	0.1	10.5	0
Upper canyon	0.3	0.5	0.2	1.5

LITERATURE CITED

- Brown, C. J. 1976. Standing stocks of fishes in sections of Red Clover, Little Last Chance, Big Grizzly, Last Chance, and Squaw Queen Creeks, Plumas County, 1976. Calif. Dept. Fish and Game, Info. Rept. No. 76-4. 8p.
- DeLury, D. B. 1951. On the planning of experiments for the estimation of fish populations. J. Fish. Res. Bd. Canada. 8:281-307.
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- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fish. Res. Bd. Canada. Bull. 191, 382 p.
- Seber, G. A. F., and E. D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3):631-643.

APPENDIX 1

FISH POPULATION STATIONS FOR RED CLOVER CREEK, PLUMAS COUNTY, SEPTEMBER 1988

Station 1 - Located 2.4 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 2.7 km above Flournoy Bridge to a small, dry watercourse. Hike down hill about 46 m. to Red Clover Creek, near the site of the abandoned DWR Red Clover near Genesee streamgage (SE 1/4 of SW 1/4, Section 5, T2N, R12E). This station is labeled RC-3 in DFG Region 2 files and C2 in Erick Gerstung's data summaries. The station is comprised primarily of large boulders and is mostly a deep run (95%) with some pool area (5%). It is 30.5 m long, with average width of 7.9 m, and average depth of 0.42 m, giving it a surface area of 241 m² and a volume of 101 m³.

Station 2 - Located 9.7 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road about 11.3 km to the campsite at the top of the canyon. Hike down to the stream adjacent to the campsite (SW 1/4, NE 1/4, Section 14, T25N, R12E). This station has many large boulders but also some gravel and sand bottom areas. It is mostly pool area (66%) with some run (19%) and riffle (15%). Its length is 45.7 m, with an average width of 6.4 m, and an average depth of 0.3 m, giving it a surface area of 292 m² and a volume of 88 m³.

Station 3 - Located 10.3 stream km upstream from the confluence with Indian Creek. Drive up the Genesee-Beckwourth Road about 12.6 km to Notson Bridge

(SW 1/4, NW 1/4, Section 13, T25N, R12E). The station is located immediately downstream. The station is primarily small gravel, sand and rubble. It is primarily riffle (90%) with a few shallow pools (10%). Its length is 80.5 m, with an average width of 8.8 m, and an average depth of 0.13 m, giving it a surface area of 708 m² and a volume of 92 m³.

Station 4 - Located 13.0 stream km upstream from the confluence with Indian Creek. Drive up to the Genesee-Beckwourth Road about 16.1 km above Flournoy Bridge and turn left on a spur road. Drive 0.3 km down the spur road. The station is located just upstream of a dry tributary and downstream from a live tributary (SE 1/4, NE 1/4, Section 24, T25N, R12E). This station is labeled RC-2 in DFG Region 2 files and C3 in Eric Gerstung's data summaries. The substrate is mostly volcanic with a small amount of sand and gravels. The station is broken up by bedrock outcroppings and is primarily pool (74%) and riffle (23%) with a small amount of run (3%). We estimated it was about half water surface and half bedrock islands. The station is 84 m long, with an average width of 11.9 m, and an average depth of 0.2 m, giving it a surface area of 500 m² and a volume of 100 m³.

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, SEPTEMBER 1988

<u>Fork Length</u> <u>(mm)</u>	<u>Weight</u> <u>(g)</u>	<u>Fork Length</u> <u>(mm)</u>	<u>Weight</u> <u>(g)</u>
52	2.5	138	21,32
56	2	139	35
57	1.5	140	2(28), 2(30), 34
61	2.5, 2(3)	141	32
62	2.5, 3	142	2(32), 36
63	2.5, 3, 3.5	143	36
64	3	144	38
65	3.5, 4, 8	145	32, 36, 40
66	2(3.5)	148	34
67	3, 2(3.5), 4	150	40
68	3	153	34, 40, 48
70	2(3.5), 2(4)	155	40
71	2(4.5), 5	157	45
72	4	158	44, 46, 50
73	4, 4.5, 5	159	42
74	4, 5	161	46
75	4, 4(5)	164	55
76	5	165	44
77	5.5	167	50
78	2(5), 5.5, 6.5	170	80
79	2(5.5)	172	60
80	5(6)	174	55, 60
81	5, 5, 6	175	60
82	6	177	62
84	6.5	179	65
85	2(7), 7.5, 2(8)	180	60, 62, 66
87	8	185	75
88	7, 2(7.5)	187	70, 72, 90
90	9	190	85
118	17, 18, 20	195	41, 70
119	18	199	75
120	17	204	100, 105
121	19	205	95
123	21	208	115
125	19, 20, 21, 25	209	95
128	25	217	95
129	22, 30	219	110
130	22	220	110
133	38	225	140
134	28	231	130
135	27, 28	246	170
136	26	250	170
137	25, 28	410	no weight

APPENDIX 3

LENGTH AND NUMBER OF RAINBOW TROUT
CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 3

LENGTH AND NUMBER OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, 1988

<u>Fork Length</u>	<u>Number</u>	<u>Fork Length</u>	<u>Number</u>
52	1	138	2
56	1	139	1
57	1	140	6
61	3	141	1
62	2	142	3
63	3	143	1
64	1	144	1
65	3	145	3
66	2	148	1
67	4	150	1
68	1	153	3
70	4	155	1
71	3	157	1
72	1	158	3
73	3	159	1
74	2	161	1
75	5	164	1
76	1	165	1
77	1	167	1
78	4	170	1
79	2	172	1
80	5	174	2
81	2	175	1
82	1	177	1
84	1	179	1
85	5	180	3
87	1	185	1
88	3	187	3
90	1	190	1
118	3	195	2
119	1	199	1
120	1	204	2
121	1	205	1
123	1	208	1
125	4	209	1
128	1	217	1
129	2	219	1
130	1	220	1
133	1	225	1
134	1	231	1
135	2	246	1
136	1	250	1
137	2	410	1

APPENDIX 4

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 4

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

Fork Length (mm)	Weight (g)
95	11
110	18
95	10
105	16
105	15
111	16

APPENDIX 5

LENGTH AND NUMBER OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 5

LENGTH AND NUMBER OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

<u>Fork Length</u> <u>(mm)</u>	<u>Number</u>
95	2
105	2
110	1
111	1

APPENDIX 6
METRIC CONVERSION FACTORS

Ca Department of Fish and Game Standing Stocks of Fishes Data 1990

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN
SECTIONS OF RED CLOVER CREEK,
PLUMAS COUNTY, 1990

by

Charles J. Brown
Bay-Delta and Special Water Projects Division

1991

STANDING STOCKS OF FISHES IN SECTIONS
OF RED CLOVER CREEK, PLUMAS COUNTY, 1990

INTRODUCTION

Red Clover Creek (Figure 1) is the site of a proposed and authorized dam (Abbey Bridge) that would be a part of the State Water Project. It is also the site of projects designed to reduce quantities of granitic sand flowing into Indian Creek and the Feather River. Red Clover Creek is an important source of rainbow trout (Oncorhynchus mykiss) in the Indian Creek system.

An earlier study of standing stocks of fishes in Red Clover Creek established stations for long-term studies of trout populations in this watershed (Brown 1976). Four stations identified and sampled in 1976 were sampled again in 1988 (Brown 1990). Biomass of trout was much higher in 1988 than 1976.

The purpose of this study is to report the results of periodic fish sampling at established stations in Red Clover Creek for the purpose of gathering information on tributaries to Indian Creek which will add to our knowledge of the dynamics of that system. This knowledge will be used in evaluating the effects of proposed projects such as dam construction on the fishery resources of this system.

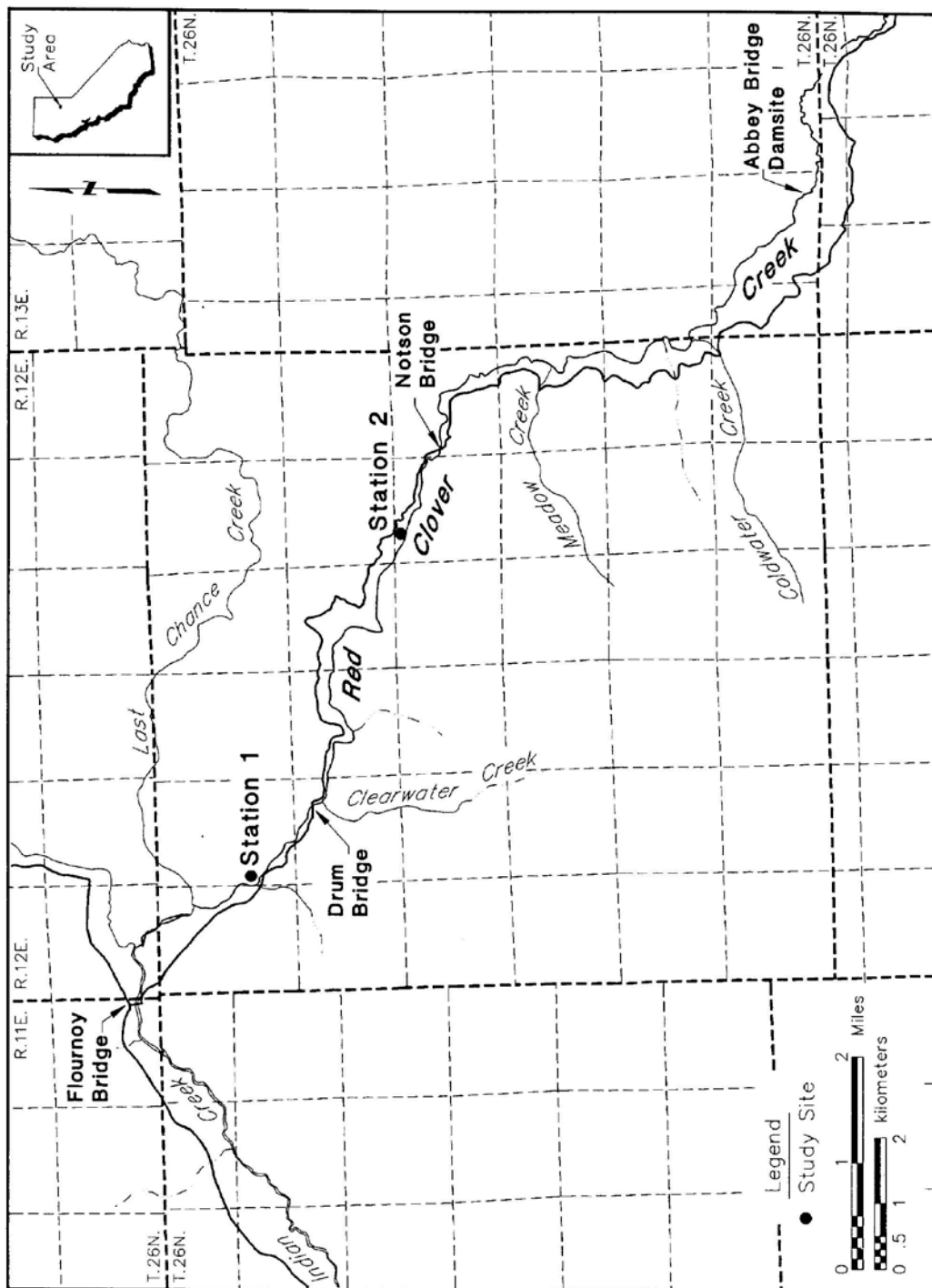


Figure 1. Stations Sampled to Estimate Standing Crop of Trout in Red Clover Creek, Plumas County, 1990.

METHODS

Standing stocks of fishes were estimated at two stations in Red Clover Creek (Figure 1) in Plumas County. The length, average width, and average depth of each station were measured (Appendix 1). Fish were captured with a battery powered backpack electroshocker in stream sections blocked by seines. Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of rainbow trout and brown trout were determined by displacement. Weights were measured for all trout caught, and fork lengths (FL) of each fish was measured to the nearest millimeter. Sacramento sucker (Catostomous occidentalis) and speckled dace (Rhinichthys osculus) were counted; however, no weights were measured for these species.

Scale samples were taken only from rainbow trout over 100 mm in length. No brown trout over 100 mm in length was caught. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42X. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker, 1975). Estimation of true mean growth rate (G) was calculated using methods of Ricker (op. cit.).

Distribution of all fish caught is listed according to location. Standing crops of brown trout and rainbow trout were calculated for individual stations where the species of interest were caught and combined for the entire creek. Age and growth were calculated only for rainbow trout. Mean individual growth was calculated only for rainbow trout. Length-weight relationships were determined for rainbow trout in Red Clover Creek. The coefficient of condition and 95 percent confidence intervals were calculated for rainbow trout.

RESULTS

Distribution

Rainbow trout were caught at stations 1 and 2. Brown trout were caught only at Station 1. Sacramento sucker and speckled dace were caught only at Station 2 (Table 1).

Table 1. Distribution of Fishes in Sections of Red Clover Creek, 1990.

	Station Number	
	1	2
Distance above mouth (km)	2.4	9.7
Rainbow Trout	X	X
Brown Trout	X	
Sacramento sucker		X
Speckled dace		X

Standing Crop

Rainbow trout were the most common game fish caught in Red Clover Creek. Biomass averaged 4.6 g/m^2 at two stations. Biomass for rainbow trout large enough for fishermen to catch and keep (127 mm FL) averaged 4.0 g/m^2 (Table 2). Brown trout biomass was 0.1 g/m^2 ; no catchable brown trout was caught (Table 3).

Table 2. Estimates of Rainbow Trout Standing Crop in Red Clover Creek, Plumas County, 1990.

Distance above mouth (km)	Population Estimate	95% Confidence Interval	Biomass (g/m^2)	Estimate of Catchable Trout ($\geq 127 \text{ mm FL}$)	Biomass of Catchable Trout (g/m^2)
2.4	71	59-88	6.5	37	5.6
9.7	27	27-29	2.7	18	2.3

Table 3. Estimates of Brown Trout Standing Crop in Red Clover Creek, Plumas County, 1990.

Distance above mouth (km)	Population Estimate	95% Confidence Interval	Biomass (g/m ²)	Estimate of Catchable Trout (>127 mm FL)	Biomass of Catchable Trout (g/m ²)
2.4	3	3-6	0.1	0	0

Sacramento sucker and speckled dace were the only non-salmonid fish caught in Red Clover Creek. Biomass averages were not calculated for these species, because the weights were not recorded (Table 4).

Table 4. Population Estimates of Nongame Fishes in Red Clover Creek, Plumas County, 1990.

Distance above mouth (km)	Species	Population Estimate	95% Confidence Interval
9.7	Sacramento sucker	11*	---
9.7	Speckled dace	224	166-282

* Number is the total catch. Due to an irregular removal pattern, the population estimate was unreliable.

Age and Growth

The formula $L = 25.2 + 4.4 S$ describes the relationship between the fork length (L) and enlarged scale radius (S) of 66 rainbow trout. The coefficient of correlation (r^2) is 0.72.

Population growth rate was faster than mean individual growth in age 1+ fish (Table 5).

Table 5. Growth Rates for Rainbow Trout Caught in Red Clover Creek, Plumas County, 1990

Age Interval	Population Growth			Mean Individual Growth		
	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	85-173	0.711	2.1	101-173	0.054	1.6

Age 1+ rainbow trout averaged 142 mm in fork length; age 2+ fish averaged 206 mm (Table 6).

Table 6. Calculated Fork Length of Rainbow Trout from Red Clover Creek, Plumas County, 1990

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli	
			1	2
1	61	142	85	-
2	5	206	101	173
Number of back-calculations			66	5
Weighted means (mm)			86	173
Increments (mm)			86	87

Length and Weight

Age group 0+ rainbow trout represented 22% of the catch. Age group 1+ trout comprised 72% of the total, and age 2+ fish made up the remaining 6% of the catch (Figure 2) (Appendix 2).

The relationship between length (L) and weight (W) of rainbow trout is:

$$\text{Log}_{10} W = -4.6 + 2.9 \text{ Log}_{10} L$$

$$r^2 = 0.98$$

$$N = 87 \text{ (Figure 3) (Appendix 4)}$$

Not enough brown trout were caught, so we did not calculate the relationship between length (L) and weight (W) (Appendices 3 and 5).

Coefficient of Condition

We calculated the coefficient of condition and 95% confidence limits for a total of 87 rainbow trout (Table 7). There is no significant difference between the coefficient of condition for any age group of rainbow trout we tested ("t" test, 0.05 level).

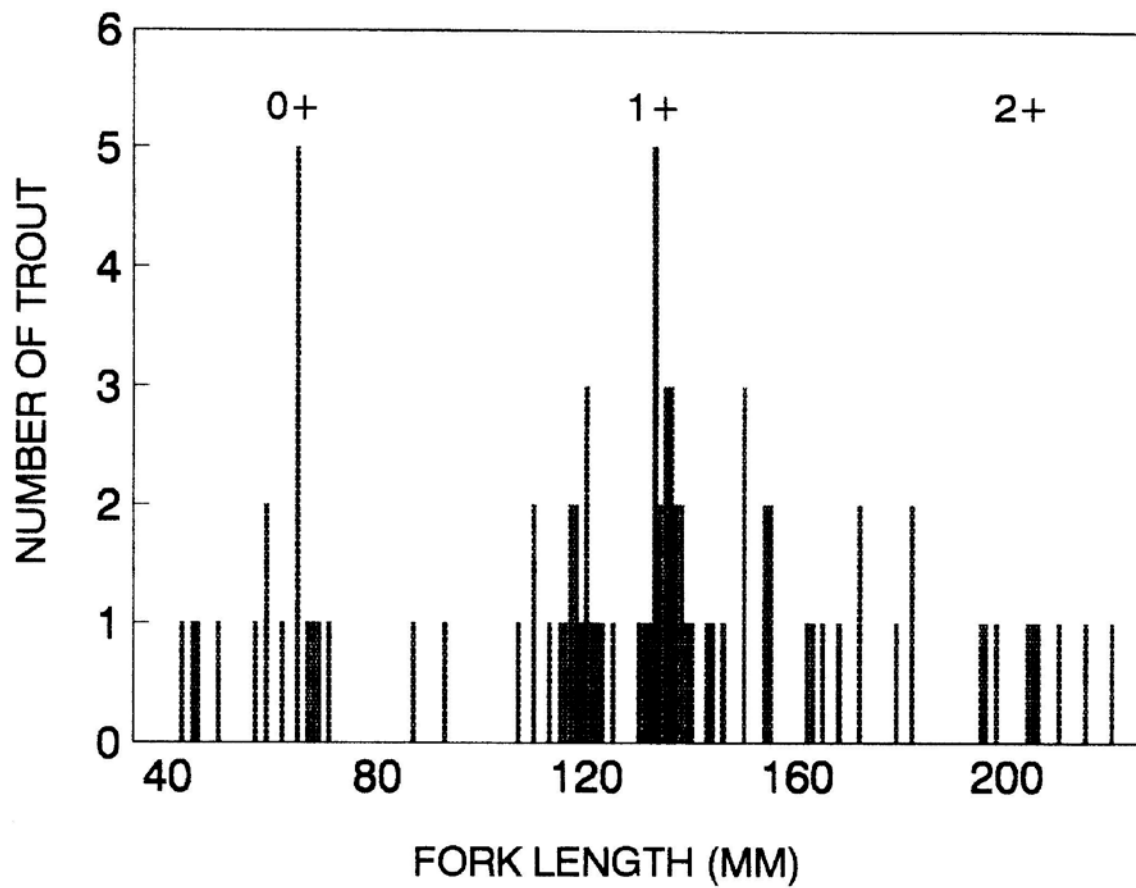


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Red Clover Creek, Plumas County, 1990.

