INTRODUCTION

Anadromous fish species using the Scott River for some or all of their life-history stages include: Chinook salmon, coho salmon, steelhead trout and lamprey. Extensive coho salmon use of the Scott sub-basin is demonstrated by juvenile outmigration and cooperative adult spawner surveys conducted by California Department of Fish and Game (CDFG) and the Siskiyou Resource Conservation District (RCD). Coho salmon were listed as threatened under federal and California state ESA in 1997 and 2005, respectively. The Scott River is listed as impaired for water temperature and sediment by the California State Water Quality Control Board. Total Maximum Daily Load (TMDL) allotments for water temperatures and sediment load increases are currently being assessed for the Scott River. Initial results indicate much of the mainstem Scott (from Callahan north) is largely unsuitable for salmonid rearing during much of the summer period.

Human activities that have the potential to affect temperatures in the Scott River are being assessed by the North Coast Water Quality Control Board (NCWQCB), including impacts to stream shade, stream flow via surface water diversion, stream flow via changes in groundwater accretion, channel geometry and microclimate. It appears that present over-summering conditions have forced salmonids, at times of water temperature stress, into microhabitats of cold water (thermal refugia). This pilot study seeks to better understand where refugial areas are located, how salmonids use the refugial areas, and how the refugial areas are influenced by water year type.

"The Role of Thermal Refugia in the Freshwater Fish Assemblage in Northern California Rivers" was a study conducted by Jennifer Nielsen from 1988 to 1991. Nielsen identified four types of thermal refugia: mouths of tributaries, hillslope seeps, stratification of pools and intragravel upwelling. Studies previous to Nielsen's have documented thermal refugia microhabitats as providing refuge for fish in stressful environments (Fry, 1971; Magnuson et al., 1979; Smith and Li, 1983; Sedell et al., 1990).

Scott River investigations regarding thermal refugia were initiated in 2002 (Pisano, California Department of Fish and Game, pers. comm., 2005) and expanded in 2004 (NCRC, 2004). Investigations in 2005 continued the search for thermal refugia habitat in the lower Scott and intensified dive observations of fish use in refugia and non-refugial areas. The objectives of the Thermal Refugia Pilot Project 2005 are as follows:

1. Identify as many thermal refuges (2º C < the ambient river temperature) on the Scott River main stem as possible and quantify the amount of cold water refugia each site has to offer.
2. Determine at which temperatures fish are most dependent on thermal refugia in the mainstem Scott River.
3. Determine with statistical validity if a temperature preference is occurring for coho 0+ in the Scott River mainstem. Establish thermal refugia sites and paired habitats (without thermal refuge) for comparison. Dive established Kelsey Creek refugia and its paired habitat four times per week. Dive established Canyon and Boulder Creek refugia habitats as often as possible.
4. Measure Discharge on Kelsey, Canyon, Boulder and the mainstem Scott below Bridge Flat river access in a permanently established location.

5. Monitor water temperatures on the following refugia sites identified during the 2004 Thermal Refugia Pilot Project Study: Kelsey, Canyon, Boulder and Tompkins refuge along with each paired habitat.
6. If possible, estimate standing crop of juvenile coho in the lower mainstem Scott River in 2005.

METHODS

A. Investigation

A variety of techniques for finding thermal refugia microhabitats were applied during the 2005 season. Aerial Forward Looking Infra-red Survey (FLIR) data from the lower Scott River was used to identify refugia surface temperatures associated with tributary mouths. Tributary surface flows not detected in 2003 on FLIR data were investigated with priority given to perennial streams draining high elevation peaks in the Scott River canyon. Investigation for subsurface flow, associated with seeps and mainstem intragravel flow, occurred at river confluences with intermittent streams and at each intersection of the river with the toe of a historic landslide (De la Fuente, Klamath National Forest, pers. comm., 2005). Landslide toe zones were obtained by superimposing a GIS geo morphological layer on a map of the Scott River. Investigation for stratified pools were prioritized by depth based on USFWS habitat typing data for the mainstem Scott River canyon. All investigations occurred between the hours of 1400 and 1600 for comparison purposes.

