Rainbow Trout and Steelhead Studies in the Matilija Creek/ Ventura River Basin

Summary of Activities

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Steelhead and rainbow trout (*Oncorhynchus mykiss*) in the Matilija Creek/Ventura River watershed were examined between June 2000 and February 2002 by researchers from the USGS Western Fisheries Research Center. These studies were intended to examine steelhead populations at the southern extent of their range and provide information to the Matilija Dam Removal planning effort. This report is a summary of activities. A final report is in progress.

Historically, steelhead were thought to exist throughout the Ventura River watershed (including Matilija Creek). The number of steelhead returning to the Ventura River is unknown, although some estimates of run size in the 1930's and 1940's exist. Hubbs (1946) suggested that the Ventura River supported "large and consistent runs" of steelhead. In 1946, California Department of Fish and Game personnel estimated that a minimum of 4000 to 5000 steelhead spawned in the Ventura River system in normal water years (Titus et al. in prep). Currently classified as endangered, steelhead are still observed in the Ventura River (below Robles Diversion Dam) but little is known about their distribution or biology. In this study, we focused on three main objectives: 1) Identification of spawning locations by steelhead and rainbow trout; 2) Describing the distribution and characteristics (including genetic population structure) of rainbow trout throughout Matilija Creek; and 3) Determining the utility of otolith microchemistry for determining the maternal origin and migratory polymorphism in steelhead and rainbow trout throughout the basin. Other objectives that were explored but not implemented will be presented in the pending final report.

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Spawning Surveys

Between January and June 2001, spawning surveys were conducted throughout the basin. A single steelhead was observed holding in a pool in San Antonio Creek (at Soule Golf Course). Because of private property issues, we were unable to walk San Antonio Creek to locate redds. Rainbow trout were observed spawning in upper Matilija Creek on 29 March 2001. Within the Ventura River, between the Shell Road Bridge and the Robles Diversion Dam, one steelhead redd was encountered on 30 March 2001. The redd was located approximately 100m upstream of the Foster Park Bridge. The redd was 2 m long, in gravel of 25 – 60 mm diameter, and in water of 40 cm depth.

Juvenile Sampling

Rainbow trout sampling was conducted throughout the upper basin by means of electrofishing. The basin was divided into several reaches including:

1. Mainstem Matilija (reservoir to Murietta Canyon)
2. Mainstem Matilija (Murietta Canyon to impassible falls)
3. Mainstem Matilija (above falls)
4. Upper N. F. Matilija Below Falls
5. Upper N. F. Matilija Above Falls
6. Murietta Canyon Below Falls
7. Murietta Canyon Above Falls
8. North Fork Matilija Below Wheeler Gorge
9. North Fork Matilija Above Wheeler Gorge
10. Coyote Creek
11. Santa Ana Creek

The upper distribution of rainbow trout was encountered above the second falls on the Mainstem Matilija Creek. Scale samples were collected from all fish and age and growth analyses will be reported in the final report.

Otolith Microchemistry

Otolith samples were collected from 6 mortalities collected during the above electrofishing surveys. Otolith microchemistry can be used to describe the chronology of

migration between freshwater and saltwater and identify maternal origin (steelhead or resident rainbow trout). See Zimmerman and Reeves (2000) and Zimmerman and Reeves (2002) for a description of methods. These methods are based on examination of elements (strontium and calcium) in the otolith. Generally, strontium is low in freshwaters and high in the ocean. Analysis is ongoing and will be reported in the final report.

Genetic Population Structure

This work is not yet completed and is being done in collaboration with the Alaska Science Center (Jennifer Nielsen). Using nonlethal, molecular genetics techniques (mtDNA and micro-satellites), samples of fifty fish are being assayed from each of nine potential subpopulations, and compared with baseline data from southern steelhead and from hatchery populations of rainbow trout. We will test the hypothesis that distance upstream from road access and presence of high-gradient reaches downstream (i.e., increased "remoteness" or isolation from stocking locations) are negatively related to genetic contribution from hatchery trout.

During electrofishing surveys (described below) and during downstream migrant trapping (described below), fin clips will be collected from fish for analysis of mtDNA according to the methods of Nielsen et al. (1997). Results will be compared to the distribution of haplotypes in natural and hatchery populations throughout the distribution of steelhead and resident rainbow trout (Nielsen et al. 1994) to determine occurrence of non-native genotypes throughout the basin. Samples will be blocked according to location in basin and the presence of waterfalls.