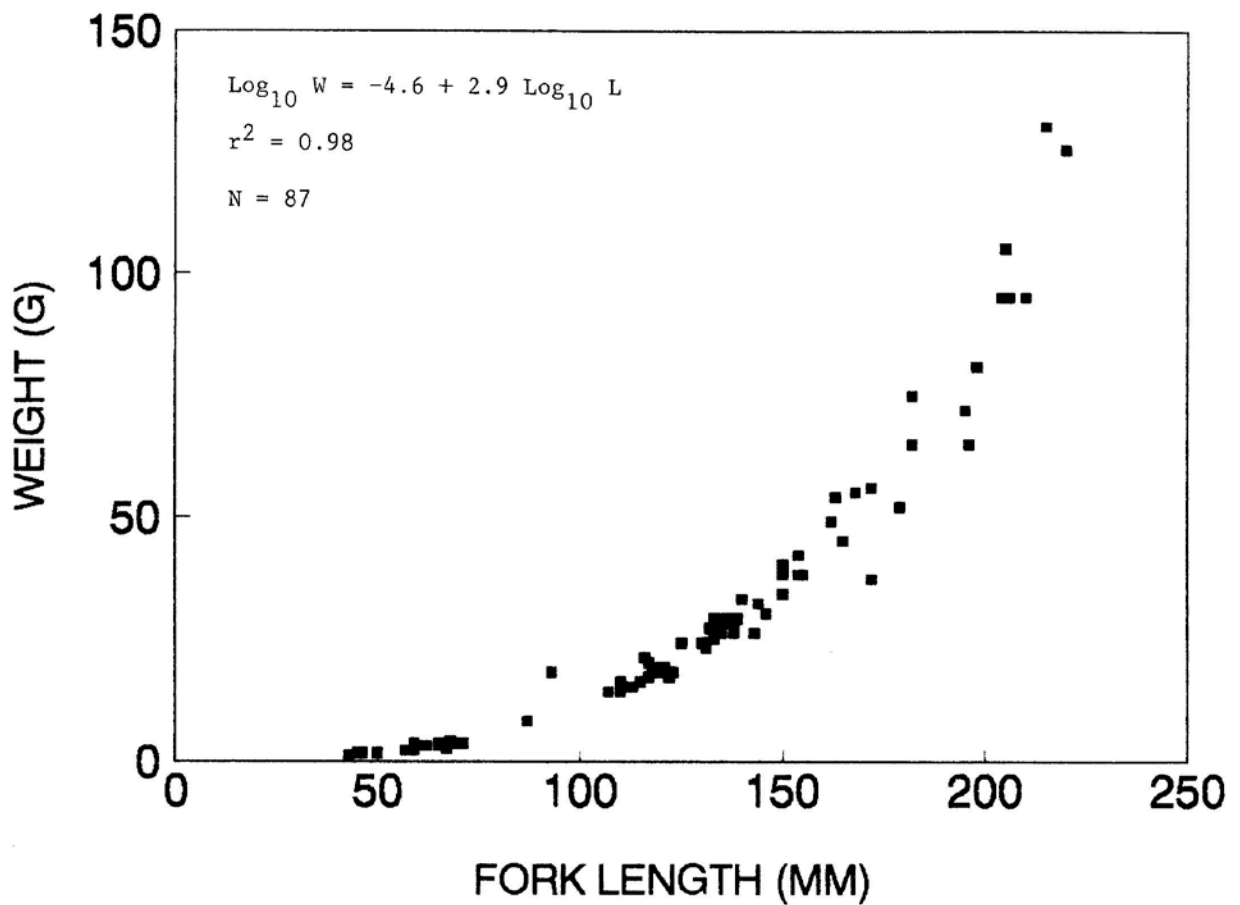


FIGURE 3. The relationship between length and weight of rainbow trout caught in sections of Red Clover Creek, Plumas County, 1990.

Table 7. Coefficient of Condition and Age of Rainbow Trout in Red Clover Creek, Plumas County, 1990.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Rainbow Trout			
0+	19	1.2677	0.6502-1.8853
1+	63	1.0833	0.8855-1.2811
2+	5	1.1627	0.9688-1.3565
Combined	87	1.1282	0.7594-1.4969

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APPENDIX 1

FISH POPULATION STATIONS FOR RED CLOVER CREEK, 1990

Station 1 - Located 2.4 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 2.7 km above Flournoy Bridge to a small, dry watercourse. Hike downhill about 46 m. to Red Clover Creek, near the site of the abandoned DWR Red Clover near Genesee streamgage (SE 1/4 of SW 1/4, Section 5, T2N, R12E). This station is labeled RC-3 in DFG Region 2 files. The station is comprised primarily of large boulders and is mostly a deep run (95%), with some pool area (5%). It is 32.5 m long, with average width of 7.1 m, and average depth of 0.43 m, giving it a surface area of 231 m² and a volume of 99 m³.

Station 2 - Located 9.7 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road about 11.3 km to the campsite at the top of the canyon. Hike down to the stream adjacent to the campsite (SW 1/4, NE 1/4, Section 14, T25N, R12E). This station has many large boulders, but also has some gravel and sand bottom areas. It is mostly pool area (66%), with some run (19%) and riffle (15%). Its length is 60 m, with an average width of 4.5 m, and an average depth of 0.3 m, giving it a surface area of 270 m² and a volume of 81 m³.

APPENDIX 2

LENGTH AND NUMBER OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, 1990

<u>Fork Length (mm)</u>	<u>Number of Fish</u>	<u>Fork Length (mm)</u>	<u>Number of Fish</u>
43	1	133	5
45	1	134	2
46	1	135	3
50	1	136	3
57	1	137	2
59	2	138	2
62	1	139	1
65	5	140	1
67	1	143	1
68	1	144	1
69	1	146	1
71	1	150	3
87	1	154	2
93	1	155	2
107	1	162	1
110	2	163	1
113	1	165	1
115	1	168	1
116	1	172	2
117	2	179	1
118	2	182	2
119	1	195	1
120	3	196	1
121	1	198	1
122	1	204	1
123	1	205	1
125	1	206	1
130	1	210	1
131	1	215	1
132	1	220	1

APPENDIX 3

LENGTH AND NUMBER OF
BROWN TROUT CAUGHT IN
RED CLOVER CREEK, 1990

<u>Fork Length</u> <u>(mm)</u>	<u>Number</u> <u>of</u> <u>Fish</u>
81	1
87	2

APPENDIX 4
LENGTH AND WEIGHT OF RAINBOW
TROUT CAUGHT IN RED CLOVER
CREEK, 1990

<u>Fork Length (mm)</u>	<u>Weight (g)</u>	<u>Fork Length (mm)</u>	<u>Weight (g)</u>
43	1	133	29
45	1.5	133	25
46	1.5	134	26
50	1.5	134	28
57	2	135	26
59	2	135	26
59	3.5	135	28
62	3	136	29
65	3	136	28
65	3.5	136	29
65	3	137	28
65	3	137	29
65	3.5	138	26
67	2.5	138	28
68	4	139	29
69	3.5	140	33
71	3.5	143	26
87	8	144	32
93	18	146	30
107	14	150	34
110	14	150	38
110	16	150	40
113	15	154	42
115	16	154	38
116	21	155	38
117	20	155	38
117	17	162	49
118	18	163	54
118	18	165	45
119	18	168	55
120	18	172	37
120	19	172	56
120	18	179	52
121	19	182	65
122	17	182	75
123	18	195	72
125	24	196	65
130	24	198	81
131	23	204	95
132	27	205	105
133	27	206	95
133	25	210	95
133	26	215	130
		220	125

APPENDIX 5

LENGTH AND WEIGHT OF BROWN
TROUT CAUGHT IN RED CLOVER
CREEK, 1990

<u>Fork Length (mm)</u>	<u>Weight (g)</u>
81	6.5
87	7.5
87	8.0

Ca Department of Fish and Game Standing Stocks of Fishes Data 1991

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN
SECTIONS OF RED CLOVER CREEK,
PLUMAS COUNTY, 1991

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1992

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An earlier study of standing stocks of fishes in Red Clover Creek established stations for long-term studies of trout populations in this watershed (Brown 1976). Four stations identified and sampled in 1976 were sampled again in 1988 (Brown 1990). Biomass of trout was much higher in 1988 than 1976.

The purpose of this study is to gather information on tributaries to Indian Creek through periodic fish sampling at established stations in Red Clover Creek which will add to our knowledge of the dynamics of that system. This knowledge will be used in evaluating the effects of proposed projects such as dam construction on the fishery resources of this system. This report documents the results of sampling conducted in 1991.

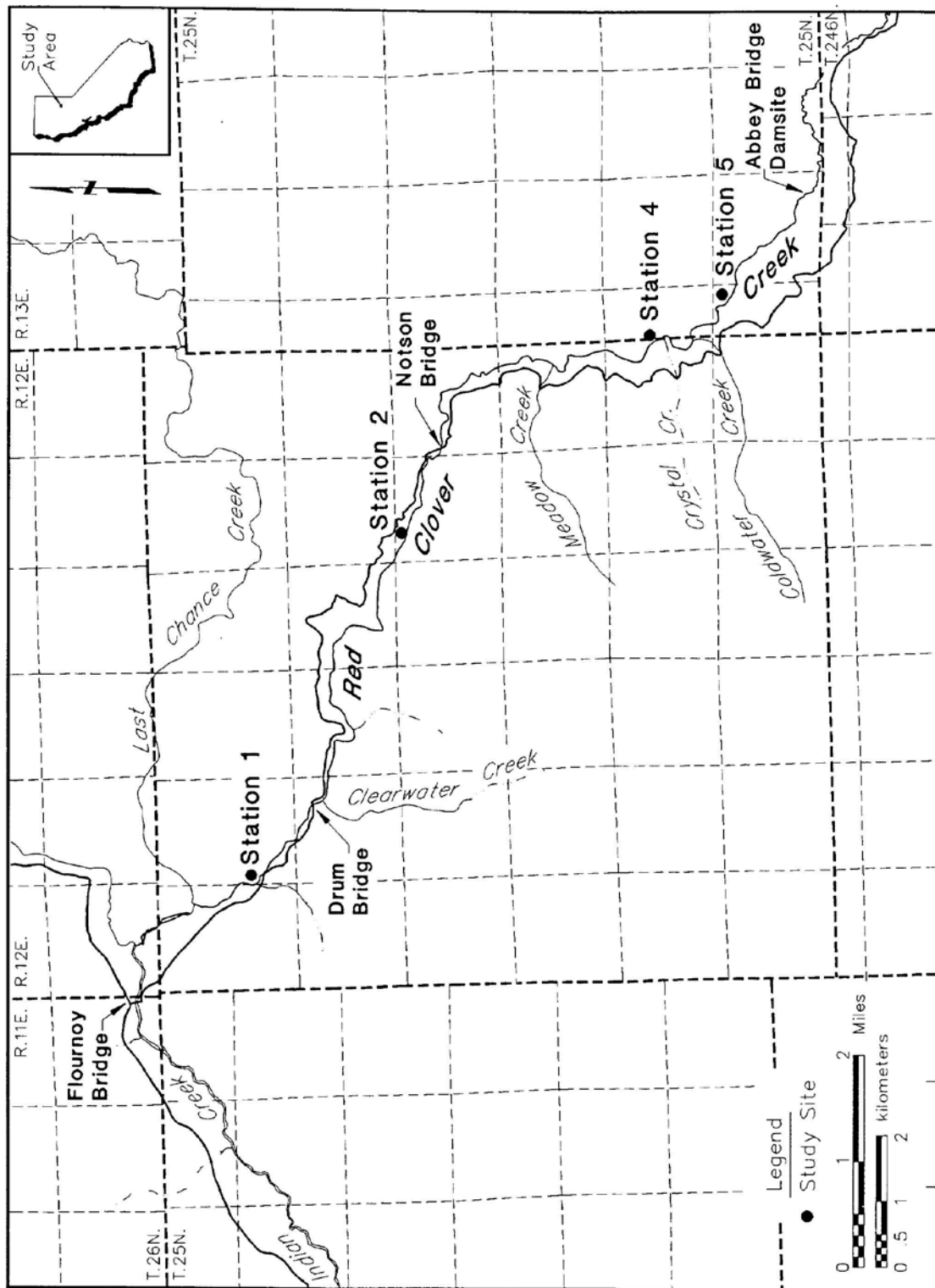


Figure 1. Stations Sampled to Estimate Standing Crop of Trout in Red Clover Creek, Plumas County, 1991.

METHODS

Standing stocks of fishes were estimated at four stations in Red Clover Creek (Figure 1) in Plumas County. The length, average width, and average depth of each station were measured (Appendix 1). Fish were captured with a battery powered backpack electroshocker in stream sections blocked by seines . Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of rainbow trout were determined by displacement. Weights were measured for all trout caught, and fork lengths (FL) of each fish was measured to the nearest millimeter.

Scale samples were taken from trout over 100 mm in length. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42X. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker 1975). Estimation of true mean growth rate (G) was calculated using methods of Ricker (op. cit.).

Distribution of all fish caught is listed according to location. Standing crops of rainbow trout were calculated for individual stations where they were caught and combined for the entire creek. Age and growth, mean individual growth, and length-weight relationships were determined for rainbow trout. The coefficient of condition and 95 percent confidence intervals were also calculated.

RESULTS

Distribution

Rainbow trout were caught at stations 1,2,4 and 5. Sacramento sucker (Catostomus occidentalis) were caught only at station 2. Speckled dace (Rhinichthys osculus) were caught at stations 2, 4 and 5 (Table 1).

Table 1. Distribution of fishes in sections of Red Clover Creek, 1991.

	Station Number			
	<u>1</u>	<u>2</u>	<u>4</u>	<u>5</u>
Distance above mouth (km)	2.4	9.7	13.0	14.8
Rainbow trout	X	X	X	X
Sacramento sucker		X		
Speckled dace		X	X	X

Standing Crop

Rainbow trout were the only game fish caught in Red Clover Creek. Biomass averaged 3.0 g/m² at four stations. Biomass for rainbow trout large enough for fishermen to catch and keep (≥ 127 mm FL) averaged 2.3 g/m² (Table 2).

Table 2. Estimates of rainbow trout standing crop in Red Clover Creek, Plumas County, 1991.

Distance above mouth (km)	Population Estimate	95% Confidence Interval	Biomass (g/m ²)	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout (g/m ²)
2.4	58	50-72	6.9	16	4.7
9.7	22	21-26	4.9	16	4.5
13.0	25	24-29	0.1	0	0
14.8	7	7-8	0.1	0	0

Sacramento sucker and speckled dace were the only non-salmonid fish caught in Red Clover Creek. Biomass averages were not calculated for these species, because the weights were not recorded (Table 4).

Table 4. Population estimates of nongame fishes in Red Clover Creek, Plumas County, 1991.

Distance above mouth (km)	Species	Population Estimate	95% Confidence Interval
9.7	Sacramento sucker	174	94-300
9.7	Speckled dace	38	33-49
13.0	Speckled dace	120	40-426
14.8	Speckled dace	97	48-215

Age and Growth

The formula $L = 6.5 + 5.0 S$ describes the relationship between the fork length (L) and enlarged scale radius (S) of 39 rainbow trout. The coefficient of correlation (r^2) is 0.80.

Population growth rate slightly was faster than mean individual growth in age 1+ fish (Table 5).

Table 5. Growth rates for rainbow trout caught in Red Clover Creek, Plumas County, 1991.

Age Interval	Population Growth			Mean Individual Growth		
	Length Interval	Difference of Natural	Instantaneous Growth Rate	Length Interval	Difference of Natural	Instantaneous Growth Rate
	(mm)	Logarithms	Gx	(mm)	Logarithms	Gx
1-2	97-166	0.537	1.6	98-166	0.527	1.5

Age 1+ rainbow trout averaged 153 mm in fork length; age 2+ fish averaged 206 mm (Table 6).

Table 6. Calculated fork length of rainbow trout from Red Clover Creek, Plumas County, 1991.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli	
			1	2
1	32	153	97	-
2	7	206	98	166
Number of back-calculations			39	7
Weighted means (mm)			97	166
Increments (mm)			97	69

Length and Weight

Age group 0+ rainbow trout represented 5% of the catch. Age group 1+ trout comprised 86% of the total, and age 2+ fish made up the remaining 9% of the catch (Figure 2) (Appendix 2).

The relationship between length (L) and weight (W) of rainbow trout is:

$$\text{Log}_{10}W = -4.7 + 2.9 \text{ Log}_{10}L$$

$$r^2 = 0.98$$

N = 102 (Figure 3) (Appendix 3)

Coefficient of Condition

We calculated the coefficient of condition and 95% confidence limits for a total of 102 rainbow trout (Table 7). There is no significant difference between the coefficient of condition for any age group of rainbow trout we tested ("t" test, 0.05 level).

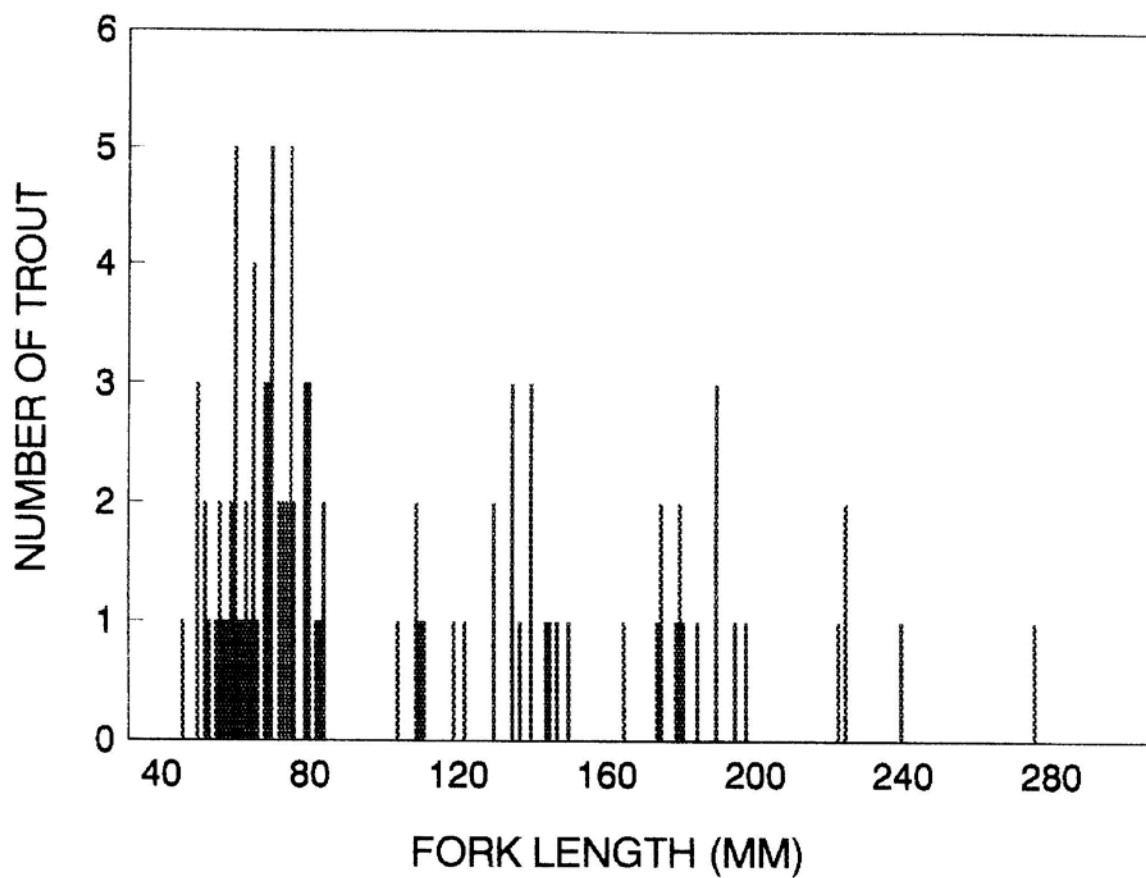


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Red Clover Creek, Plumas County, 1991.