The Thermal Refugia Pilot Study in 2004 (NCRC, 2004) established monitoring sites at the following tributary mouths on the Scott River main stem: Kelsey, Canyon, Boulder, Tompkins and Pat Ford. Each site contains a thermal refugia habitat (#A) and a paired habitat (#B) with similar habitat characteristics but without a thermal refuge. Habitats were matched based on the following dimension criteria: length, width, depth, % cover and cover types so that density comparisons based on temperature could be made. Each site and its paired habitat were sketched and photographed, see appendix.

Monitoring type and intensity varied for each site in 2005. Canyon Creek 1A was monitored for fish counts and temperature. Four thermistors were placed in different temperature zones of the thermal refugia pocket on Canyon Creek 1A. Fish count dives at each site (1A and 1B) occurred twice over the course of the project. Boulder Creek 2A and 2B were monitored for temperature and fish counts. Temperature monitoring on Boulder 2A represents the temperature at the bottom of a stratified pool within the thermal refugia unit. Fish count dives occurred three times at each Boulder site. Kelsey Creek sites 3A and 3B were monitored for temperature and fish counts. One thermistor was installed at Kelsey Creek 3A inside the core of the refugia unit and another was installed in the paired habitat, Kelsey Creek 3B. Fish count dives occurred on Kelsey 3A and 3B eighteen times during 2005. This site was selected as a pilot area for frequent diving to determine if there was a statistical difference between fish use of the thermal refuge at its paired habitat. Cabin Hole 6A and 6B were monitored for fish counts but this only occurred once in 2005. Tompkins sites 5A and 5B were monitored for temperature. One thermistor was installed at Tompkins 5A inside the core of the refugia unit, and another was installed in the Tompkins paired habitat 5B. Pat Ford site 7A and 7B were monitored for fish counts in 2005. Fish count dives occurred at 7A and 7B three times over the course of this project.

A temperature investigation occurred on 8/17/05 from 1400 to 1500 on the Scott River mainstem starting at Boulder Creek and ending at Townsend river access. Temperatures were taken using a YSI Model 30 meter. Temperature data from the same date and time were obtained from the USFS long-term monitoring thermistors on the Scott River located at the USGS Gauge, Jones Beach, above Canyon Creek and Roxbury Bridge.

B. Dives

Boundaries of thermal refugia pockets were delineated at 1400 prior to each dive. First, the ambient river temperature was taken with a Hanana K-Type Thermocouple Thermometer Model HI 9063 and/or YSI Model 30 meter. The edge line of the cold water pocket was then found by subtracting 2º C from the ambient river temperature. Using a HTI/YSI instrument the boundaries were delineated by placing cobble- sized, orange spray- painted rocks on the bottom of the river.

** Delineation of Boulder 2A stratified pool.*

Techniques for counting fish included: lane diving, duplicate counts and replicate dives. Lane diving consisted of dividing habitats into lanes and each diver counts fish inside their lane. Where the lanes meet, one diver indicates to the other, by pointing, who counts the fish between them. These numbers were then added together for total counts. Duplicate counts occurred inside delineated thermal refugia habitats. Each diver would keep a separate count of the fish inside the delineated refugia. This number was then averaged between experienced divers for better accuracy. Replicate dives occurred in smaller habitats when space for two divers was not possible. Replicate dive numbers were averaged for better accuracy. In the case of outlier fish counts, due to inexperience, counts by inexperienced divers were dropped and the experienced diver counts were used.