Previous genetic sampling efforts in the Ventura River system have focused on analysis of haplotypes variation in the mtDNA control-region of juvenile fish from various locations in the basin. Nielsen et al. (19997) examined 32 juvenile fish from Matilija Creek and 3 samples from taxidermy-preserved adult steelhead captured in the Ventura River in the early 1940's. Capelli (1997) reported mtDNA haplotypes of 9 juvenile O. mykiss collected downstream of the Robles Diversion Dam. California Department of Fish and Game collected 38 fish from the Upper North Fork Matilija Creek in 1999 (Maurice Cardenas, CDFG, personal communication). Five mtDNA

haplotypes have been identified in these studies. The dominant haplotype (MYS3) is one that is widespread in wild and hatchery populations throughout the California Coast. A haplotype (MYS5) that is more common in southern populations is also present.

HABITAT UNITS WITH & WITHOUT RESTORATION ALTERNATIVES – REACH 6

	STEELHEAD COMPONENT			RIPARIAN COMPONENT					NATURAL PROCESSES				
Target Year (TY)	No Action	Stabilize On-site	Mech Rem/ Nat. Erosion	No Action	Stabilize On-site	Mech. Removal	Natural Erosion (slurry fines)	Natural Erosion (no slurry)	No Action	Stabilize On-site	Mech. Removal	Natural Erosion (slurry fines)	Natural Erosion (no slurry)
TY - 0	0	0	0	47	48	47	47	47	30	30	30	30	30
TY - 5	30	27	27	47	45	41	41	41	30	50	60	60	24
TY -20	30	30	30	42	42	42	42	42	30	50	60	60	60
TY -50	30	30	30	35	36	35	35	35	40	50	60	60	60
AAHUs[1]	27	27	27	40	41	40	40	40	33	49	58	58	51
Change in AAHUs[2]	------	0	0	------	+1	0	0	0	-----	+16	+25	+25	+18

[1]AAHUs = Average Annual Habitat Units over 50 years.
[2]Change in AAHUs = (AAHUs of Action Alternative) - (AAHUs of No Action)

TOTAL AAHUs for RESTORATION ALTERNATIVES

ALTERNATIVE	TOTAL AAHUs*
STABILIZE ON-SITE	0 + 1 + 16 = **17**
MECHANICAL REMOVAL	0 + 0 + 25 = **25**
NATURAL EROSION (slurry)	0 + 0 + 25 = **25**
NATURAL EROSION (no slurry)	0 + 0 + 18 = **18**

*Total AAHUs = Steelhead + Riparian+ Natural Processes Components

Steelhead Habitat Component - Habitat evaluation

I. Revised HEP numbers for the Without Project condition

The steelhead component of the without project analysis performed for the F3 report was modified as discussed below. (Note: no significant modifications were made to the Riparian and Natural Processes Components for the without project conditions – as reported in the F3 Report.)

After the F3 conference, the study team recognized that fish passage through a to-be-built fish passage structure at Robles diversion dam may not have been accurately evaluated in the F3 Report (see PFG Meeting Minutes of 16 January 2003). The Environmental Working Group re-evaluated the steelhead component, and the consensus was that the equation to determine the Steelhead Habitat Value be modified from:

Steelhead Habitat Value = Steelhead Habitat Value Score x Fish Passage

Where:

Habitat Value Score is the best professional judgment scores generated in the report prepared by Entrix, Inc for the study.

Fish Passage is a multiplier to the Habitat Value Score. If no impassible barriers to steelhead migration existed in the Reach, the score was multiplied by "1." If an impassible barrier existed, the score was multiplied by "0", thereby causing the steelhead habitat value to be nil.

to:

Steelhead Habitat Value = $\{$**(Steelhead Habitat Value Score) x [(Fish Passage) x (other steelhead factors*)]**$^{1/2}\}^{1/2}$

Where:

Fish Passage is a multiplier as before but it reflects fish passage opportunity relative to discharges through the Robles diversion structure, as follows:

$$\text{Fish passage} = \frac{\text{Passage days through Robles structure with} > 50 \text{ cfs}}{\text{Natural passage days pre-Robles with} > 50 \text{ cfs}}$$

(0% passage = value of 0.0; 1-10% passage = 0.1; 11-20 % passage = 0.2; 21-30 %= 0.3; 31-40% = 0.4; 41-50% = 0.5, etc…)

The Robles fish passage structure was assumed to be constructed and operational by Target Year (TY 5). As such the fish passage variable was calculated to be 0.3 (13 passage days with >50 cfs without a passage structure/44 natural passage days pre-Robles = 30%) for Target Years (TYs) prior to construction of the Robles fish passage structure (i.e., before TY-5).

At TY5 and beyond, the variable was calculated to be 0.5 (18 passage days through Robles structure with > 50 cfs/ 44 natural passage days pre-Robles = 41%).