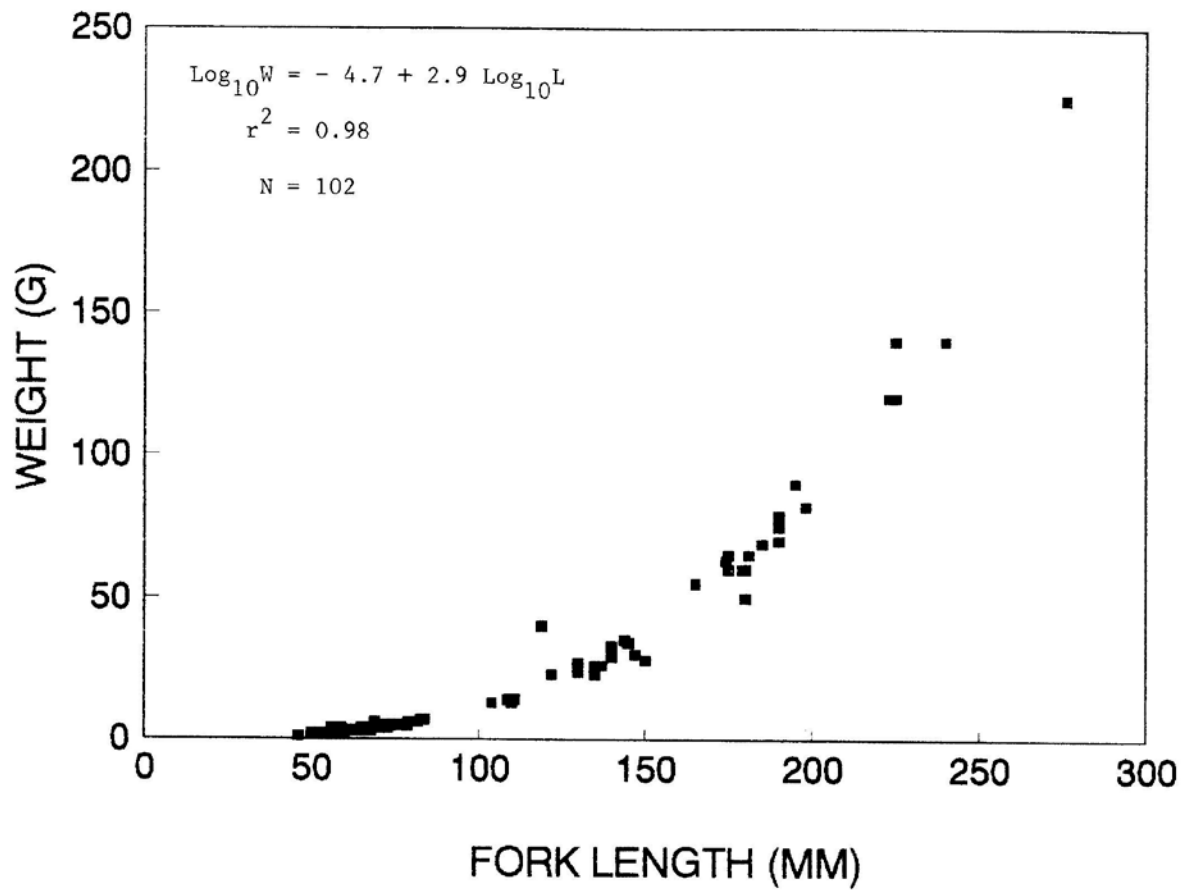


FIGURE 3. The relationship between length and weight of rainbow trout caught in sections of Red Clover Creek, Plumas County, 1991.

Table 7. Coefficient of condition and age of rainbow trout in Red Clover Creek, Plumas County, 1991.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
0+	64	1.2459	0.7921-1.6996
1+	24	1.1456	0.6038-1.6875
2+	14	1.1016	0.8652-1.3381
Combined	102	1.2011	0.7370-1.6676

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APPENDIX 1

FISH POPULATION STATIONS FOR RED CLOVER CREEK, 1991

Station 1 - Located 2.4 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 2.7 km above Flourney Bridge to a small, dry watercourse. Hike downhill about 46 m. to Red Clover Creek, near the site of the abandoned DWR Red Clover near Genesee stream gage (SE 1/4 of SW 1/4, Section 5, T2N, R12E). This station is labeled RC-3 in DFG Region 2 files. The station is comprised primarily of large boulders and is mostly a deep run (95%), with some pool area (5%). It is 30.5 m long, with average width of 5.3 m, and average depth of 0.47 m, giving it a surface area of 161.7 m² and a volume of 76 m³.

Station 2 - Located 9.7 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road about 11.3 km to the campsite at the top of the canyon. Hike down to the stream adjacent to the campsite (SW 1/4, NE 1/4, Section 14, T25N, R12E). This station has many large boulders, but also has some gravel and sand bottom areas. It is mostly pool area (66%), with some run (19%) and riffle (15%). Its length is 64.9 m, with an average width of 4.7 m, and an average depth of 0.3 m, giving it a surface area of 305 m² and a volume of 82.4 m³.

Station 4 - Located 13.0 stream km upstream from the confluence with Indian Creek. Drive up to the Genesee-Beckwourth Road about 16.1 km above Flourney Bridge and turn left on a spur road. Drive 0.3 km down the spur road. The station is located just upstream of a dry tributary and downstream from a live tributary (SE 1/4, NE 1/4, Section 24, T25N, R12E). The substrate is mostly volcanic with a small amount of sand and gravel. The station is broken up by bedrock outcroppings and is primarily pool (74%) and riffle (23%) with a small amount of run (3%). The station is 82 m long, with an average width of 7.3 m, and an average depth of 0.3 m, giving it a surface area of 598.6 m² and a volume of 149.7 m³.

Station 5 - Located 14.8 stream km upstream from the confluence with Indian Creek. Drive up to the Genesee-Beckwourth Road about 18.1 km above Flourney Bridge and turn left on a spur road. Drive about 0.6 km down the spur road. The station is located just downstream from a live tributary (SE 1/4, NE 1/4, Section 31, T25N, R13E). The substrate is mostly sand, with some gravel area. The station is primarily pool (50%), with a smaller component of run (30%) and pool (20%). It is 83.2 m long, with an average width of 7.8 m and an average depth of 0.22 m, giving it a surface area of 649 m² and a volume of 142.8 m³.

APPENDIX 2

LENGTH AND NUMBER OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, 1991

<u>Fork Length (mm)</u>	<u>Number of Fish</u>	<u>Fork Length (mm)</u>	<u>Number of Fish</u>
46	1	109	2
50	3	110	1
52	2	111	1
53	1	119	1
55	1	122	1
56	2	130	2
57	1	135	3
58	1	137	1
59	2	140	3
60	5	144	1
61	1	145	1
62	1	147	1
63	2	150	1
64	1	165	1
65	4	174	1
66	1	175	2
68	3	179	1
69	3	180	2
70	5	181	1
72	2	185	1
73	2	190	3
74	2	195	1
75	5	198	1
76	2	223	1
79	3	225	2
80	3	240	1
82	1	276	1
83	1		
84	2		
104	1		

APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW
TROUT CAUGHT IN RED CLOVER
CREEK, 1991

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
46	1	73	4
50	2	73	5
50	2	74	5
50	2	74	5
52	2	75	5
52	2	75	5
53	2	75	5
55	2	75	5
56	4	75	5
56	2	76	5
57	2	76	5
58	2	79	5
59	3	79	5
59	4	79	6
60	3	80	6
60	2	80	6
60	2	80	6
60	3	82	6
60	3	83	7
61	3	84	7
62	3	84	7
63	3	104	13
63	3	109	14
64	3	109	14
65	3	110	13
65	3	111	14
65	3	119	40
65	4	122	23
66	3	130	24
68	4	130	27
68	4	135	23
68	3	135	26
69	4	135	30
69	4	137	26
69	6	140	29
70	4	140	30
70	4	140	33
70	4	144	35
70	4	145	34
70	4	147	30
72	4	150	28
72	5	165	55
		174	63
		175	60

APPENDIX 3
(con't)

Fork Length <u>(mm)</u>	Weight <u>(g)</u>
175	65
179	60
180	50
180	60
181	65
185	69
190	70
190	75
190	79
195	90
198	82
223	120
225	120
225	140
240	140
276	225

Ca Department of Fish and Game Standing Stocks of Fishes Data 1998

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN
SECTIONS OF RED CLOVER CREEK,
PLUMAS COUNTY, 1998

by

Charles J. Brown
Central Valley Bay-Delta Branch

1999

STANDING STOCKS OF FISHES IN SECTIONS
OF RED CLOVER CREEK, PLUMAS COUNTY, 1998

INTRODUCTION

Red Clover Creek (Figure 1) is the site of a proposed and authorized dam (Abbey Bridge) that would be part of the State Water Project. It is also the site of projects designed to reduce quantities of granitic sand flowing into Indian Creek and the Feather River. Red Clover Creek is an important source of rainbow trout (Oncorhynchus mykiss) in the Indian Creek system.

An earlier study of standing stocks of fishes in Red Clover Creek established stations for long-term studies of trout populations in this watershed (Brown 1976). Stations identified and sampled in 1976 were sampled again in 1988, 1990, and 1991 (Brown 1990, Brown 1991, and Brown 1992). The biomass of trout was highest in 1988.

The purpose of this study was to gather information on tributaries to Indian Creek through periodic fish sampling at established stations in Red Clover Creek in order to increase our knowledge of the dynamics of that system. This knowledge will be used in evaluating the effects of proposed projects such as the construction of a dam on the fishery resources of this system. This report documents the results of sampling conducted in 1998.

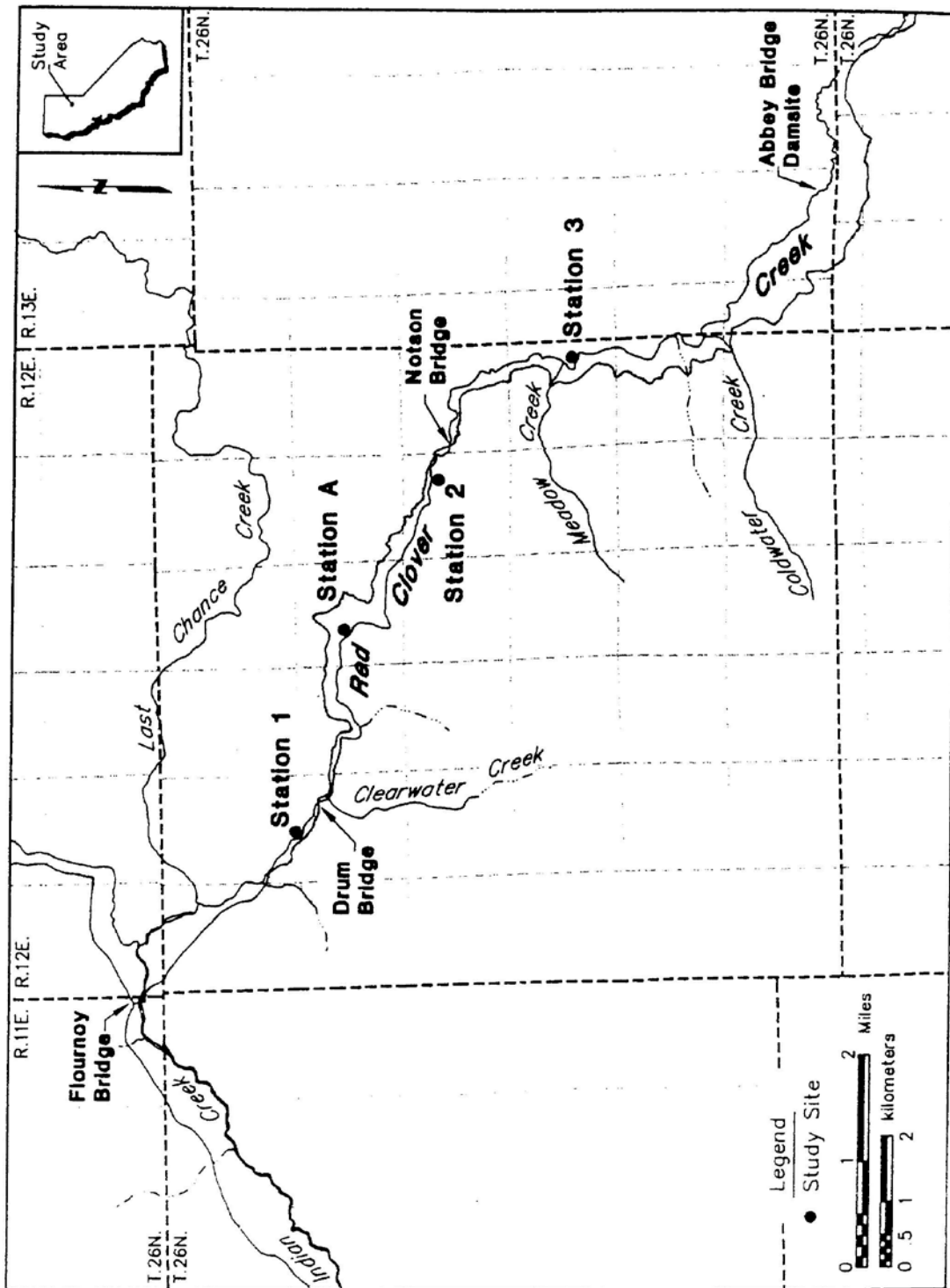


Figure 1. Stations Sampled to Estimate Standing Crop of Trout in Red Clover Creek, Plumas County, 1998.

METHODS

Standing stocks of fishes were estimated at four stations in Red Clover Creek (Figure 1) in Plumas County. The length, average width, and average depth of each station were measured (Appendix 1). Fish were captured with a battery powered backpack electroshocker in stream sections blocked by seines. Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weight of rainbow trout was determined to the nearest milliliter by displacement in water. Weights were measured for all trout caught, and fork length (FL) of each fish was measured to the nearest millimeter.

Scale samples were taken from trout over 100 mm in length. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42X. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker 1975). Estimation of true mean growth rate (G) was calculated using methods of Ricker (op. cit.).

Distribution of all fish caught is listed according to location. Standing crops of rainbow trout were calculated for individual stations where they were caught and combined for the entire creek. Age and growth, mean individual growth, and length-weight relationships were determined for rainbow trout. The coefficient of condition and 95 percent confidence intervals were also calculated by station.

RESULTS

Rainbow trout were caught in each station. Sacramento suckers were caught in stations 1 and A, while speckled dace were also caught in station A (Table 1).

Table 1. Fishes caught in selected sections of Red Clover Creek, Plumas County, 1998.

	Station Number			
	1	A	2	3
Distance above Indian Creek (km)	2.4	5.8	9.7	13.0
Rainbow trout	X	X	X	X
Speckled dace		X		
Sacramento sucker	X	X		

Rainbow trout ranged in size from 49 to 283 mm FL (Figure 2). Rainbow trout biomass averaged 4.9 g/m² at four stations. An estimated 70 rainbow trout large enough for anglers to catch and keep (127 mm FL) were present in all the stations we sampled (Table 3).

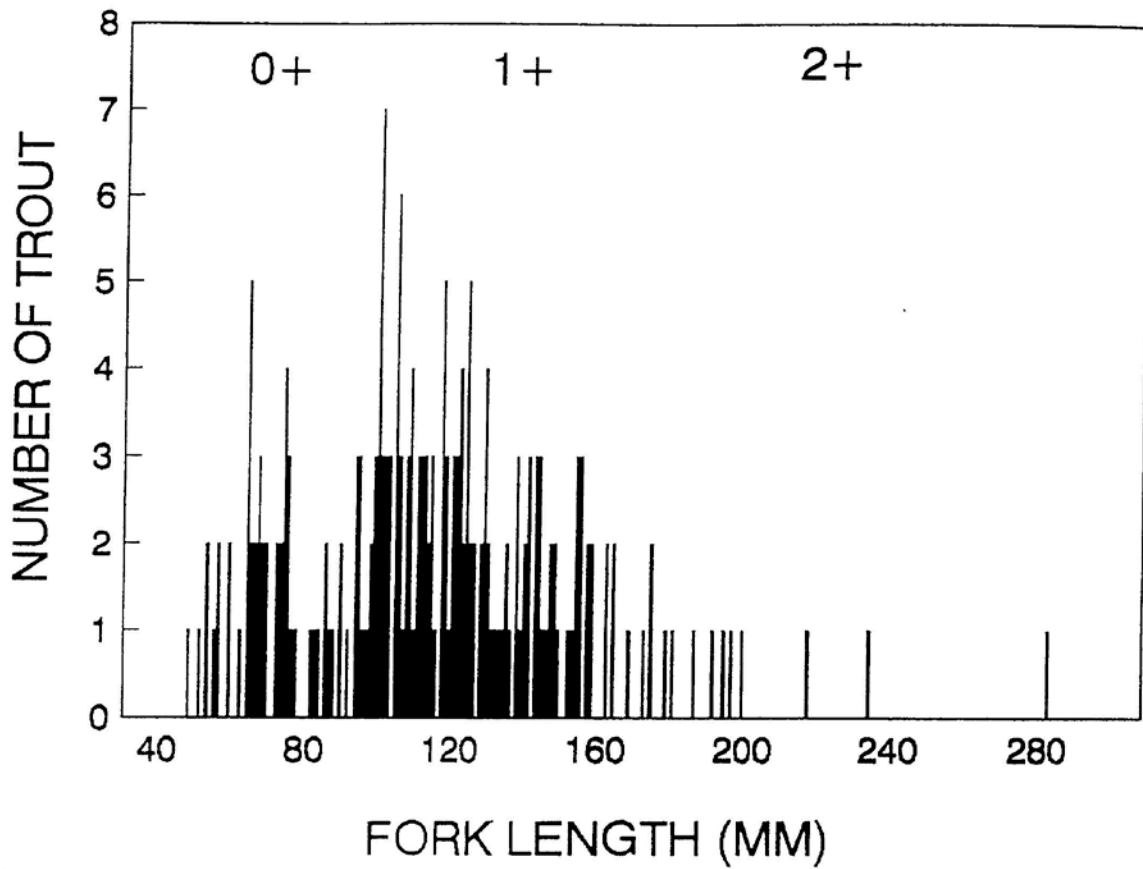


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Red Clover Creek, Plumas County, 1998.

Table 3. Estimate of rainbow trout standing crop in Red Clover Creek, Plumas County, 1998.

Distance above the mouth of Red Clover Creek (km)	Population Estimate	95% Confidence Interval	Biomass (g/m ²)	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout (g/m ²)
2.4	78	72-88	7.5	24	4.0
5.8	110	90-135	4.1	23	4.1
9.7	46	43-53	6.2	22	6.2
13.0	1	1-1	1.8	1	1.8

The relationship between fork length (FL) and weight (W) of rainbow trout is:

$$\text{Log}_{10} W = -4.8 + 2.9 \text{ Log}_{10} \text{ FL}$$

$$r^2 = 0.98$$

N = 194 (Figure 3 and Appendix 2)

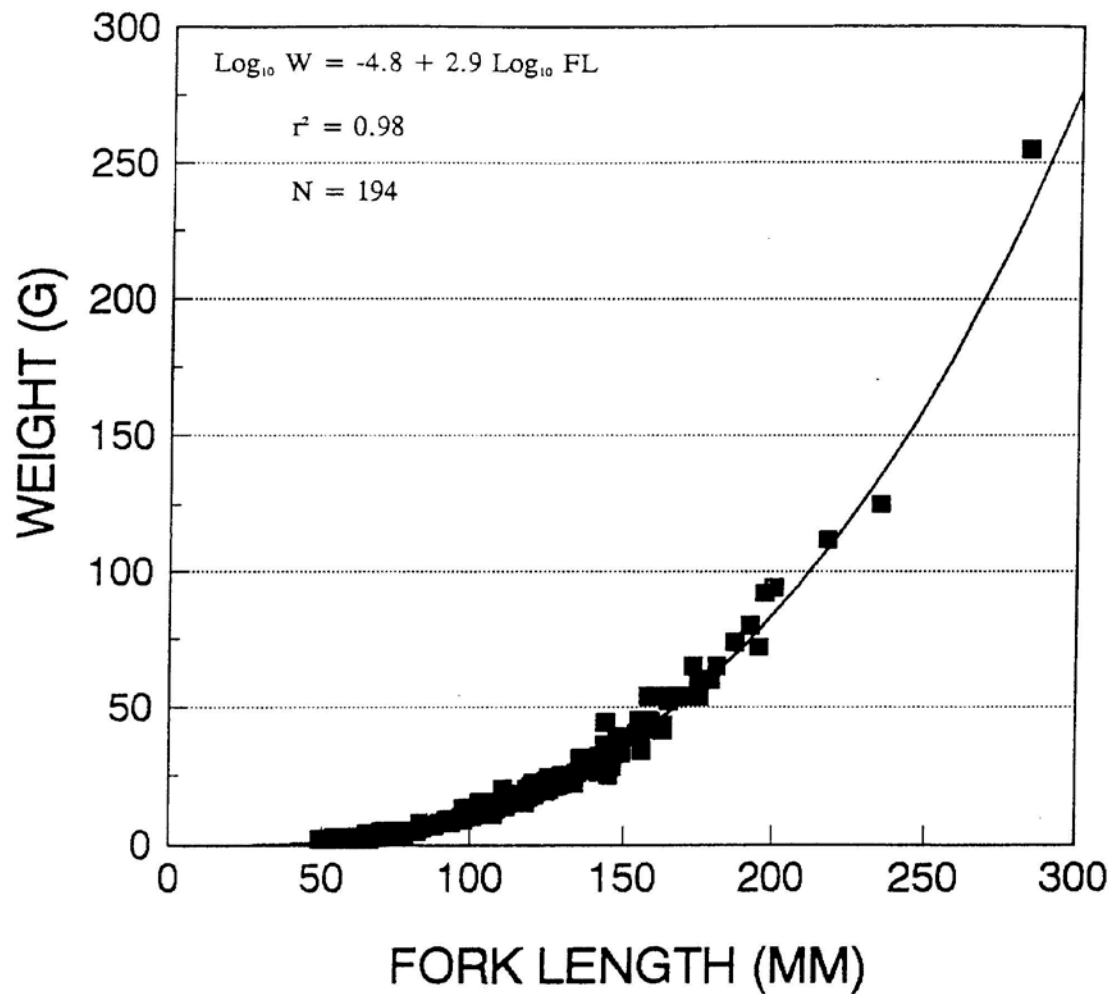


FIGURE 3. The relationship between length and weight of rainbow trout caught in sections of Red Clover Creek, Plumas County, 1998.