Equipment used for diving include: wet suits, wrist slates, hand counters, mask and snorkel. Approximate underwater sizes for identification for each age class by species were as follows: 0+ coho = 110mm, 0+ trout = 75mm, 0+ Chinook = 110mm,

1++ trout = 135mm, ½ pound steelhead = 340mm, adult steelhead = >340mm. Rulers were used to approximate sizes for identification at the start of the season. Relative sizes for each age class became more obvious to divers as the season progressed. Statistical Analysis was performed on dive data for the Kelsey thermal refuge (3A) and its paired habitat (3B). For statistical validity a minimum of four dives per week per habitat were required. Statistical analysis on Kelsey 3A and 3B was done by Rebecca Quiñones, Klamath National Forest Fish Biologist.

C. Discharge

Protocol for discharge procedures is attached to the appendix. All measurements were taken using a Swoffer Model 2200 computer and a Gurley No. 625 Pygmy Current Meter. Discharge was taken on Kelsey, Canyon, Boulder, Middle, Deep and Tompkins Creeks. Discharge on the Scott River was taken at the USGS Gage, for calibration of the meter, and at Gold Flat river access. Permanent discharge sites were selected to compare year to year. USGS gage data was retrieved for the duration of this project, 07/23/05 to 10/31/05.

D. Temperature Monitoring

Two types of thermistors were used for temperature monitoring: AE50 Underwater Temperature Logger and Optic Stowaway Temp Loggers both made by Onset Computer Corporation. Calibration and deployment occurred on all thermistors according to protocol (see appendix). Thermistors were programmed to record temperature in degrees Celsius every ten minutes.

Thermistors were installed in the middle or core of the delineated refugial habitat of Kelsey 3A and Tompkins 5A. At Boulder 2A a thermistor was installed at the bottom of a thermally stratified pool. Boulder 2A consisted of 4 separated refugia pockets; the stratified pool was the largest of the four cold water habitats at the Boulder refuge (2A) and held the most fish. Canyon Creek 1A thermistors were installed at pre-set increments on a chain stretched across the bottom of the Scott River anchored perpendicular to the mouth of the creek. Pre-set increments and the location of the chain and anchor were determined in the 2004 Thermal Refugia Pilot Study. Starting on river left (0m), the thermistor increments are as follows: 3.3m, 7.8m, 9.5m and 12.5m. Thermistors were installed in a temperature representative location for all paired habitats.

Results

A. Investigation

Table #1: Identified Thermal Refugia Habitats on the Mainstem Scott River, CA 2005									
Location	**River Mile**	**Date**	**Refugia Type**	**Refugial Temp (ºC)**	**Volume (m^3)**	**Surface Area (m^2)**	**# of 0+Coho**	**Comments**	**Density (fish/m^2)**
Johnson's Bar	2.1-2.18	8/3/2005	Seeps	No Data	See Comments		0	Four separate seeps.Refugia combines with Trib 2.2 refugia.	
Location	**River Mile**	**Date**	**Refugia Type**	**Refugial Temp (ºC)**	**Volume (m^3)**	**Surface Area (m^2)**	**# of 0+Coho**	**Comments**	**Density (fish/m^2)**
Unnamed Trib 2.2	2.2	8/3/2005	Tributary	No Data	no depth	1.44	0	Equipment problem	
Cabin Hole Seeps	4.79-4.9	8/22/2005	Seep	16	no depth	0.81	10	Two separate seeps. Six total seeps located here.	12.3
Pat Ford Creek	5.01	8/24/2005	Tributary	15.5	0.2	1.9	18		9.5
McGuffy Creek	6.35 - 6.4	8/23/2005	Seeps	13.9	1.7	2	3	Three separate seeps.	1.5
Schuler Creek	8.07	8/23/2005	Tributary	17.4	no depth	9.5	120		12.6
Unnamed Trib 8.9	8.9	8/25/2005	Tributary	17.7	25	33.3	32		0.96
Kelsey Creek	14.8	8/8/2005	Tributary	18.5	135	128	65		0.5
Downstream Canyon	15.5	8/10/2005	Seep	19	0.4	0.5	50		100
Canyon Creek	15.9	8/10/2005	Tributary	16	87	240	66		0.3
Upstream Canyon	16.1-16.15	8/10/2005	Seep	13.1	0.03	0.26	100	Two separate seeps.	384.6
Boulder Creek	16.28	08/17-18/05	Tributary	19	30.67	113	200		1.8
Upstream Boulder	16.35-16.4	8/18/2005	Seeps	No Data	no depth	0.45	115	Two separate seeps. Lost thermometer.	255.6
Upstream Boulder	16.7	8/17/2005	Intragravel	17.5	2.7	9	30		3.3
Unnamed Trib 17.5	17.5	8/15/2005	Tributary	No Data	no depth	0.54	30	Estimated flow =1.5 gpm.	55.6
Isinglass	19.39	8/11/2005	Tributary	14.6	0.79	2.07	30		14.5