Age and Growth

The formula $FL = 58.3 + 0.9 S$ describes the relationship between the fork length and enlarged scale radius (S) of 60 rainbow trout caught in Red Clover Creek. The coefficient of correlation (r^2) is 0.91.

Population growth was less than mean individual growth for age 1-2 rainbow trout (Table 4).

Table 4. Growth rates for rainbow trout caught in Red Clover Creek, 1998.

Age	Population Growth			Mean Individual Growth		
	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	89-186	0.737	2.211	86-186	0.771	2.314

Age 1+ and age 2+ rainbow trout averaged 133 mm and 205 mm FL, respectively. (Table 5).

Table 5. Calculated average fork length of rainbow trout from Red Clover Creek, 1998.

Age	Number of Fish	Length at Capture	<u>Length at Successive Annulus</u>	
			1	2
1	57	133	89	
2	3	205	86	186
Number of back-calculations			60	3
Weighted means (mm)			95	191
Increments (mm)				96

Coefficient of Condition

The average coefficient of condition for 207 rainbow trout was 1.1030 (Table 6). Age 0+ rainbow trout had slightly higher coefficients of condition than age 1+ or age 2+ rainbow trout.

Table 6. Condition of rainbow trout in Red Clover Creek, Plumas County, 1998.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
0+	95	1.1231	0.7483-1.4980
1+	107	1.0849	0.8821-1.2877
2+	5	1.0950	0.9442-1.2748
Combined	207	1.1030	0.8068-1.3993

DISCUSSION

We sampled Red Clover Creek in 1976, 1988, 1990, 1991, and 1998. Average standing crop varied between 25 and 59 rainbow trout per station (Table 7) while biomass varied between 1.0 and 5.6 g/m² (Table 8). Standing crop averaged 44 rainbow trout and biomass averaged 3.8 g/m² (Table 11). Standing crop of brown trout averaged 4 trout (Table 9) and 0.1 g/m² (Table 10). Brown trout were caught in 1976, 1988, and 1990, but not in 1991 or 1998 (Table 9).

Rainbow trout have dominated the catch each year we have sampled Red Clover Creek (Table 11). Brown trout may be scarce in our stations because high flows have been occurring in late winter and spring in recent years. High flows in early spring wash young brown trout downstream. Rainbow trout have not hatched yet, so they may survive such events (Seegrist and Gard 1972, Hansen and Waters 1974, Harvey 1987).

Speckled dace and Sacramento suckers were caught each year we sampled Red Clover Creek.

Table 7. Estimated populations of rainbow trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	46	118	71	58	78
A				22	110
2		30	27	25	46
3	5	48		7	1
Average	25	58	49	28	59

Table 8. Estimated biomass (g/m²) of rainbow trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	1.1	10.2	6.5	6.9	7.5
A				4.9	4.1
2		6.4	2.7	0.1	6.2
3	0.8	0.2		0.1	1.8
Average	1.0	5.6	4.6	3.0	4.9

Table 9. Estimated populations of brown trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	4	5	3		
A					
2					
3	6	1			
Average	5	3	3		

Table 10. Estimated biomass (g/m²) of brown trout by station in Red Clover Creek, 1976-1998.

Station	1976	1988	1990	1991	1998
1	0.2	0.3	0.1		
A					
2					
3	0.1	0.1			
Average	0.1	0.2	0.1		

Table 11. Average standing crop and biomass for rainbow trout and brown trout in Red Clover Creek, 1976-1998.

Year	Rainbow Trout		Brown Trout	
	Population Estimate	Biomass (g/m ²)	Population Estimate	Biomass (g/m ²)
1976	25	1.0	5	0.1
1988	58	5.6	3	0.2
1990	49	4.6	3	0.1
1991	28	3.0		
1998	59	4.9		
Average	44	3.8	4	0.1

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APPENDIX 1

PERMANENT FISH POPULATION STATIONS FOR RED CLOVER CREEK, PLUMAS COUNTY.

Station 1 - Located 2.4 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 2.7 km above Flournoy Bridge to a small, dry watercourse. Hike downhill about 46 m, to Red Clover Creek, near the site of the abandoned DWR Red Clover near Genesee stream gage (SE 1/4 of SW 1/4, Section 5, T2N R12E). This station is labeled RC-3 in of DFG Region 2 files. The station is comprised primarily of large boulders and is mostly a deep run (95%), with some pool area (5%). It is 30.5 m long, with average width of 7.2 m, giving it a surface area of 218 m².

Station A - Located 5.8 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 1.8 km above Drum Bridge to a small pullout on the stream edge of a steep canyon. Hike down a trail about 1.2 km to Red Clover Creek (SE 1/4 of NE 1/4, Section 10, T2N R12E). The station is comprised primarily of large boulders and cobbles with some sand and gravel. It is mostly riffle and run (70%), with some mid-channel pools (30%). It is 44.2 m long, with average width of 10.2 m, giving it a surface area of 451 m².

Station 2 - Located 9.7 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road about 11.3 km to the campsite at the top of the canyon. Hike down to the stream adjacent to the campsite (SW 1/4, NE 1/4, Section 14, T25N, R12E). This station has many large boulders, but also has some gravel and sand bottom areas. It is mostly pool area (66%), with some run (19%) and riffle (15%). Its length is 39.9 m, with an average width of 8.1 m, giving it a surface area of 325 m².

Station 3 - Located 13.0 stream km upstream from the confluence with Indian Creek. Drive up to the Genesee-Beckwourth Road about 16.1 km about Flournoy Bridge and turn left on a spur road. Drive 0.3 km down the spur road. The station is located just upstream of a dry tributary and downstream from a live tributary (SE 1/4, NE 1/4, Section 24, T25N, R12E). Previous studies refer to this station as "Station 4". The substrate is mostly volcanic with a small amount of sand and gravel. The station is broken up by bedrock outcroppings and is primarily pool (74%), and riffle (23%), with a small amount of run (3%). The station is 47.2 m long, with an average width of 2.9 m, giving it a surface area of 138 m².

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, 1998

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
49	2	66	2	75	4	92	9
52	2	67	4	75	3	94	8
54	2	67	3	76	4	94	9
54	3	68	3	76	5	94	9
56	2	68	4	76	4	95	9
57	3	68	4	77	5	95	9
57	2	69	4	78	3	95	9
60	3	69	4	82	5	96	9
60	2	70	5	83	8	97	10
63	2	70	4	84	6	98	9
65	4	73	4	86	7	100	11
65	3	73	4	86	7	100	12
65	3	74	5	87	7	100	12
65	4	74	4	88	7	100	11
65	3	75	5	90	8	100	11
66	3	75	4	90	8	100	13

APPENDIX 2 (cont)

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN RED CLOVER CREEK, 1998

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
100	12	105	13	111	20	116	17
101	10	105	13	111	14	118	18
101	11	106	14	111	16	118	18
101	12	106	13	112	15	118	16
102	12	106	14	112	16	118	17
102	12	107	15	112	14	118	15
102	11	108	14	113	18	119	17
103	12	108	12	113	15	119	20
103	11	108	11	113	16	119	18
103	15	109	15	114	15	120	21
105	13	109	14	114	15	122	20
105	12	109	13	115	17	122	20
105	11	109	15	115	16	123	19
105	12	110	15	115	16	123	20

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, 1998 (Continued)

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
123	20	130	25	139	29	147	36
124	21	130	23	140	27	148	38
124	22	130	23	141	29	148	33
125	20	130	25	141	30	149	35
125	23	131	24	142	32	149	33
125	19	132	22	142	26	150	39
125	21	133	23	142	30	153	39
125	20	134	22	144	36	154	40
126	20	135	26	144	44	155	42
126	24	136	30	144	27	155	45
127	21	136	31	145	25	155	39
127	24	137	31	145	33	158	54
129	23	139	29	145	33	159	44
129	21	139	30	146	28	159	42

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT CAUGHT IN RED CLOVER CREEK, 1998 (Continued)

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
163	41	181	65
163	43	187	74
165	54	192	80
165	52	195	72
169	54	197	92
173	65	200	94
175	60	218	112
175	54	235	125
179	60	283	255

Excerpt from Red Clover Creek Erosion Control Demonstration Project Ten-Year Research Summary

Section 10

Fish and Water Quality

Purpose and Objective

The upper end of Red Clover Creek, which flows through the project area, has a low gradient and generally fine substrates. Due to erosion and channel downcutting, water flow was confined to a deep and wide channel with minimal vegetation and little cover for fish. In general, habitat was considered very poor for trout. Prior to 1880, this portion of Red Clover Creek was characterized as a fairly healthy stream—a narrow, meandering channel with stable, undercut banks vegetated by willows and grasses. The stream also had a reputation as a good trout fishery subsequent to land management changes by early settlers (R. Cooke, historian, Plumas County, 1988 per. comm.).

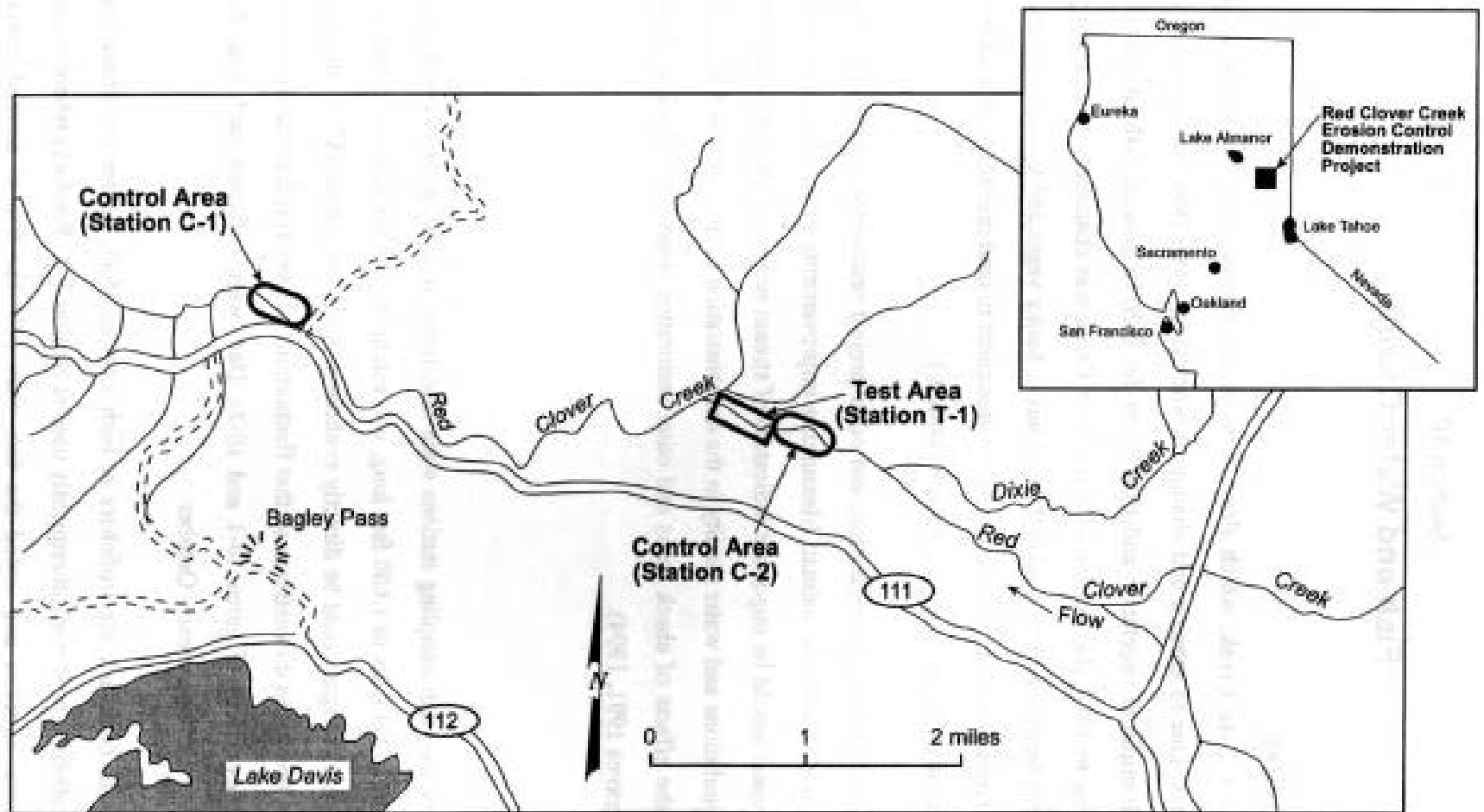
The check dams, exclosure fencing, revegetation, and other project restoration measures were expected to improve the water quality and fish habitat. Measurable improvements in water quality and the type and quantity of fish present would be important indicators of stream recovery. The objective of the study was to monitor fish populations and water quality in the demonstration project area and at a downstream control site to assess the effects of check dams and other restoration measures on fish and fish habitat (Longanecker and Segraves 1991, 1994).

Methods

Fish Sampling Data

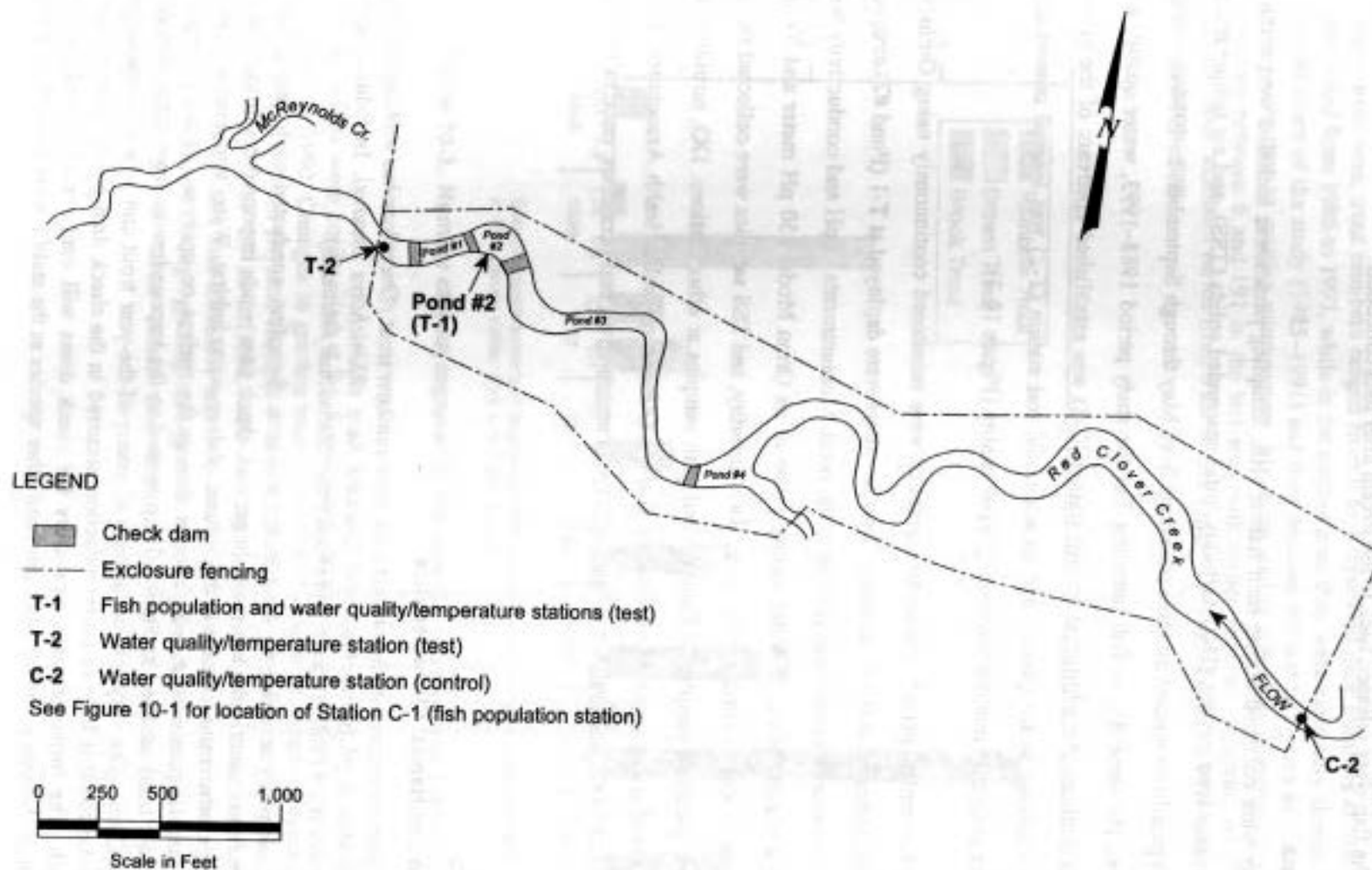
To collect baseline data, two fish sampling stations were established in 1985 prior to construction of the check dams. A test station (T-1), about 1,600 feet long, was established in the section of stream that later contained Pond #2 so that changes could be directly evaluated. A control station (C-1), about 1,500 feet long, was established a few miles downstream so that fluctuations of annual fish populations unrelated to the test area could be evaluated (Figures 10-1 and 10-2). Data were collected each year from 1985 through 1993 during late September/early October.

Fish were collected with backpack electrofishers at both sites in 1985, before the check dams were constructed. An electrofishing boat was subsequently used at Station T-1 (Pond #2) where water was too deep to wade. The crew shocked and netted the fish, then held the fish in aerated containers for identification, counting, measuring, and weighing. Fork lengths were measured for each trout and sucker



Source: Longanecker and Segraves, 1994, *Erosion Control Demonstration Project in Red Clover Valley: Fish and Water Quality*

Figure 10-1. Location of fish sampling stations in the Red Clover Creek test and control areas.



Source: Longanecker and Sagraves, 1994, *Erosion Control Demonstration Project in Red Clover Valley: Fish and Water Quality*

Figure 10-2. Location of fish and water quality sampling stations in the test area.

and for a representative subsample (50 speckled dace). The total weight for each species was measured volumetrically. The fish were released back to the stream after data collection.

Water Quality Data

Water quality data were collected during each station visit. Sampling parameters included temperature, pH, conductivity, dissolved oxygen (DO), turbidity, total suspended solids (TSS), and air temperatures. Monitoring was typically conducted on three occasions from May through September. In 1986 and 1987, data were collected the same day as fish sampling. For the study period 1988–1993, water quality was monitored at four stations. An additional control station (C-2) was established upstream of the project area to monitor inflowing water quality, and an additional test station (T-2) was located immediately downstream of the project to monitor outflowing water quality (Figure 10-2).

During the May-September period, stream temperatures were monitored continuously using Omnidata 112 thermographs calibrated to 0.1°C accuracy. Two recorders were deployed at T-1 (Pond #2) at depths of 3 and 8 feet to measure thermal stratification in the pond. Measurements of pH and conductivity were performed using a Martek Mark 15 water quality probe or an Orion Model 250 pH meter and Yellow Springs Instrument Model 33 conductivity meter. DO, turbidity, and TSS samples were collected using a Van Dorn depth separating sampler in Pond #2 and grab samples at other stations. DO, turbidity, and TSS were determined using standard methods of analysis (American Public Health Association 1989). The diurnal cycle of DO concentrations at Station T-1 was measured on two occasions, once in 1990 and again in 1991.

Key Findings

Fish Population and Habitat Characteristics

- Native fish species present in the project area were rainbow trout (*Oncorhynchus mykiss*), mountain sucker (*Catostomas platyrhynchus*), and speckled dace (*Rhinichthys osculus*). Introduced species included brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*).
- Pre-project sampling revealed no trout in the test area. Sampling conducted each year following construction found trout in the test pond. In general, check dam ponds improved conditions for trout by providing a substantial increase in the volume of deep-water habitat. Water temperatures near the bottom of the test ponds were 1–3°C cooler than at the surface or upstream of the project area. However, most trout sampled at Station T-1 migrated to the impoundments from other sections of Red Clover Creek. The very low occurrence of young-of-the-year trout and lack of suitable gravel substrate indicated that little or no reproduction occurred in the check dam ponds or in the control stream reach. The impoundments created by the check dams will continue to provide attractive habitat with cool-water pools for adult trout and other species as the stabilization process continues.

- The number of rainbow trout collected at Station T-1 was 0 in 1985 (pre-check dam) and then varied from 4 to 32 during the eight years following completion of the dams (Figure 10-3, Table 10-1). In the control area, trout numbers ranged from 0 to 4. Speckled dace numbers at Station T-1 generally increased from 1986 to 1993, while in the control area, they were extremely abundant during the first seven years of the study (1985–1991) and then declined the last two years as the channel narrowed due to changes in grazing management. Mountain sucker were less numerous than speckled dace, varying between 6 and 191 in the test area with higher numbers occurring in 1988–1990. In the control area, numbers varied from 0 to 50. See Figure 10-3 and Table 10-1 for additional data on fish population counts.

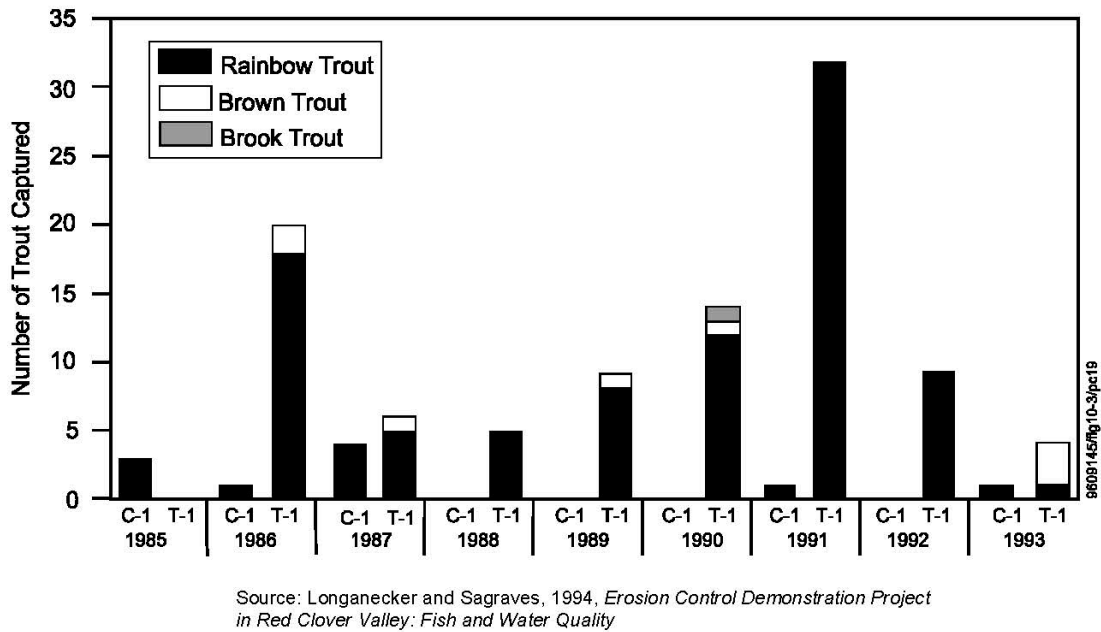


Figure 10-3. Number of trout captured at Stations C-1 (control) and T-1 (test), 1985–1993.

- Study results were confounded at the downstream control site (C-1) due to livestock management changes in 1990. Changes in grazing encouraged establishment of riparian vegetation, particularly sedge, and promoted physical changes to the stream channel. The mean stream width narrowed from 10.4 m in 1989 to 7.7 m in 1993, with resultant increases in depth and velocity (Table 10-2). Therefore, it appears that extensive improvement of fish habitat in some cases might be achieved most economically through grazing management and, as needed, selective resloping and vegetative stabilization of cut banks rather than through the use of check dams (Longanecker and Sagraves 1994).

Table 10-1

Number of Fishes Captured at Stations C-1 and T-1, 1985–1993

Year	Rainbow Trout		Brown Trout		Brook Trout		Speckled Dace		Mountain Sucker	
	C-1	T-1	C-1	T-1	C-1	T-1	C-1	T-1	C-1	T-1
1985	3 (3) ^a	0	0	0	0	0	1682 ^b	-- ^c	20 ^b	-- ^c
1986	1 (1) ^a	18 (29)	0	2 (2) ^a	0	0	279 ^b	83 (83) ^a	3 ^b	11 (11) ^a
1987	4 (4) ^a	5 (5)	0	1 (1) ^a	0	0	357 ^b	109 (229)	50 ^b	26 (47)
1988	0	5 (13)	0	0	0	0	703 (1106)	169 (211)	1 (1) ^a	191 (191) ^a
1989	0	8 (9)	0	1 (1) ^a	0	0	604 (745)	517 (667)	19 (21)	48 (68)
1990	0	12 (14)	0	1 (1) ^a	0	1 (1) ^a	944 (1173)	703 (800)	0	45 (45) ^a
1991	1 ^d	32 (53)	0	0	0	0	874 (1193)	670 (3083)	10 (10)	21 (21) ^a
1992	0	9 (9)	0	0	0	0	360 (493)	491 (823)	0	6 (6)
1993	1 ^d	1 (1)	0	3 (3) ^a	0	0	361 (490)	775 (1270)	0	33 (86)

Source: Longanecker and Sagraves, 1994, *Erosion Control Demonstration Project in Red Clover Valley: Fish and Water Quality*

Note: Numbers in parentheses represent population estimates. MicroFish 3.0 (Van Deventer and Platts 1989) unless otherwise noted.

^aNumber collected (multiple passes).

^bSubsample collected.

^cPresent but not counted.

^dCollected in the qualitative section (single pass).

Excerpts from Recreation Use Survey of Red Clover Creek

SUMMARY

A survey of streamside recreation along Red Clover Creek, Plumas County, was made in 1991. This survey was made to estimate the amount and types of recreation occurring along a fairly remote stream previously authorized for a State Water Project reservoir. The random sample survey combined roving use counts with interviews of anglers and other recreationists to gather information on recreation use, activities, visitor origin, and angler success. Survey data gathered on Red Clover Creek will provide baseline data to help plan potential future projects in the area, and to help evaluate the erosion control project constructed in Red Clover Valley in 1985 as part of a Coordinated Resource Management Project.

There were an estimated 15,000 hours of recreation use on approximately 25 miles of Red Clover Creek, between Red Clover Valley and the junction with Little Last Chance Creek, from April 27 to November 3, 1991. The most frequently observed activities were camping, fishing, relaxing and hunting. About 34 percent of the visitors and 36 percent of the anglers lived in the Sacramento Valley, mostly Butte and Sacramento Counties.

Anglers caught an estimated 1,150 rainbow trout (0.38 per hour) and 170 brown trout (0.06 per hour) in 3,000 hours of fishing. The mean fork lengths of creel fish were 22.6 cm for rainbow trout, and 23.2 cm for brown trout.

tents was probably due to the rough roads and poor access for trailers. The average length of stay for visitors camped along Red Clover Creek was 2.3 days.

Most recreational visitors to Red Clover Creek came from the Sacramento Valley, Nevada, Northeast Counties, San Francisco Bay area (Figure 2).

Creel Census Data and Angler Success

During the 1991 trout season, 166 anglers were contacted, with an average length of stay 3.1 hours for completed efforts. They had fished 461 hours, with an observed catch of 34 brown trout and 163 rainbow trout. In addition, a total of 118 trout were reported caught, or reported to have been caught and released.

Total angling use was estimated at 3,000 hours (± 700 hours) or 967 angler days, with an estimated catch of 170 brown trout (0.06 per hour) and 1,150 rainbow trout (0.38 per hour). Based on reported catch and release, as many as 860 additional trout may have been caught and released. No other species of fish were observed or reported to have been caught this year.

About 54 percent of the anglers censused fished with bait, 11 percent with lures, 2 percent with flies, and about 33 percent fished with some combination of these methods, mostly bait and lures.

The mean fork length of brown trout caught during 1991 was 23.2 cm (9.13 in.) with a range of 18.0 to 42.5 cm (7.0 to 16.7 in.) (Appendix III). The mean fork length of rainbow trout was 22.6 cm (8.9 in.) with a range of 13.0 to 38.1 cm (5.1 to 15 in.) (Appendix IV). An estimated 37.6 kg (83 lbs.) of brown trout and 205.5 kg (453 lbs.) of rainbow trout were caught. A brown trout measuring 42.5 cm (16.7 in.) and a rainbow trout 38.1 cm (15.0 in.) in length were the largest fish observed this year.

DISCUSSION

Limitations of Use Counts and Creel Census

Understanding the limitations of the recreation use survey and creel census helps put the data obtained in perspective. Most recreationists on the creek were readily observed during the use counts, but accurate counts were difficult in some areas where the creek was not visible from the road. Experienced anglers tended to park along the road and hike to various fishing spots. Vehicle access points were checked on each count, but people were not found for some vehicles. Vehicle counts were not utilized in this survey, because vehicles of USFS workers, loggers, and other non-recreationists often park along the road on Red Clover Creek, making vehicle counts a poor index of recreation use.

Use on Red Clover Creek was heaviest in the spring months and about 41 percent of the annual recreation and 80 percent of the fishing occurred by the end of June. The major activities were camping, fishing, and relaxing. Overall, the best fishing probably occurs before July. Fishermen reported the best success in the morning hours (before noon for both rainbow and brown trout), although evening fishing (after 4 p.m.) was also good. Morning and evening periods nearly always provided better fishing than mid-day. About 15 percent of the estimated fishing use was represented in the creel census.

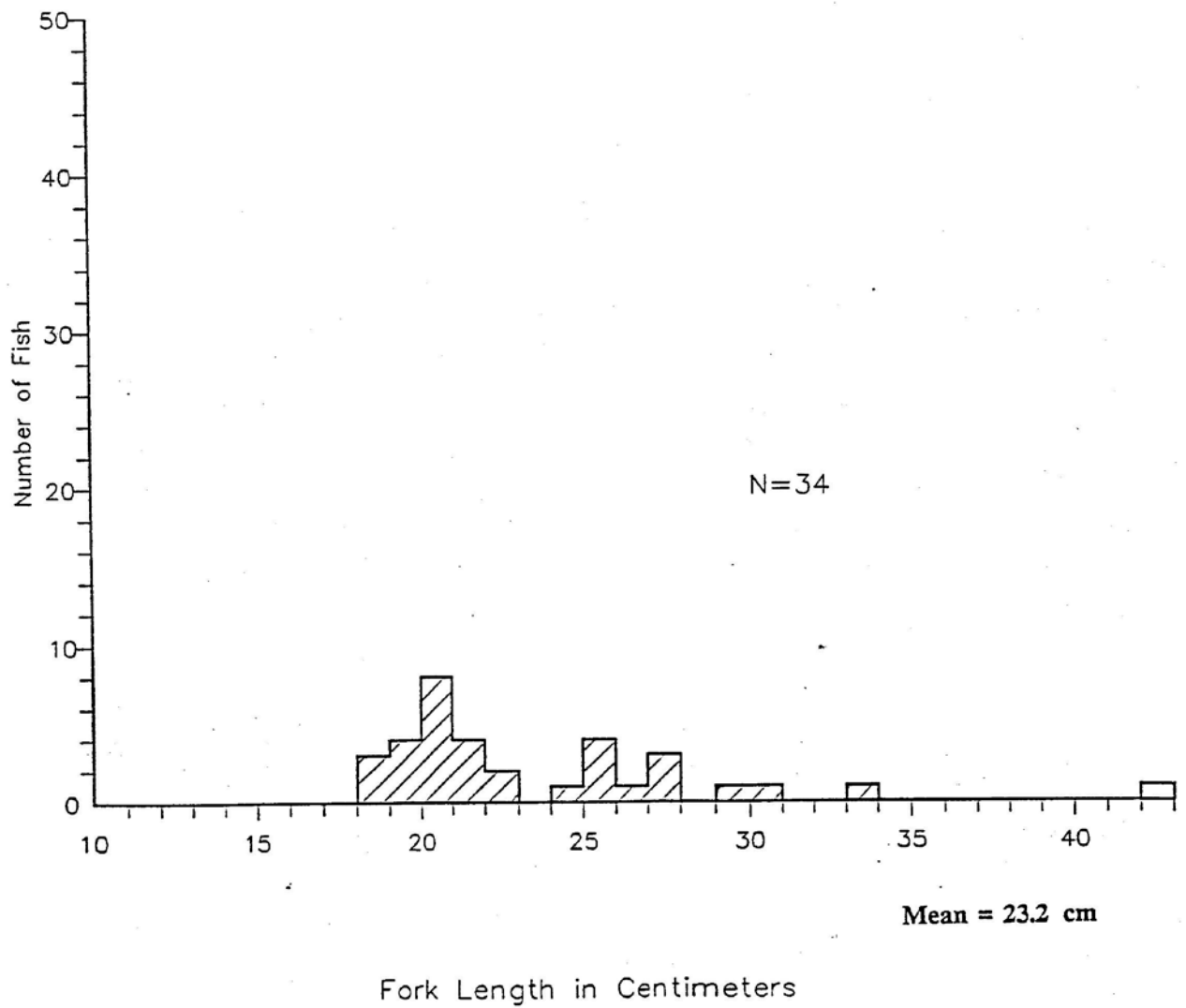
Most of the exceptionally large fish observed in the creel census were caught on the opening weekend or early in the season. The opening weekend had the highest angling use of the year (about 14 percent of the annual use) but lower fishing success than the later strata.

The places of residence for anglers at Red Clover Creek were slightly different than those of general recreationists. Residents of the San Francisco Bay Area made up 25 percent of the anglers while only 13 percent of the general recreationists were from this area. Out-of-state residents made up 28 percent of

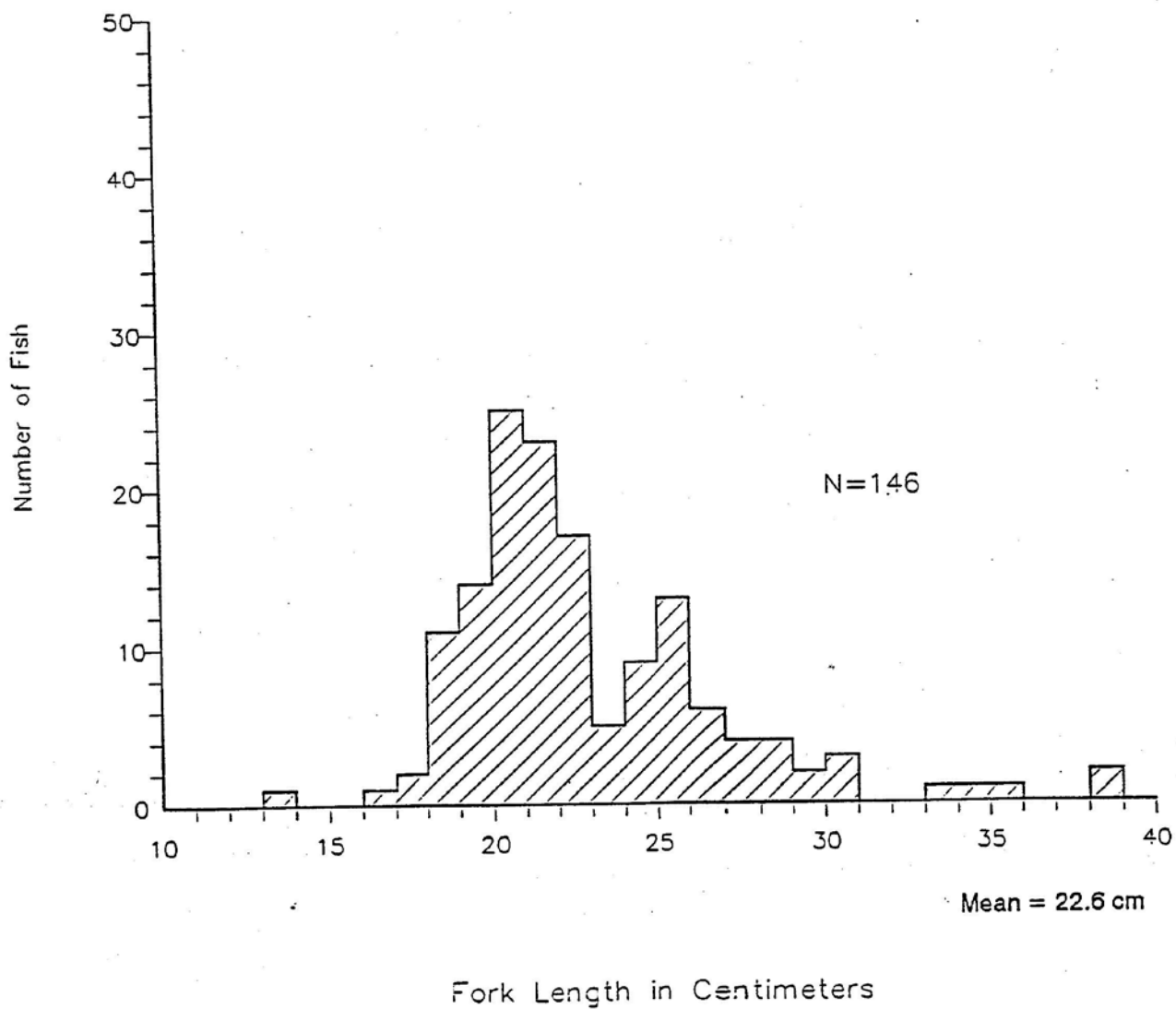
general visitor origin while only 10 percent of the anglers were from out of state. This was probably due to the necessity of purchasing a relatively costly out-of-state fishing license.

Comparison of this survey to data collected in 1977 is of limited utility. In 1977, the lower seven miles of the Red Clover Creek was substituted for part of the 1977 Indian Creek survey. For the lower seven miles of Red Clover Creek, total estimated recreation hours were 6,450. The 1977 survey included only three strata, only eleven survey days in a 101-day study period, and the opening weekend of trout season was not included in the survey.

Appendix III
Length Frequency of Censused
Brown Trout, Red Clover Creek
1991



Appendix IV
Length Frequency of Censused
Rainbow Trout, Red Clover Creek
1991



DRAFT Red Clover Creek Fish Monitoring 2003, 2004, and 2005 Fish Sampling Efforts California

Department of Water Resources

Purpose

The purpose of this study is to allow long term pre- and post-restoration evaluation of fish assemblages and abundance in a reach of Red Clover Creek within Red Clover Valley. Fish in general and rainbow trout (*Oncorhynchus mykiss*), specifically, are considered excellent indicators of the health of aquatic ecosystems.

This study is part of a larger monitoring effort to evaluate changes in key physical and biological indicators of stream health and stability for the Red Clover Creek restoration project. The monitoring program was requested by the Feather River Coordinated Resource Management Program (FR-CRM) and developed by the Department of Water Resources to determine if the restoration project would provide anticipated benefits. These watershed benefits include enhanced late-season streamflow, improved flood detention, enhanced riparian habitat, improved water quality, enhanced fish and wildlife habitat, decreased erosion, sedimentation and downcutting.