Snow Creek	19.61	8/11/2005	Tributary	18.5	1.62	5.4	3		0.6
Unnamed Trib 19.8	19.8	8/10/2005	Tributary	19	no depth	1.4	5		3.6
Unnamed Trib 20.7	20.7	8/10/2005	Tributary	17.5	no depth	29.7	18		0.6

Table #1: Identified thermal refugia habitats on the mainstem Scott River, CA 2005.

Table #1 lists thermal refugia habitat identified in 2005 on the Scott River mainstem including: river mile, date, type of cold water influence, thermal refugia core temperature, volume of refugia, surface area of refugia, number of 0+ coho salmon observed, comments and fish density. All investigations, temperatures and fish counts were conducted between the hours of 1400 and 1600 for comparison. All densities were calculated using the following equation: density = (# of fish / surface area).

The total number of coho 0+ observed inside thermal refugia habitat, on the Scott mainstem during investigations, was 895 fish. The total thermal refugia surface area identified during investigations in 2005 on the Scott River canyon mainstem was 578.8 m^2. Total coho 0+ density from investigations in 2005, 1.5 fish/m^2.

The largest refugia by volume, investigated in 2005, was Kelsey refugia 3A with 135 m^3 of cold water habitat. On average, sixty-six coho 0+ were observed at 3A in 2005. The second largest refugia habitat was Canyon 1A containing 87m^3 of cold water. Sixty-five fish on average were observed using this habitat (1A). Boulder Creek refugia 2A was the third largest with 30.7 m^3 of cold water refugia. Two hundred 0+ coho were observed in the Boulder Creek refugia (2A) on average. Seeps were the smallest cold water habitat investigated averaging 0.9m^3 of cold water habitat. Fish density was greatest at seep points when compared to tributary mouths. Only one intragravel upwelling site was located so comparisons with intragravel refugia fish densities were not possible.

Figure #1A: Scott River, CA map of thermal refugia locations 2005. See Appendix.

Figure #1A depicts the thermal refugia locations on the Scott River mainstem investigated and identified in the summer of 2005. The highest concentration of identified thermal refugia habitats existed between Boulder Creek and Kelsey Creek. Seeps identified were often associated with intermittent and perennial tributary mouths. The types of cold water influence are specified through symbols (See Legend).

Table #2: Temperature Investigation on 08/17/05 Scott River, CA			
Location	**River Mile**	**Time**	**Temperature (ºC)**
USGS Gauge	21	1400	28.8
Jones Beach River Access	18.1	1430	24.8
Above Boulder Creek	16.3	1415	23.8
Below Boulder Creek	16.2	1415	22.5
Above Canyon Creek	16	1400	21.5
Bridge Flat River Access	14.5	1441	20.9
1/3 mi. downstream Bridge Flat	14.2	1445	21
~300m upstream of Deep Cr.	13.3	1450	21.3
~10m upstream of Middle Cr.	12.9	1455	21.3
~200m downstream of Tompkins Cr.	11.5	1510	21.4
Townsend River Access	10.58	1515	21.9
Roxbury Bridge	0.5	1500	25.3

Table #2: Main stem temperatures over 1 hr. period Scott River, CA 08/17/05.

A temperature investigation occurred on 8/17/05 on the Scott River main stem. Table #2 lists each location, river mile, time and temperature. The Scott River ambient temperatures are represented by the USGS gage and the Roxbury Bridge thermistor readings. The highest temperature recorded on 08/17/05 was 28.8º C taken at the USGS gage. The lowest temperature recorded on 08/17/05 was 20.9º C taken at the Bridge Flat river access. Temperatures increase downstream of Bridge Flat and the highest temperature recorded on 08/17/05 below Bridge Flat was 25.3º C at Roxbury Bridge.

B. DIVES Table #3: Thermal Refugia and Paired Habitat Fish Counts Scott River, CA 2005

Date	Time	Site	Species								Temperature (ºC)			Mean Daily Flow at USGS Gauge (cfs)
			Coho Salmon		Steelhead/Rainbow Trout				Chinook Salmon		Thermal Core	TR Unit-Ambient	Paired Habitat	
			0+	1+	0+	1++	1/2 LB-Steelhead	Adult - Steelhead	0+	Adult-Spring Chinook				
7/26/2005	1515	Kelsey 3A-Inside TR	19	0	8	33	1	0	0	0	17.2	21		31
7/26/2005	1515	Kelsey 3A-Outside TR	19	0	21	0	0	0	0	0		21		31
7/26/2005	1415	Kelsey 3B	102	0	71	31	6	2	2	0			21.4	31
7/26/2005	1540	Kelsey 3B	95	0	95	47	5	2	2	0			21.4	31
8/2/2005	1415	Kelsey 3B	108	0	27	33	2	1	0	0			22	20
8/2/2005	1500	Kelsey 3A-Inside TR	40	0	10	58	0	0	0	0	18.5	22		20
8/2/2005	1500	Kelsey 3A-Outside TR	21	0	2	22	0	0	0	0		22		20
8/2/2005	1540	Kelsey 3B	95	0	42	32	2	1	2	0			22	20
8/2/2005	1615	Kelsey 3A-Inside TR	32	0	18	50	0	0	1	0				20
8/2/2005	1615	Kelsey 3A-Outside TR	20	0	2	18	0	0	0	0				20
8/4/2005	1420	Kelsey 3A-Inside TR	67	0	25	55	0	0	0	0	18.8	22.6		13
8/4/2005	1420	Kelsey 3A-Outside TR	19	0	55	58	2	0	0	0		22.6		13
8/4/2005	1400	Kelsey 3B	31	3	30	88	2	0	0	0				13
8/4/2005	1500	Kelsey 3A-Inside TR	44	0	10	63	0	0	10	0	18.8	22.6		13
8/4/2005	1500	Kelsey 3A-Outside TR	20	0	80	74	2	0	0	0		22.6		13
8/4/2005	1457	Kelsey 3B	8	0	34	35	2	0	0	0			22.6	13
8/8/2005	1400	Kelsey 3B	84	0	73	76	0	0	3	0			22	9
8/8/2005	1450	Kelsey 3A-Inside TR	81	0	5	40	0	0	7	0	18.5	22		9