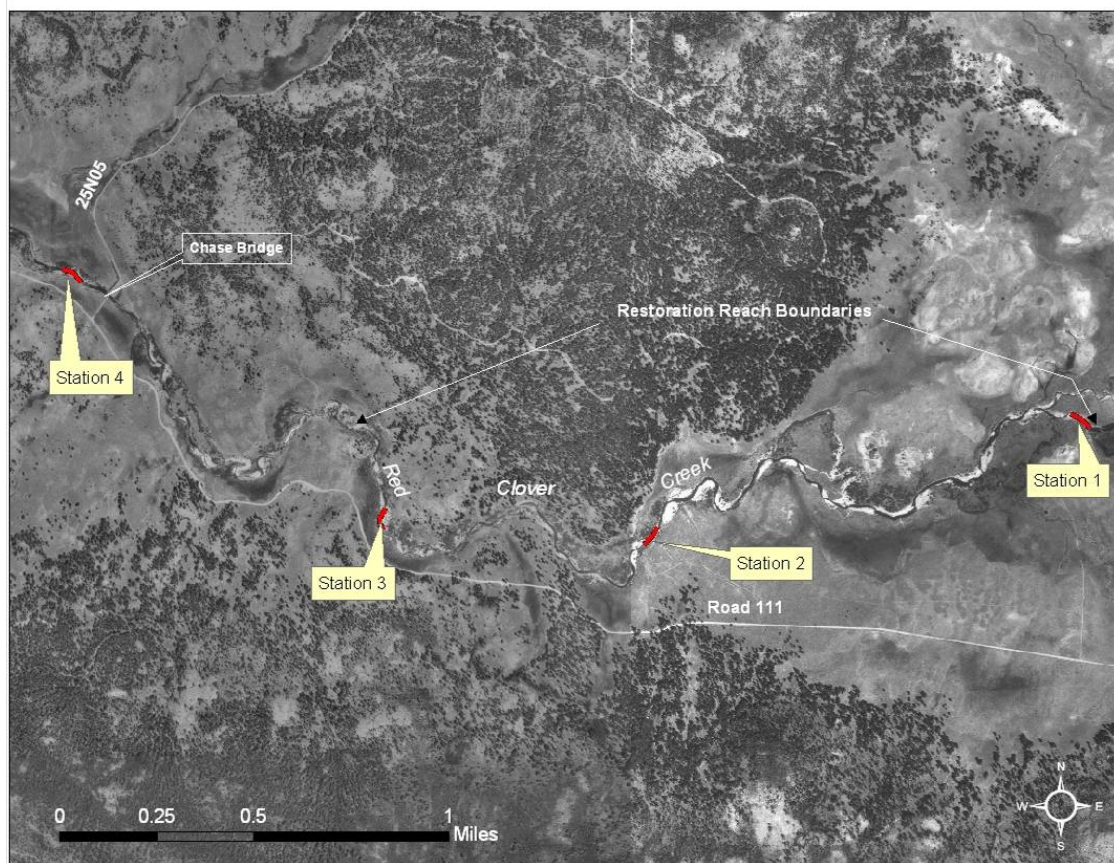
Study Area

Red Clover Creek is a tributary to Indian Creek, which is a tributary to the East Branch North Fork Feather River. The restoration project area includes a reach of Red Clover Creek just over 3 miles long on privately owned land in Red Clover Valley. The downstream end of the reach is about 13 miles upstream from the mouth of Red Clover Creek. The reach is bounded by the fence line below the first restoration project implemented on Red Clover Creek by the FR-CRM and PG&E in 1985 and the Forest Service property boundary upstream of the Chase Bridge (Forest Service Road 25N05). Three 100 meter stream segments were sampled in the restoration reach in 2004 and 2005. A station was also sampled below the Chase Bridge in 2003 and 2005. Figure 1 depicts the restoration reach and the sample stations.

Methods

Trout abundance was estimated using two-catch electrofishing methods (Seber and Le Cren 1967). Sampling occurred between June 21 and 22 within the restoration project reach. The station below Chase Bridge (station 4) was sampled on June 13, 2003 and July 12, 2005. This station is part of the Stream Condition Inventory conducted by the US Forest Service and could be used as a control for future analysis of restoration benefits for the Red Clover project. The electrofishing crew consisted of staff from DWR, DFG, Plumas Corp, and US Forest Service.

Figure 1. Map of restoration reach and sample stations.



Stations in the restoration reach had a mix of riffle, run, and pool habitats and were of a suitable depth throughout for backpack electrofishing. Two of the stations were at either end of the restoration reach and the third was approximately in the middle. Sample stations were located in 2005 by referring to the notes taken during previous fish sampling effort. At each of the stations, a 100 meter stream segment was sampled for fish using battery-powered backpack electrofishers (Smith Root models LR-24 and 12B). Two electrofishers and two netters sampled the stations in parallel, except for the 2005 effort at station 3. Due to equipment difficulties, only one electrofisher was used. The channel at this station was narrow enough that a single electrofisher was sufficient. The upstream and downstream ends of the survey segment were blocked using seines. To better relocate the stations in the future, photos and GPS coordinates were taken at each of the upstream and downstream net sites (Appendix A).

For each salmonid caught, species, fork and total length to the nearest millimeter, and volumetric displacement to the nearest milliliter were taken. Non-salmonids were counted and an aggregate volume measured and recorded by species. Fish were then immediately released outside of the enclosed section. A second pass was made if trout were captured on the first pass. Electrofishers were set to deliver enough power to effectively capture fish while minimizing the period it took fish to recover (USFWS 2000). The settings can be found in Appendix A. The length of stream habitat types

(riffle, run, pool) were measured with a 300 meter metric tape and the average width and depth of the section were estimated in meters. Population estimates for rainbow trout were processed using MicroFish 3.0 (Van Deventer and Platts 1989). At each station, water temperature was measured with a mercury thermometer, and electro conductivity, salinity, and total dissolved solids were measured using an ExStick EC400 Meter by EXTECH. Fish, habitat, and water quality data can be found in Appendix A.

Results and Discussion

Table 1 shows the fish species captured during the 2004 and 2005 fish sampling efforts in the restoration reach and the 2003 and 2005 sampling efforts at station 4 below Chase Bridge. Rainbow trout (*Oncorhynchus mykiss*), Speckled dace (*Rhinichthys osculus*), Sacramento sucker (*Catostomus occidentalis*), and mountain sucker (*C. platyrhynchus*) were captured. Speckled dace were the most common species.

Table 1. Fish species captured in the restoration reach (stations 1-3) and below Chase Bridge (station 4) on Red Clover Creek in Red Clover Valley.

	Rainbow Trout			Speckled Dace			Mountain Sucker			Sacramento Sucker		
Year	03	04	05	03	04	05	03	04	05	03	04	05
Station 1	-	x	x	-	x	x	-	x		-		x
Station 2	-		x	-	x	x	-	x		-		x
Station 3	-			-	x	x	-	x		-		
Station 4	1	-		x	-	x	x	-	x		-	

A dash indicates that no sampling occurred

Table 2 shows the population estimate for rainbow trout (*Oncorhynchus mykiss*) for each station. Rainbow trout were absent or of low abundance (0 to 5 trout per 100 meters) in all years in the restoration reach and below Chase Bridge. They were most abundant in 2005 in the restoration reach. This may be attributable to the late spring rains and cooler temperatures that occurred that year. No trout were captured at the Chase Bridge station in 2005, but this is likely attributable to the fact that sampling did not occur until July, when flows had declined and average water temperatures increased.

Rainbow trout are common in the reach of Red Clover Creek below Red Clover Valley (DFG 1991) and probably migrate up into Red Clover Valley during periods of cooler temperatures and higher flows. In this lower reach, the creek is cooled by frequent first order tributaries and is sheltered within a forested canyon.

Table 2. Estimate of abundance of rainbow trout at each of the sample stations (per 100 yards) in the restoration reach and below Chase Bridge on Red Clover Creek in Red Clover Valley.

Restoration Reach	2004	2005
Station 1	1	5
Station 2	0	4
Station 3	0	0
Total	1	9
Chase Bridge	2003	2005
Station 4	1	0

The channel in the restoration reach and below Chase Bridge is low gradient and flows through meadow and willow thicket. The channel is deeply incised and mostly broad and shallow with little overhanging vegetation to regulate water



Red Clover Creek in the restoration reach

temperature. Water temperatures in the restoration reach stations were as low as 13°C in the morning, but would increase to temperatures as high as 22.5°C by the afternoon during the period of sampling. Optimal temperatures for rainbow trout are between 15 and 18°C (Baltz et al. 1987). Temperatures above 24°C begin to result in mortality (Hokanson et al. 1977, Bjornn and Reiser 1991; all as cited in Moyle 2002).

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Appendix A

Summary of trout data for 2004 and 2005 sampling efforts within the restoration reach and the 2003 and 2005 sampling efforts below Chase Bridge.

Upper Reach (1)

Date	Species	Reach Length (ft)	Pass 1 Catch	Pass 2 Catch	Total Catch	Population Estimate	Capture Probability	Lower Conf Interval	Upper Conf Interval	Biomass ml/100yds	Average Fork Length	Trout per 100 yds
6/9/2004	RBT	300	1	0	1	1	-	-	-	-	89	1
6/22/2005	RBT	328	4	1	5	5	0.833	5	6.469	345	12.44	4

Middle Reach (2)

Date	Species	Reach Length (ft)	Pass 1 Catch	Pass 2 Catch	Total Catch	Population Estimate	Capture Probability	Lower Conf Interval	Upper Conf Interval	Biomass ml/100yds	Average Fork Length	Trout per 100 yds
6/9/2004	-	274	-	-	0	0	-	-	-	-	-	0
6/21/2005	RBT	328	3	1	4	4	0.8	4	5.949	298	17.72	3

Lower Reach (3)

Date	Species	Reach Length (ft)	Pass 1 Catch	Pass 2 Catch	Total Catch	Population Estimate	Capture Probability	Lower Conf Interval	Upper Conf Interval	Biomass ml/100yds	Average Fork Length	Trout per 100 yds
6/9/2004	-	302	-	-	0	0	-	-	-	-	-	0
6/21/2005	-	328	-	-	0	0	-	-	-	-	-	0

ChaseBridge

Date	Species	Reach Length (ft)	Pass 1 Catch	Pass 2 Catch	Total Catch	Population Estimate	Capture Probability	Lower Conf Interval	Upper Conf Interval	Biomass ml/100yds	Average Fork Length	Trout per 100 yds
6/13/2003	RBT	339	1	0	1	1	-	-	-	5	92	1
7/13/2005	-	328	-	-	0	0	-	-	-	-	-	0

RBT – Rainbow Trout

Fish data from 2004 and 2005 sampling efforts in the Red Clover Creek restoration reach and from the 2003 and 2005 sampling efforts below Chase Bridge

Crew: Aric Lester, Jim Davis, Cassie Heinbockel, Leslie Mink, Lori Powers, Gia Martynn

Date 06/22/05 Time Begin 0925 End 1110

Creek: Red Clover Creek Reach: Upper (1)

Reach Length: 100 meters GPS UTM, 10, NAD 83 - US Net: 715796, 4426602 DS Net: 715721, 4426659

Weather: Mostly Clear and calm; 65°F at Doyle Crossing

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
1- Upper Reach	1	<i>Oncorhynchus mykiss</i>	Rainbow Trout	176	181		1	50	
		<i>Oncorhynchus mykiss</i>	Rainbow Trout	132	141		1	24	
		<i>Oncorhynchus mykiss</i>	Rainbow Trout	91	99		1	9	
		<i>Oncorhynchus mykiss</i>	Rainbow Trout	94	101		1	8	
		<i>Catostomus occidentalis</i>	Sacramento Sucker				1	15	
		<i>Rhinichthys osculus</i>	Speckled Dace				50	100	
		<i>Rhinichthys osculus</i>	Speckled Dace				26	45	
	2	<i>Oncorhynchus mykiss</i>	Rainbow Trout	129	135		1	26	
		<i>Catostomus occidentalis</i>	Sacramento Sucker				5	55	
		<i>Rhinichthys osculus</i>	Speckled Dace				22	45	
			Ave FL	124.4			TotRBTn	377	

Crew: Aric Lester, John Lance, David Siler, Leslie Mink, Lori Powers, Gia Martynn

Date 06/21/05 Time Begin 1300 End 1450

Creek: Red Clover Creek Reach: Middle (2)

Reach Length: 100 meters GPS UTM, 10, NAD 83 - US Net: 714012, 4426192 DS Net: 713959, 4426118

Weather: Mostly Clear and calm; 68°F at Doyle Crossing

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
2 - Middle Reach	1	<i>Oncorhynchus mykiss</i>	Rainbow Trout	272	286			200	Large fish (~35cm)
		<i>Oncorhynchus mykiss</i>	Rainbow Trout	154	162			46	escaped net
		<i>Oncorhynchus mykiss</i>	Rainbow Trout	97	100			12	
		<i>Rhinichthys osculus</i>	Speckled Dace				50	150	
		<i>Rhinichthys osculus</i>	Speckled Dace				50	140	
		<i>Rhinichthys osculus</i>	Speckled Dace				18	65	
	2	<i>Oncorhynchus mykiss</i>	Rainbow Trout	186	194			68	
		<i>Catostomus occidentalis</i>	Sacramento Sucker				7	85	
		<i>Rhinichthys osculus</i>	Speckled Dace				38	120	
		<i>Rhinichthys osculus</i>	Speckled Dace				20	63	
		<i>Catostomus occidentalis</i>	Sacramento Sucker				5	55	
		<i>Catostomus occidentalis</i>	Sacramento Sucker				1	15	
			Ave RBT FL	177.25			TotRBTn	326	

Crew: Aric Lester, John Lance, David Siler, Leslie Mink, Lori Powers, Gia Martynn

Date 06/21/05 Time Begin 1015 End 1044

Creek: Red Clover Creek Reach: Lower (3)

Reach Length: 100 meters GPS UTM, 10, NAD 83 - US Net: 712889, 4426188 DS Net: 712866, 4426274

Weather: Mostly Clear and calm; 65°F at Doyle Crossing

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
3 - Lower	1	<i>Rhinichthys osculus</i>	Speckled Dace				16	50	

Crew: Leslie Mink, Aric Lester, Sara Metzler, Kara Rockett, Gia Martynn

Date 7/13/05 Time Begin 1300 End 1440

Creek: Red Clover Creek Reach: Chase Bridge (4)

Reach Length: 100 meters GPS UTM, 10, NAD 83 - US Net: 711633, 4427200

DS Net: 711557, 4427255

Weather: Mostly Clear; wind 5-10mph; 87°F

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
Chase Bridge	1	<i>Rhinichthys osculus</i>	Speckled Dace				50	185	
		<i>Rhinichthys osculus</i>	Speckled Dace				74	154	
		<i>Rhinichthys osculus</i>	Speckled Dace				19	84	
		<i>Rhinichthys osculus</i>	Speckled Dace				51	150	
		<i>Rhinichthys osculus</i>	Speckled Dace				48	88	
		<i>Rhinichthys osculus</i>	Speckled Dace				80	290	
		<i>Rhinichthys osculus</i>	Speckled Dace				26	75	
		<i>Catostomus platyrhynchus</i>	Mountain Sucker				5	40	
		<i>Catostomus platyrhynchus</i>	Mountain Sucker				2	26	

Crew: Aric Lester, Kevin Pond, Margie Graham, Leslie Mink, Lori Powers, Julie Cunningham

Date 06/09/2004 Time Begin 1330 End 1500

Creek: Red Clover Creek Reach: Upper (1)

Reach Length: 91.4 meters GPS UTM, 10, NAD 83 - US Net: See 2005 effort

DS Net:

Weather

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
3 - Upper Reach	1	<i>Oncorhynchus mykiss</i>	Rainbow Trout	89			1		Observed:
									76mm rainbow trout
	1	<i>Rhinichthys osculus</i>	Speckled Dace				138	225	dead with sediment
									in mouth
	1	<i>Catostomus platyrhynchus</i>	Mountain Sucker				5	37	
									Observed but did not
									capture:
									~140mm rainbow trout
									& ~140mm trout or
									sucker

Crew: Aric Lester, Kevin Pond, Margie Graham, Leslie Mink, Lori Powers, Julie Cunningham
 Date 06/09/2004 Time Begin 11:45 End Not Recorded
 Creek: Red Clover Creek Reach: Middle (2)
 Reach Length: 83.6 meters GPS UTM, 10, NAD 83 - US Net: See 2005 effort DS Net:
 Weather

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
2 - Mid Reach	1	<i>Rhinichthys osculus</i>	Speckled Dace				505	888	
	1	<i>Catostomus platyrhynchus</i>	Mountain Sucker				16	145	

Crew: Aric Lester, Kevin Pond, Margie Graham, Leslie Mink, Lori Powers, Julie Cunningham
 Date 06/09/2004 Time Begin 09:00 End Not Recorded
 Creek: Red Clover Creek Reach: Middle Reach (2)
 Reach Length: 92 meters GPS UTM, 10, NAD 83 - US Net: See 2005 effort DS Net:
 Weather

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
1 - Lower Reach	1	<i>Rhinichthys osculus</i>	Speckled Dace				410	830	
	1	<i>Catostomus platyrhynchus</i>	Mountain Sucker				15	82	

Crew: Mink, Kundargi, Ponce, Graham, Neal
 Date 06/13/03 Time Begin End
 Creek: Red Clover Reach: Chase Bridge (4)
 Reach Length: 95.1 meters GPS UTM, 10, NAD 83 - US Net: See 2005 effort DS Net:
 Weather

Station	Pass	Scientific Name	Common Name	FL (mm)	TL (mm)	Weight (g)	Total #	Total Displacement (ml)	Note
4 - Chase Bridge	1	<i>Oncorhynchus mykiss</i>	Rainbow Trout		92			5	
	1	<i>Rhinichthys osculus</i>	Speckled Dace				125	345	
	2	<i>Rhinichthys osculus</i>	Speckled Dace				138	340	
	2	<i>Catostomus platyrhynchus</i>	Mountain Sucker				6	70	

Habitat and water quality data from 2004 and 2005 sampling efforts in the Red Clover Creek restoration reach and from the 2003 and 2005 sampling efforts below Chase Bridge

Station	Date	Water Temp °C	%Riffle	%Run	%Pool	Ave Depth (m)	Av. Width (m)	Conductivity µS	TDS mg/L	Salinity ppm
1 - Upper	6/22/2005	16.5	46	25	29	1	10	140.6	95.7	69
	6/9/2004	14	38	46	16	-	-	140.9	98.7	70.5
2 - Middle	6/21/2005	22.5	50	50	0	0.6	9	148	104.7	75.1
	6/9/2004	16	15	85	0	-	8	150.2	105.7	75.3
3 - Lower	6/21/2005	15.5	37	42	21	0.25	11	144.4	105.8	71.8
	6/9/2004	13	34	31	34	-	6.75	150.2	105.7	75.3
Chase Bridge	7/13/2005	23	26	53	21	0.55	5	187.1	130	131.3
	6/13/2003	-	0	50	50	-	-	-	-	-

Effort and electrofisher settings for the 2004 and 2005 sampling efforts in the Red Clover Creek restoration reach and from the 2003 and 2005 sampling efforts below Chase Bridge

Electrofisher Settings for 2005 Red Clover Creek Sampling Effort

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root 12-B	1 - Upper	1	300	I5	Pulsed DC		6ms	60Hz	1034
		2	"	"	"	"	"	"	532
Smith-Root LR-24		1	300	N/A	Pulsed DC	0.18	25%	60Hz	1747
		2	"	"	"	"	"	"	1201
Combined Effort (seconds)									4514

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root 12-B	2 - Middle	1	200	I5	Pulsed DC		6ms	60Hz	1023
		2	"	"	"	"	"	"	902
Smith-Root LR-24		1	180	N/A	Pulsed DC	0.28	25%	60Hz	1745
		2	"	"	"	"	"	"	1639
Combined Effort (seconds)									5309

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root LR-24	3 - Lower	1	175-180	N/A	Pulsed DC	0.28	25%	60Hz	1262
Combined Effort (seconds)									1262

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root 12-B	ChaseBridge	1	300	J5	Pulsed DC		8ms	70Hz	1375
Smith-Root LR-24		1	200	N/A	Pulsed DC	0.6	25%	60	2983
Combined Effort (seconds)									4358

Electrofisher Settings for 2004 Red Clover Creek Sampling Effort

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root 12-B	1 - Upper	1	400	-	Pulsed DC	-	-	-	1410
Smith-Root LR-24		1	-	N/A	Pulsed DC	-	-	-	1654
Combined Effort (seconds)									3064

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root 12-B	2 - Middle		400	-	Pulsed DC	-	-	-	-
Smith-Root LR-24			200	N/A	Pulsed DC	-	-	-	-
Combined Effort (seconds)									2806

	Station	Pass	Voltage	Setting	Waveform	Amps	Duty Cycle	Frequency	Effort
Smith-Root 12-B	3 - Lower	1	400	12B	Pulsed DC	-	-	-	1938
Smith-Root LR-24		1	148	N/A	Pulsed DC	0.15	-	-	2053
Combined Effort (seconds)									3991

A dash indicates that data was not recorded

Pictures of Red Clover Creek net sites by station

Station 1

Upstream Net Site



Downstream Net Site



Station 2

Upstream Net Site



Downstream Net Site



Station 3

Upstream Net Site



Downstream Net Site



Chase Bridge - Station 4

Upstream Net Site



Downstream Net Site



Red Clover McReynolds Post-Project Electroshocking 2007 and 2008 efforts

In 2007 and 2008 DWR helped to conduct post-project monitoring in the same reaches that were surveyed pre-project. Three of the reaches are within the Red Clover-McReynolds Project area, while the fourth reach is located just downstream of Chase Bridge and served as a control.