8/8/2005	1450	Kelsey 3A-Outside TR	34	0	89	58	0	0	0	0		22		9
8/8/2005	1515	Kelsey 3B	155	0	71	107	0	0	10	0			22	9
8/8/2005	1555	Kelsey 3A-Inside TR	50	0	32	49	0	0	2	0	18.5	22		9
8/8/2005	1555	Kelsey 3A-Outside TR	9	0	63	20	0	0	0	0		22		9
8/11/2005	1324	Kelsey 3B	80	2	77	61	0	0	17	0			20.2	20
8/11/2005	1430	Kelsey 3A-Inside TR	27	0	18	24	0	0	9	0	17.4	20.1		20
8/11/2005	1430	Kelsey 3A-Outside TR	18	1	47	23	0	0	0	0		20.1		20
8/11/2005	1520	Kelsey 3B	159	0	61	122	0	0	32	0				20
8/11/2005	1610	Kelsey 3A-Inside TR	37	3	31	26	0	0	4	0	17.4	20.1		20
8/11/2005	1610	Kelsey 3A-Outside TR	20	0	50	60	2	0	1	0		20.1		20
8/16/2005	1330	Kelsey 3B	282	0	140	39	0	0	6	0				4
8/16/2005	1430	Kelsey 3A-Inside TR	87	0	49	27	0	0	5	0				4
8/16/2005	1430	Kelsey 3A-Outside TR	40	0	35	55	0	0	0	0				4
8/16/2005	1540	Kelsey 3B	252	0	172	81	0	0	8	0				4
8/23/2005	1300	Kelsey 3A-Inside TR	104	0	48	54	2	0	4	0	17.8	20.9		13
8/23/2005	1300	Kelsey 3A-Outside TR	23	0	153	51	0	0	5	0		20.9		13
8/23/2005	1340	Kelsey 3B	163	0	68	61	1	0	4	0			20.6	13
8/23/2005	1550	Kelsey 3A-Inside TR	99	0	57	54	0	0	4	0		22.6		13
8/23/2005	1550	Kelsey 3A-Outside TR	112	0	115	58	0	0	1	0		22.6		13
8/23/2005	1445	Kelsey 3B	189	0	74	38	0	0	3	0			22.6	13
8/31/2005	1310	Kelsey 3B	110	0	15	45	0	0	8	0			21.6	13
8/31/2005	1300	Kelsey 3A-Inside TR	83	0	23	15	0	0	1	0	18.1	21.6		13
8/31/2005	1300	Kelsey 3A-Outside TR	66	0	77	46	0	0	8	0		21.6		13
8/31/2005	1350	Kelsey 3B	110	0	16	50	0	0	10	0			21.6	13
8/31/2005	1345	Kelsey 3A-Inside TR	75	0	46	26	0	0	2	0	18.1	21.6		13
8/31/2005	1345	Kelsey 3A-Outside	49	0	91	51	0	0	7	0				13

		TR												
9/8/2005	1410	Kelsey 3B	0	0	4	8	0	0	0	0			17.4	15
9/8/2005	1455	Kelsey 3A-Inside TR	3	0	6	0	0	0	0	0	14.7	17.4		15
9/8/2005	1455	Kelsey 3A-Outside TR	0	0	6	25	0	0	0	0		17.4		15
9/8/2005	1535	Kelsey 3A-Inside TR	0	0	2	0	0	0	0	0	14.7	17.4		15
9/8/2005	1535	Kelsey 3A-Outside TR	3	0	13	21	0	0	0	0		17.4		15
Date	**Time**	**Site**	**Species**								**Temperature (ºC)**			**Mean Daily Flow at USGS Gauge (cfs)**
			Coho Salmon		**Steelhead/Rainbow Trout**				**Chinook Salmon**		**Thermal Core**	**TR Unit-Ambient**	**Paired Habitat**	
			0+	**1+**	**0+**	**1++**	**1/2 LB-Steelhead**	**Adult - Steelhead**	**0+**	**Adult-Spring Chinook**				
8/16/2005	1450	Canyon 4B	160	0	94	89	0	0	0	0			20.5	15
8/16/2005	1545	Canyon 4A-Inside	72	0	71	72	0	0	0	0	17			15
8/16/2005	1545	Canyon 4A-Outside	20	0	92	97	0	0	0	0		21.5		15
8/25/2005	1420	Canyon 4A -Outside	34	0	127	146	0	0	0	0		22		14
8/25/2005	1420	Canyon 4A - Inside	57	0	75	56	0	0	0	0	17.5			14
8/25/2005	1350	Canyon 4B	127	0	76	77	0	0	0	0			20.5	14
8/25/2005	1500	Canyon 4A -Outside	22	0	123	169	0	0	0	0		22		14
8/25/2005	1500	Canyon 4A - Inside	71	0	66	51	0	0	0	0	17.5			14
8/25/2005	1550	Canyon 4B	131	0	72	65	0	0	0	0			20.5	14
Date	**Time**	**Site**	**Species**								**Temperature (ºC)**			**Mean Daily Flow at**
			Coho Salmon		**Steelhead/Rainbow Trout**				**Chinook Salmon**		**Thermal Core**	**TR Unit-Ambient**	**Paired Habitat**	

			0+	1+	0+	1++	1/2 LB-Steelhead	Adult - Steelhead	0+	Adult-Spring Chinook				USGS Gauge (cfs)
8/24/2005	1415	Pat Ford 7A - Inside	1	0	0	0	0	0	0	0				13
8/24/2005	1415	Pat Ford 7A - Outside	0	0	18	10	0	0	0	0		21.6		13
8/24/2005	1520	Pat Ford 7B	0	0	7	2	0	0	0	0			24.1	13
8/29/2005	1445	Pat Ford 7A - Inside	0	0	1	0	0	0	0	0	15.5			13
8/29/2005	1445	Pat Ford 7A - Outside	0	0	5	12	0	0	0	0		20.7		13
8/29/2005	1400	Pat Ford 7B	0	0	0	0	0	0	0	0			21.4	13
9/20/2005	1400	Pat Ford 7A - Inside	0	0	2	0	0	0	0	0	13			12
9/20/2005	1400	Pat Ford 7A - Outside	0	0	1	3	0	0	0	0		17.5		12
9/20/2005	1425	Pat Ford 7B	0	0	0	1	0	0	0	0			17.5	12

Date	Time	Site	Species								Temperature (ºC)			Mean Daily Flow at USGS Gauge (cfs)
			Coho Salmon		Steelhead/Rainbow Trout				Chinook Salmon		Thermal Core	TR Unit-Ambient	Paired Habitat	
			0+	1+	0+	1++	1/2 LB-Steelhead	Adult - Steelhead	0+	Adult-Spring Chinook				
8/17/2005	1345	Boulder 2A	200	0	0	0	0	0	0	0	18		23.5	14
8/22/2005	1410	Boulder 2A - Inside	208	0	29	75	0	0	0	0	17.4			14
8/22/2005	1410	Boulder 2A - Outside	0	0	43	45	0	0	0	0		23.3		14
8/22/2005	1410	Boulder 2B	10	0	103	82	0	0	0	0			23.3	14
8/22/2005	1545	Boulder 2A - Inside	217	0	34	110	0	0	2	0	17.5			14
8/22/2005	1545	Boulder 2A - Outside	0	0	63	158	0	0	1	0		24.5		14
9/8/2005	1500	Boulder 2A-Inside	24	0	0	0	0	0	0	0	16.2	19		15
9/20/2005	1530	Boulder 2A - Inside	45	0	19	20	0	0	0	0	16			12
9/20/2005	1530	Boulder 2A - Outside	10	0	21	54	0	0	0	0		18.5		12

9/20/2005	1600	Boulder 2B	0	0	18	60	0	0	0	0			18.5	12
Date	**Time**	**Site**	**Species**								**Temperature (ºC)**			**Mean Daily Flow at USGS Gauge (cfs)**
			Coho Salmon		**Steelhead/Rainbow Trout**				**Chinook Salmon**		**Thermal Core**	**TR Unit-Ambient**	**Paired Habitat**	
			0+	**1+**	**0+**	**1++**	**1/2 LB-Steelhead**	**Adult - Steelhead**	**0+**	**Adult-Spring Chinook**				
8/29/2005	1400	Cabin Hole 6B	0	0	2	8	0	0	0	0			21.4	13
8/29/2005	1400	Cabin Hole 6A	0	0	0	0	0	0	0	0	21.7	21.7		13

Table #3: Thermal refugia and paired habitat fish counts Scott River, CA 2005.