2007

Red Clover McReynolds Reach #1

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/20/2007	1	Speckled Dace	42	150	-
	1	Trout	not captured		

Red Clover McReynolds Reach #2

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/20/2007	1	Speckled Dace	81	120	-

Red Clover McReynolds Reach #3

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/21/2007	1	Speckled Dace	191	305	-
	1	Mountain Sucker	6	40	-

Red Clover McReynolds Reach #4 (control)

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/21/2007	1	Speckled Dace	181	370	-
	1	Mountain Sucker	2	20	-

2008

Red Clover McReynolds Reach #1

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/16/2008	1	Speckled Dace	116	279	-
	1	Mountain Sucker	9	97	-
	2	Speckled Dace	67	170	-
	2	Mountain Sucker	7	81	-

Red Clover McReynolds Reach #2

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/17/2008	1	Speckled Dace	43	120	-
	1	Mountain Sucker	1	9	-
	2	Speckled Dace	20	82	-

Red Clover McReynolds Reach #3

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/17/2008	1	Speckled Dace	115	210	-
	1	Mountain Sucker	70	160	-
	2	Speckled Dace	119	185	-
	2	Mountain Sucker	26	108	-

Red Clover McReynolds Reach #4 (control)

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/16/2008	1	Speckled Dace	218	367	-
	1	Mountain Sucker	8	67	-
	1	Brown Trout	1	1	3.3
	1	Brown Trout	1	1	4.8
	2	Speckled Dace	55	98	-
	2	Mountain Sucker	1	3	-
	2	Brown Trout	1	0.5	3.8
	2	Brown Trout	1	0.5	2.2

Red Clover McReynolds Post-Project Electroshocking 2009 Pond Shocking Effort

Red Clover Pond Electroshocking

Second pond from top of project on Red Clover Mainstem

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/9/2009	1	Rainbow Trout	1	710	40.9
	1	Rainbow Trout	1	52	15.6
	1	Speckled Dace	10	-	-
	2	Rainbow Trout	1	780	40.9
	2	Rainbow Trout	1	700	42.5
	2	Rainbow Trout	1	760	41.1
	2	Rainbow Trout	1	440	36
	2	Rainbow Trout	1	610	40.8
	3	Rainbow Trout	1	780	44

Pond downstream of constriction

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/10/2009	1	Rainbow Trout	1	500	33.9
	1	Rainbow Trout	1	320	30
	1	Rainbow Trout	1	46	15.9
	1	Sucker	1	19	11.5
	1	Sucker	1	23	12.4
	2	Brown Trout	1	1000	45
	2	Rainbow Trout	1	670	39.2
	2	Rainbow Trout	1	620	40.1
	2	Rainbow Trout	1	740	40.5
	2	Rainbow Trout	1	600	39.2
	2	Rainbow Trout	1	410	32.4
	2	Rainbow Trout	1	205	25.8
	2	Rainbow Trout	1	390	32.5
	3	No Fish			
	4	Rainbow Trout	1	410	34.8
	5	Rainbow Trout	1	370	31.5

Pond upstream of constriction

Date	Pass	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
6/10/2009	1	Rainbow Trout	1	100	40.6
	1	Mountain Sucker	1	42	14.6



Brown Trout in pond downstream of constriction



Rainbow Trout in pond downstream of constriction

Summary of Trout in DWR fish monitoring effort

	Upper		Middle		Lower		Chase Br	
	Number of Fish	Average Fork Length (in)	Number of Fish	Average Fork Length (in)	Number of Fish	Average Fork Length (in)	Number of Fish	Average Fork Length (in)
2003	-	-	-	-	-	-	1	3.6
2004	1	3.5	0	-	0	-	-	-
2005	5	0.5	4	0.7	0	-	0	-
2007	0	-	0	-	0	-	0	-
2008	0	-	0	-	0	-	4	1.3
	Upper Pond		Middle Pond					
	Number of Fish	Average Fork Length (in)	Number of Fish	Average Fork Length (in)				
2009	8	14.9	13	13.3				

**Red Clover McReynolds Volunteer Fishing Data
2008-2012**



2010



2009

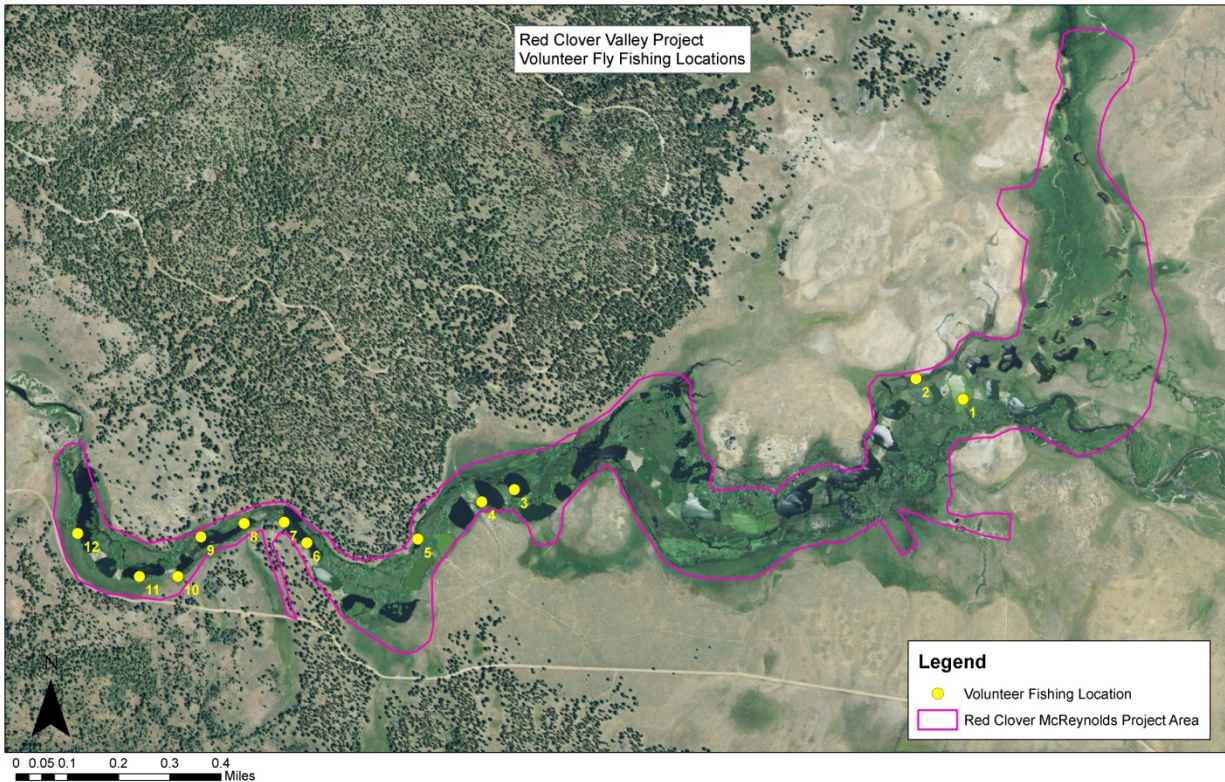


2011

June 2008				June 2010			
Location**	Species (Trout)	Size (In)	Visual Only	Location**	Species (Trout)	Size (In)	Visual Only
1	Rainbow	13	✓	1	Rainbow	24	✓
1	Rainbow	15		3	Rainbow	12	
1	Rainbow	16		4	Rainbow	15	
2	Rainbow	12	✓	4	Rainbow	12	
6	Rainbow	13	✓	5	Rainbow	16	✓
6	Brown	16		7	Rainbow	5	
6	Rainbow	13		8	Rainbow	8	
				8	Rainbow	11	
				8	Rainbow	12	✓
				9	Rainbow	12	
				10	Rainbow	16	
				10	Rainbow	13	
				10	Rainbow	13	✓
				11	Rainbow	12	
				11	Rainbow	14	
				11	Rainbow	12	
				11	Rainbow	18	

**Fishing locations are number 1-12 starting at the top of the project. See map on next page.

June 2011				June 2012			
Location**	Species (Trout)	Size (In)	Visual Only	Location**	Species (Trout)	Size (In)	Visual Only
6	Rainbow	16		4	Rainbow	7.5	
6	Rainbow	16		4	Rainbow	8	
6	Rainbow	18		4	Rainbow	9	
7	Rainbow	18		4	Rainbow	15.5	
7	Rainbow	4		8	Rainbow	6	
7	Rainbow	8-12		8	Rainbow	11	
7	Rainbow	8-12					
7	Rainbow	8-12					
7	Rainbow	8-12					
12	Rainbow	7					
?	5 Rainbow	12-15 in					
?	2 Rainbow	17-18 in					

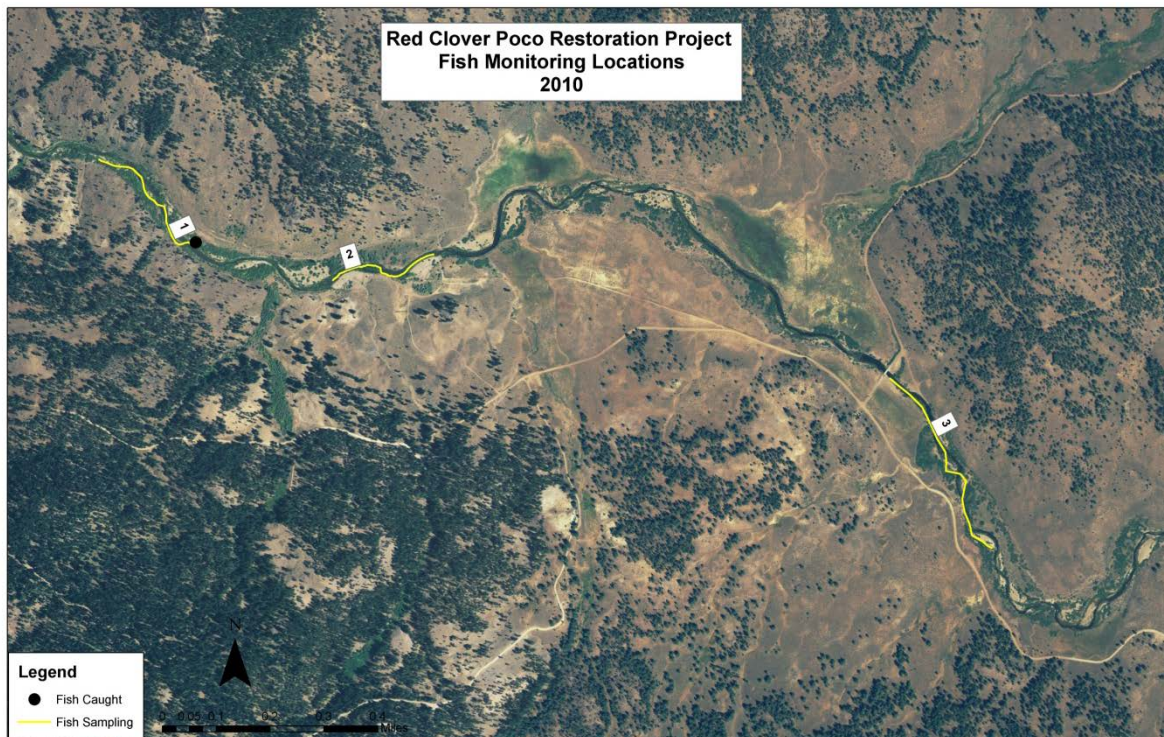


Red Clover Poco Volunteer Fish Monitoring Data 2010-2012

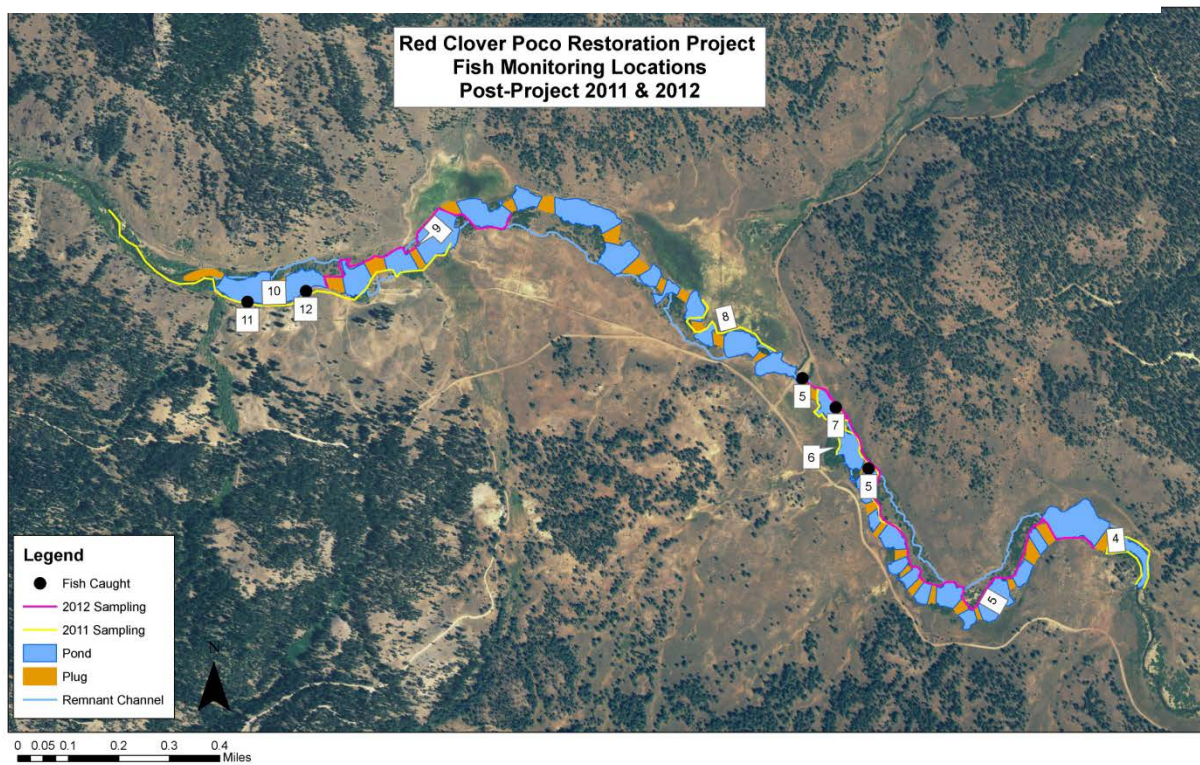
Three areas within the project area were fished in July 8, 2010. Enticing volunteers to fish the degraded project area proved challenging, so an advanced fly-fisherman was hired to fish the project area. Post-project monitoring was conducted by volunteers in 2011 and 2012. Anecdotal data was collected from a recreational fisherman encountered in the project area. Table 2 below shows results from all fishing efforts. The average catch per unit effort pre-project was 1.39 fish per hour. The average catch per unit effort in 2011 was 0.57 fish per hour. Average catch per unit effort in 2012 was 0.45 fish per hour.



Year	Date	Fishing Area #	Time Spent (hr)	Length (mi)	Fish Caught	Visual Only	Species	Size	Notes	Fish/hr
Pre-Project 2010	7/8	1	1.2	0.22	5		Rainbow	2 x 9-10" 3 x 6-8"		4.17
	7/8	2	0.65	0.27	0					0
	7/8	3	0.58	0.40	0					0
Post-Project 2011	5/11	6	2	0.55	0					0
	6/25	10	3	0.86	0				No rises	0
	6/25	8	1.67	0.31	0					0
	9/10	4	1.33	0.32	3		Rainbow	4", 7", 10"		2.26
Post-Project 2012	6/23	5	2	1.1	1		Rainbow	8"		0.50
	6/23	5	5	1.1	1	✓	Rainbow	caught and lost before a length was estimated		0.20
	7/10	9	2	0.56	0					0
	7/10	7	1.57	0.10	1		Rainbow	14"		0.64
	9/30	11	Unk	-	1		Brown	4lb	Anecdotal	Unk
	10/1	12	Unk	-	2		Rainbow	2 x 14"	Anecdotal	Unk



Red Clover Pocosin Lake Pre-project fish sampling locations



Red Clover Pocosin Lake Post-project fish sampling locations

Red Clover Poco Project Construction Fish Moving Data 2010

Date	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
8/2/2010	Speckled Dace	280	-	-
	Sacramento Sucker	12	-	avg 7.4
8/18/2010	Speckled Dace	300	-	-
	Mountain Sucker	4	-	-
	Sacramento Sucker	29	-	11.1
	Rainbow Trout	1	54	17.8
	Rainbow Trout	1	29	14.4
	Rainbow Trout	1	103	21.1
	Rainbow Trout	1	145	24.2
	Rainbow Trout	1	175	25.1
	Rainbow Trout	1	150	23.4
9/20/2010	Rainbow Trout	1	-	21
	Rainbow Trout	1	-	22
	Rainbow Trout	1	-	24
	Rainbow Trout	1	-	24
	Rainbow Trout	1	-	26
	Rainbow Trout	1	-	10
	Rainbow Trout	1	-	24
	Rainbow Trout	1	-	17
	Rainbow Trout	1	-	13
	Rainbow Trout	1	-	20
	Rainbow Trout	1	-	27
	Rainbow Trout	1	-	17
	Rainbow Trout	1	-	28
	Brown Trout	1	-	24
	Brown Trout	1	-	29
	Suckers	98	-	-
	Speckled Dace	440	-	-
10/18/2010	Rainbow Trout	-	-	27
	Rainbow Trout	-	-	12
	Rainbow Trout	-	-	19.5
	Rainbow Trout	-	-	18
	Rainbow Trout	-	-	17
	Rainbow Trout	-	-	~30
	Rainbow Trout	-	-	~31

Date	Common Name	Number	Total Displacement (ml)	Fork Length (cm)
10/18/2010	Rainbow Trout	-	-	~32
	Brown Trout	-	-	35
	Brown Trout	-	-	35.5
	Brown Trout	-	-	35.5

Red Clover Poco Electrofishing Survey 2012

October 10, 2012

The electroshocking reach was located within the USFS Stream Condition Inventory reach below the grade control of the Red Clover Poco project. This site is below the originally planned grade control. The constructed grade control site is several hundred feet upstream. The upper block net was placed at a flag marked "bug pt 4", and was at the confluence of the main channel and a side channel just down valley of the road access to this site. Water temp = 15C. 1 shocker, 2 netters. Surveyed from 12:45 to 14:54 pm. Reach length 310 feet. This reach was only e-shocked once, due to lack of trout, and difficulty in shocking the best habitat. Noted that there was a LOT of algae. Between the filamentous algae and the silt, it was difficult to capture fish. We were able to take time to positively identify the suckers we caught, and determined that all suckers were mountain suckers. The suckers we saw today had a definitely more sharply defined crevice between the upper and lower lip (distinctive for mountain sucker).

Habitat was typed as follows, working from the bottom block net to the top:

Habitat type	start	end	Total feet length	notes
Pool	310	215	95	Max depth approx 3.3 ft
Riffle	215	140	75	
Run	141	90	51	
riffle	91	0	91	

Pass 1 (and only) = 1,785 seconds

Species	Number of fish	Total volume (ml)	Total Length (mm)
Speckled dace	59	68	
Speckled dace	65	63	
Mountain sucker	1	7	90
Mountain sucker	1	5	81
Mountain sucker	1	4	74
Mountain sucker	1	5	76
Mountain sucker	1	3	70
Mountain sucker	1	6	76
Mountain sucker	1	4	70
Mountain sucker	1	5	70
Mountain sucker	1	4	69
Mountain sucker	1	7	89
Mountain sucker	1	4	70
Mountain sucker	1	4	70

Scientific names:

Speckled dace = *Rhinichthys osculus*

Rainbow trout = *Oncorhynchus mykiss*

Mountain sucker = *Catostomus platyrhynchus*

Since we didn't do a second pass in the same reach, we just walked upstream, one shocker and one netter to see if we could capture any trout. No luck. This effort lasted from 14:31 to 14:54 pm. In the first pool, 20 dace were captured (about 60 seen), and 4 suckers captured. In the ensuing riffle, 2 dace were captured. In the next pool, tons of dace were seen, and 6 suckers captured.