Fish counts occurred at different intensities at each location in 2005 on the Scott River mainstem. Table #3 lists each site, date, time, species, age class, temperature (º C) and the mean daily flow (cfs) taken from the USGS Gauge.

The largest number of coho 0+ were observed on 08/16/05 at Kelsey paired habitat 3B, 267 coho 0+. The second largest coho 0+ fish count was on 08/22/05 at Boulder thermal refugia (2A), 217 coho 0+. The largest trout 0+ count was on 08/16/05 at Kelsey 3B, 156 trout 0+. The second largest trout 0+ count was on 08/23/05 at Kelsey thermal refuge 3A but outside the delineated cold water pocket, 153 trout 0+. The largest number of trout 1++ were observed on 08/25/05 at Canyon thermal refuge 1A but outside the delineated cold water pocket, 169 trout 1++. The second largest trout 1++ were observed on 08/22/05 at Boulder thermal refuge 2A but outside the delineated cold water pocket, 158 trout 1++. Three adult summer steelhead were observed at Kelsey paired habitat 3B on 07/26/05 and 08/2/05. A combined total of eighteen half pound steelhead trout were observed in the following study units: Kelsey thermal refugia 3A, Kelsey paired habitat 3B and Boulder thermal refugia 2A. Dives including half pound steelhead counts occurred on the following days: 07/26/05, August 2, 4, 11, 22, 23, 2005. Chinook salmon were observed in the following dive units: Kelsey thermal refugia 3A, Kelsey paired habitat 3B and Boulder thermal refugia 2A. Dives including Chinook salmon counts occurred on the following days: 7/26/05 and August 2, 4, 8, 11, 16, 23, 31, 2005.

Figure 2A and 2B: See Appendix.

Figure 2A: Vicinity map of the Scott River canyon.

All thermal refugia habitats investigated and monitored in 2005 are within the indicated vicinity.

Figure 2B: Thermal refugia habitats and paired habitats monitored in 2005, Scott River, CA.

Locations of identified thermal refugia habitats and paired habitats are mapped on Figure 2B. Note the vicinity map, Figure 2A, for location of the Scott River, CA canyon monitoring area.

Table #4: Kelsey 3A and 3B Fish Counts and Statistical Analysis						
Species	**Chinook 0+**		**Trout 1+**		**Coho 0+**	
Habitat Type	TR	PH	TR	PH	in TR	out TR
	0	2	33	31	19	19
	0	2	80	47	40	21
	2	0	68	33	32	20
	1	2	113	32	67	19
	0	0	137	88	44	22
	0	0	98	35	81	34
	10	3	69	76	50	9
	7	10	47	107	27	18
	2	17	86	61	37	20
	9	32	82	122	87	40
	5	6	105	39	104	23
	5	8	112	81	99	112
	9	4	61	38	83	66
	5	3	77	45	75	49
	9	8	25	50	3	0
	7	10	21	8	0	3
total	71	107	1214	893	848	475
mean	4.4375	6.6875	75.875	55.8125	53	29.6875
t value	2.6	2.6	2.6	2.6	2.6	2.6
st dev	16.54517	25.59067	277.8995	205.2454	32.99899	27.50205
SE	4.136292	6.397667	69.47489	51.31136	8.249747	6.875511
CI	10.75436	16.63394	180.6347	133.4095	21.44934	17.87633
	-6.31686	**-9.94644**	**-104.76**	**-77.597**	**31.55066**	**11.81117**
	15.19186	**23.32144**	**256.5097**	**189.222**	**74.44934**	**47.56383**

Table #4: Kelsey 3A and 3B fish counts and Statistical Analysis table.

Table #5A: See Appendix. CDFG fish rescue information 2005.

California Department of Fish and Game rescue, from unsuitable habitat, and relocate juvenile coho salmon and steelhead trout each year. Table #5A lists by tributary/river the amount of each species rescued, the location of planting, the date and comments (i.e. temperature, time) for the 2005 rescue efforts.