2012 Bank Walk and Electroshocking Surveys

Red Clover Confluence Proposed Project

Fishery Bank Walk Survey- Red Clover Valley April 18, 2012 and other dates throughout summer and fall

Introduction:

Seven volunteers participated in an effort to walk Red Clover Creek and important tributaries to collect information on spawning activity. Eight reaches were walked within Red Clover Valley. Metrics collected were estimated flow; water clarity; water temperatures; fish species, number, length, and number of young of year; number and depth of redds; as well as other pertinent observations. Water temperature was collected at three locations within each reach in the morning, mid-day, and afternoon.

Weather: There was no snow on the ground, and very little on the surrounding slopes. Skies were overcast. Air temperature was 63°F at 1315 at Crocker Creek.

Stream Flows: Stream flows were roughly estimated: 8-10 cfs Red Clover Cr at Causeway; 10-12 cfs Dixie Cr at mouth; 3-5 or 8 cfs coming out of Dotta; 3 cfs at Crocker Cr. At this time, 2012 is approximately 86% of normal precipitation for the Northern Sierra 8-station Index.

Water Clarity: Visibility was less than 3' on Red Clover Cr mainstem below the causeway, Dixie Cr, and restored areas, which limited fish observation. Crocker Cr, Dixie Cr above the diversion dam, and Red Clover Cr mainstem above the causeway had good clarity.

Many thanks to Bill Copren of TU; Dennis Heiman, retired RWQCB; Joe Hoffman, PNF; and Devin Wilcox. Plumas Corp staff Jim Wilcox, Terry Benoit and Leslie Mink also participated in the survey.

Water temperatures (°F) and Survey Distances (mi):

Reach #	Stream reach	Early Time	°F	Mid-Day Time	°F	Later time	°F	Approx. Channel Distance Surveyed
1	Red Clover Cr abv causeway	0930 cswy 1030 abv cswy	43 45	1316 Cswy 1100@Crocker conflu	52 46	1415 crossfence 1230 Btwn 2 Headcuts	55 52	2.09
2	Red Clover Cr blw causeway	0950 cswy	41	1230 Btwn ranch house & barns	46	1330 proposed grade control	52	2.88

3	Dixie Creek in project area	1000 prty fence 1030 mouth	43 46	1210 1201 mid-pt	46 48	1230 Dixie dam 1306 property fence	50 54	2.99
4	Dixie Cr abv project area	945 Dixie dam	44	1108 bridge	42	1157 Maddalena fence	47	1.16
5	Crocker Creek in project area	1120 mouth	44	1230 rock sill	45			1.68
6	Crocker Cr abv project area			1315 abv culvert	48	1500 at Mike Flynn house	48	0.93
7	Red Clover Cr @ McReynolds Project			1444 stringer meadow	57	1511 begin marsh	59	0.13
8	Red Clover Cr at Poco Project	1000 Chase bridge	51	1230 plug 28	52			1.21

* Reach map included on page 32

Fish Observations:

Reach #	Stream reach	# Adult RBT	Avg length (in)	Range Length (in)	# Subadult RBT	# Redds	# Unk sp Adult	# Unk small
1	Red Clover Cr abv causeway	20	5.5	3-8	52	0	220 dace?	380 1" long
2	Red Clover Cr blw causeway	1	6		1	2?	3 – 6"	1,000+ dace
3	Dixie Creek in project area	1	12			4		3" brn trt 147 dace
4	Dixie Cr abv project area	4	10	8-16		Not observed		2
5	Crocker Creek in project area	4	4	3-6	13	7		1,000s dace

6	Crocker Cr abv project area	18	6		8	1		
7	Red Clover Cr @ McReynolds Project				1		1 – 7"	1; 38 dace; 1 snail
8	Red Clover Cr at Poco Project	Some in ponds						some

Other observations:

Red Clover Cr abv causeway

- Stream is wide & shallow below Crocker, more narrow and deep abv Crocker
- Good gravels within 100 ft of lower, large headcut. Good gravels between lower large headcut and upper smaller headcut. Survey ended 600' upvalley from smaller headcut (across from the house in Dotta Canyon)

Red Clover below Causeway

- Virtually no habitat or cover or spawning habitat from upper fence up to causeway.
- Green-winged teal pair, 3 greater yellowlegs(?)
- Only gravel appears to be from eroding banks that stays on local bars.
- Habitat below confluence with Dixie is 41% riffles, 39% pools, and 20% runs. Vast majority of riffles not suitable for spawning.
- Habitat abv confluence with Dixie is 17% riffles, 25% pool, 58% run. Only 1-2 riffles abv Dixie suitable for spawning.

Dixie Cr in project area

- Substrate in most riffles was a veneer of gravel over clay hardpan or deposited silt
- One 12" RBT carcass found below Dixie Diversion Dam not counted in table

Dixie Cr above project area

- Many swallow nests on bridge
- Eroding bank throughout length of channel
- Beaver sign
- Black caddis, water boatman, midges

Crocker Cr in project area

- Beaver chews
- One 18" RBT carcass found not counted in table (Predation- Found headless)

Red Clover Poco

- Fresh beaver cuttings throughout the project reach

- Mallards, Canada geese, diver ducks (goldeneyes ?), teal, mergansers, 2 immature bald eagles
- Structural integrity of the channels, ponds, and plugs looked good

Summary:

On Red Clover Creek below the causeway, as well as Dixie and Crocker creeks, there were very few fish within the Red Clover Confluence Project area. Despite limited visibility volunteers expected to see more fish than were observed. Even deeper pools on Crocker Cr within the project area no fish were observed. Terry Benoit noted that on Crocker Creek more fish were observed when the creek changed from an alluvial system with fines to an alluvial system with more gravel. On Dixie Cr it was noted that most riffles were composed of fine sediments with a small veneer of gravel on top. On Red Clover Cr below the causeway there was very little cover and virtually no riffle habitat suitable for spawning.

Photos:

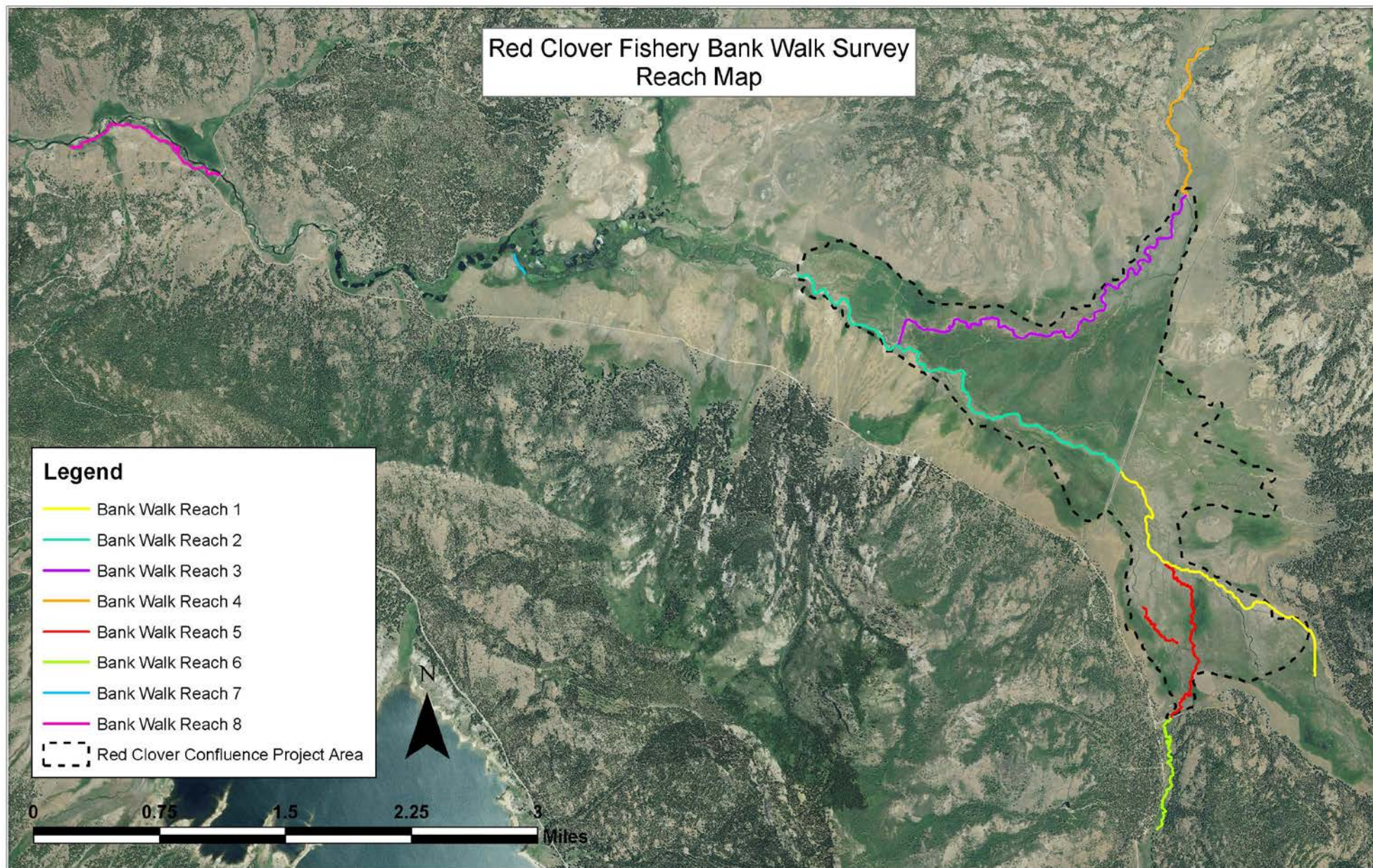


Red Clover Mainstem



Dixie Creek





Additional bank walking fish surveys:

May 2, 2012 – Jim Wilcox walked Red Clover McReynolds project. Sunny, cool, breezy. In McReynolds Creek, there was abundant surface water averaging 500' wide over 3 channels. Vegetation was 20% clover. Species observed throughout project area: YOY trout in channel too numerous to count mostly from quarry thru main beaver complex (they weren't in mainstem), one adult trout in Red Clover channel at xsec 19. One subadult in channel and six redds on Red Clover mainstem just downstream of railroad grade. Four trout observed rising in 4th pond up from constriction.

June 19, 2012: Sunny Day. Walked from the mouth of Dixie Creek (just above Goodwin's blown-out diversion on the main stem) up to the diversion dam looking for downstream migrant fry. Saw fry that were about 1.25" long, and observable with parr marks, especially with binoculars. All fish were observed in a microhabitat of fast water, trying to hold a spot in the current, or off to the side of the current. Interesting to observe dace constantly chasing the trout out of the location where food would most likely drift down. Suckers had a beautiful red stripe.

Observations:

12°C at 0947 at the mouth of Dixie Creek.

Habitat was dramatically better on Bennardo property. Lots more riparian vegetation here. Didn't measure overhanging bank habitat, but even on Bennardo, there didn't appear to be much. See photos at fence.

Habitat (approximate values):

On Beartooth property, 10%pool, 35 %riffle, 54%run.

On Bennardo property, 23%pool, 20%riffle, 57%run.

Fish:

On Beartooth, saw: 1- 5" trout.

On Bennardo, saw:

Species	Number	Size (In)
Trout	20	Fry
	2	4
	7	6
	5	7
	1	8
	3	9
	1	11
	1	12
Dace	thousands	
Suckers	thousands	

Diversion was still in. No surface water over the dam, even though flow was leaking under or around sides. Only place for downstream migrants to go was into the ditch. I walked ditch back

to truck and saw no trout, but did see a 6" rainbow in there in May. Water temp at head of ditch was 20°C at 1535.

June 19, 2012 Photos:



Top Left clockwise: Dixie Creek on Bearthooth property, Dixie Dam, Dixie Creek on Bennardo property, Dixie Creek at Beartooth property boundary looking upstream towards Bennardo's.

Additional notes – Macroinvertebrate samples were collected in June 2012 in the Red Clover Confluence project area. It was noted that there were little to no bugs on Dixie Creek and Red Clover mainstem, and that trout fry were trapped in discontinuous pools in Crocker Creek.

June 22, 2012: Cloudy day – hard to see into the water. Mink walked Red Clover McReynolds project looking for fry. Found none. Major impression was that the type of habitat I found fry in on Dixie Creek (i.e. clean substrate & some current to the water) pretty much did not exist in the McReynolds project area, except for a small stretch of remnant just above the constriction structure. The constriction structure and grade control also had some channel with current. Also, some of the channels going over plugs had some current on them, but I still saw no trout

fry. Saw swarms and swarms of dace, and some suckers. Lots of beaver dams, but did not keep count.

July 2, 2012: Mink walked the Red Clover Poco project area. Little to no fast water habitat was found. Saw no trout fry, but did see swarms and swarms of dace. Mink was not sure if she was also seeing suckers or not. 3rd pond from bottom was 20C on edge surface at 0930. Channel water entering side of grade control was 22C at 0945. Spring water on grade control was 20C at 0945, and so was the main channel water on the grade control. Water temperature was 23C at 1245 in deep but stagnant remnant channel above Chase Bridge.

Some preliminary conclusions (9/18/12):

Spawning appears to be happening primarily in Dixie and Crocker. Survival unknown. Ability of fry to survive for one year unknown. Is there enough water in these tributaries to sustain the young through their first year? Perhaps if they can survive one year, and then get washed with high flows into Red Clover mainstem they could grow into large adults there. Can the pond and plug project ponds serve to provide habitat for adults? Not sure how young deal with the ponds, but maybe they don't need to??? We do know that good-sized adult trout are caught by fishermen in the 1985 check dam project reach.

Additional bank walk surveying on Dixie Creek by Mink on 9/26/12: Hot & sunny day. Started at upper seepage run site, and walked downstream to border of Bennardo and Beartooth property. Temp = 6C at seepage run site at 10am. See photos. Channel was intermittent, with most of the dry riffles occurring in the middle of this reach. Pools where fish could be easily seen in the spring were very turbid, with plenty of foamy algal scum on the surface, as well as clouds of algae deeper into the pool. Saw some chewed beaver sticks and the beginnings of two small dams. Couldn't see the bottom in most pools. Saw one 2.5" trout, and a 3" sucker was the biggest fish I saw in this reach. Still saw swarms of dace, but not as many as June walk. Either the fish I saw before are dead, or perhaps they were hanging deep in the pools where I could not see. Entirely possible that they are laying low, because visually, it looked like very tough conditions for trout. At 10:53am, there was about 0.1 cfs or less at the property line and water temp was 10C.



The thick algae, dry riffles and sloughing gully walls in these three photos characterizes this reach.

Mink walked back upvalley, and then walked from upper seepage run site up to the diversion dam along the channel again looking for fish. Water temp was 10C at 11:19. Mink saw fish right away. Stream flow was perennial, but three riffles further upstream flow became intermittent.

Trout seen:

Number	Size (In)
1	YOY
2	7
1	8
1	9

Mink saw no fish in the large pool below the dam, but I suspect they were there. Water temp was 8C at the dam at 11:30am.

Mink walked back to the truck and drove up to the bridge, and walked upvalley from there along the channel. Water temp 15C at 12:11pm.

Trout seen:

Number	Size (In)
4	3-4
2	6-7
3	9-10

One 3-4" trout was positively identified as a Brown Trout.

Even some pools are dry in this reach. The pools where I saw trout had pretty abysmal-looking water quality and quantity. Saw one pool (puddle) with four small garter snakes stuffing themselves on fish. Ended walking this section at the powerlines like in June.

Went upstream in vehicle until access road at Ross Canyon. Dixie Creek channel was flowing and had better water quality in this reach. Looked like some pretty good rearing habitat here because there was flow and some water in cobble substrate channel, where adults could not live. Stream flow is less than 0.1 cfs and intermittent again near and below Ross Canyon mouth. Water temperature was 17C at 14:32pm. Dixie is downcut here about 7'.

Trout seen:

Number	Size (In)
4	YOY
1	3
1	4
1	6

Three inch trout was positively identified as a Rainbow Trout.

Photo: Dixie Cr at confluence with Ross Canyon looking downstream.



Then drove up to Dixie Creek pond and plug project (built in 2007). About same flow coming out of the project areas as there was at Ross Canyon (less than 0.1 cfs). 13C in the last pond on the surface. Water quality in last pond looked like pea soup or mocha – lots of iron, some looked like turbidity, and some algae (not filamentous). But water flowing out of the bottom of the grade control looked clear. Water quality in other ponds looked fine. Top couple of ponds were dry.

October 9, 2012:

Electroshocking reach is located about 300' below proposed grade control of proposed confluence project. The site is within a SWAMP bioassessment monitoring reach, which was surveyed earlier this summer. Block nets set up in a reach length of 334 ft. Water temp = 10C at 12:52 pdst. Sampled (3 passes) from 12:50 to 16:24 pm. One shocker, two netters. EC =

170 microsiemens(μ S). Also note that we saw a lot of crayfish, but did not keep an accurate count (about 20 per pass). Measurements were performed with a graduated cylinder, with milliliters as the units. Trout shocked but not caught = one 6-8"; and one 4-6". Habitat = glide 147' + riffle 84' + pool 88' + run 15'.

Pass 1 = 1,835 seconds

Species	Number of fish	Total volume (ml)	Fork Length (mm)
Speckled dace	20	25	
Speckled dace	78	125	
Speckled dace	15	23	
Sucker (unknon species)*	3	38	110
Sucker (unk species)			105
Sucker (unk species)			90

*suckers had a full deep cleft

Pass 2 = 1,794 seconds

Species	Number of fish	Total volume (ml)	Fork Length (mm)
Speckled dace	72	68	
Speckled dace	22	42	
Rainbow trout*	1	3	55
Sucker (unknown species)	9	48	
Speckled dace	3	3	

*no black tail (we were noting observations of clinical signs of whirling disease (one primary sign is the black tail for younger fish)

Suckers were too small to observe mouthparts in pass 2

Pass 3 = 1,411 seconds

Species	Number of fish	Total volume (ml)	Fork Length (mm)
Speckled dace	26	46	
Sucker (unknown species)	1	3	
Speckled dace	16	26	
Speckled dace	11	13	
Speckled dace	1		

October 17, 2012. Walking bank survey on Crocker Creek:

Started at 11:14 with two surveys assistants (Lily Davis and Tenaya Rumold), each seven years of age. Water was running about 0.1 cfs just down-valley of the old Crocker Guard Station. No fish seen in this reach. Water temp 6C. 200 μ S EC. About 500' downstream, water temp 4C and 210 μ S. About 200' below the bridge, the channel goes dry. Stopped at the watering hole pond, and saw two fish, one of which was a 4" sunfish. Pond temperature 10C and 160 μ S. About 1,000 feet above Mike Flynn's house, we observed a lot of trout. Some looked thin, and some were healthy. There were a lot of differences between this trib to Red Clover and the walk up Dixie Creek I had a few weeks ago. In Crocker Creek, the water quality was much better (clearer), and very little filamentous algae. More overhanging bank habitat. Tall grass in the riparian area. Lots of little tribs coming into Crocker Creek. There were not "swarms of dace" like I frequently saw in Dixie. Water temperature was 8-9C and 160-135 μ S.

Fish Seen:

Species	Number	Size (In)
Trout	3	2
	1	3
	2	4
	1	5
	6	6
	1	7
	1	8
	1	9
	1	12
Suckers	10	3-5

Survey ended at 14:08 pm.

November 5, 2012 Walking bank survey on additional areas of Crocker Creek:

Started at 24N32 and walked upstream, then downstream. On upstream walk, channel was mostly dry, except for occasional pools of water, starting about 300 ft upstream of the road.

Biotic crusts indicate dried channel sometime in the summer. First flowing water not encountered until PNF property corner post, about 0.1 cfs. Where creek is near the road, it abandoned a rock structure, but still looks good. No cattle grazing this year above Goodwin land. The first trout was seen in the pool by the big pine near Mike Flynn's house. As with other bank surveys this year, it was difficult to ID the trout species.

Trout seen:

Number	Size (In)
40	2
3	3
2	4
1	5
1	6
2	7
1	8
1	12

Some were trout

Positively identified as Rainbow

Downstream of the corrals, I saw one 12" trout in an isolated pool of muddy water and algae. *Terry Benoit went out the following week and said that there was NO water anywhere in Crocker Creek below the 24N32 road.* The other 8-10 pools above the bedrock reef that had fish were populated with dace and suckers only. Below the reef, the channel was dry. Water started showing up again in the deeper pools about 300' upstream of confluence with Red Clover Creek. Red Clover Creek was running about 0.2 cfs. I saw two 6" rainbows, and one 7" trout.

These photos are of Crocker Creek below 24N32: One on left is an isolated pool. Second is one of the uppermost headcuts.