Other steelhead factors are those environmental factors that contribute to the quality of steelhead habitat, but are not typically evaluated in most habitat models and/or are not affected by a physical barrier upstream. They are: water availability, stream sediment regeneration (replacement), nutrient movement downstream, riparian plant propagules replenishment downstream, and smolt productivity. The presence of all these factors = "1.0" value; the presence of all factors, but not optimally = 0.75; the presence of only 3 factors = "0.5"; only one factor = "0.1".

Also it was the consensus of the EWG that the area associated with the Steelhead Habitat Component be expanded beyond the mapped "Riverine" type (as was done for the F3 Report) to include the "Forested palustrine" and the "Palustrine, emergent wetland" habitats types because they were also considered to be important to the Steelhead Habitat Component.

As a result of these modifications, the without-project Habitat Units for the Steelhead Component (presented in the F3 Report) were amended as displayed in the Tables attached.

II. With Project Steelhead HEP numbers

It is assumed that deconstruction of Matilija Dam and all associated activities would be completed by Target Year 5 and that beneficial impacts to steelhead would be apparent by TY5.

It is conservatively assumed that below Robles Diversion Dam (River Reaches 1-6) steelhead habitat values do not change after TY5 – with or without the Project. With removal of the impassible barrier at Matilija Dam, access to a significant amount of high quality habitat (Reaches 7-9) occurs and is reflected in the increased Habitat Units associated with action alternatives.

Stabilize On-Site Alternative

As mentioned previously, a significant net increase in steelhead Habitat Units occurs in Reaches 7-9 as a result of Dam removal. Under this alternative, Reach 7 (the former reservoir) has sediment from the dam stabilized in-place on the side of the former reservoir and an excavated channel with a 60' wide base width. It is calculated that the steelhead habitat in Reach 7 would be 17 acres (which includes the 7500 long channel, the 60 foot wide channel bottom, and the lower channel banks). The quality of habitat (habitat value) in the constructed channel of Reach 7 is expected to be just below average quality after construction and to reach a maximum value of just above average quality by TY-20.

High quality habitat in River reaches 8 and 9 become available to migrating steelhead and, in this analysis, is counted as beneficial impacts (i.e., increased Habitat Units) associated with the removal of Matilija Dam.

The calculations of Habitat Units for Target Years 5, 20 and 50 under this alternative are shown on the Tables attached.

Natural Erosion and Mechanical Removal Alternative

As with the "Stabilize On-site" alternative, a significant increase in net Steelhead Habitat Units occurs in reaches 7-9 as a result of the removal of Matilija Dam. Since both alternatives result in returning Matilija Reservoir to pre-dam conditions, from a steelhead perspective, these alternatives are functionally identical. River Reach 7 (the former reservoir) is estimated to provide some 48 acres of steelhead habitat after construction activities are completed by TY-5. The quality of habitat (habitat value) in the natural channel of Reach 7 is expected to be just below average quality after construction, to improve to just above average quality by TY-20, and expected to reach a maximum high quality value by TY-50.

As with the "Stabilize On-site" alternative, high quality habitat in River Reaches 8 and 9 become available to migrating steelhead and, in this analysis, is counted as beneficial impacts (i.e., increased Habitat Units) associated with the removal of Matilija Dam.

The calculations of Habitat Units for Target Years 5, 20 and 50 under this alternative are shown on the Tables Attached.

Incremental Dam Removal

It is assumed that the second increment of the dam removal would occur within the first 5 years, and this alternative is the same as the one-increment (since it was conservatively estimated that construction would not be entirely completed until TY 5).

As a "sensitivity" analysis – if it is assumed that Dam removal would not be completed until (say) TY 10, then steelhead Average Annual Habitat Units (AAHUs) are reduced from 488 AAHUs to 460 AAHUs, (i.e., – 6% change).

III. Summary (see last page of Tables)

Action alternatives provide a significant net increase in AAHUs. There is, however, only a slight difference in AAHUs between the two action alternatives.

TABLES FOR STEELHEAD HABITAT COMPONENT CALCULATIONS

I. MODIFICATION OF F3 HEP APPENDIX
WITHOUT PROJECT- STEELHEAD HABITAT UNITS

Target Year 0

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.37	45.34	16.8
2	.37	166.49	61.6
3	.5	53.93	27.0
4	.34	134.67	45.8
5	.37	83.14	30.8
6	0	49.83	0.0
7	0	92.76	0.0
8	0	129.00	0.0
9	0	200.00	0.0
		TOTAL	181.9
[1]Habitat Units = Habitat Value x Acres			

Target Year 5

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.6	49.83	29.9
7	0	92.76	0.0
8	0	129.00	0.0
9	0	200.00	0.0
		TOTAL	234.2
[1]Habitat Units = Habitat Value x Acres			

Target Year 18 & 50 (Same as target Year 5)

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.6	49.83	29.9
7	0	64.95	0.0
8	0	129.00	0.0
9	0	200.00	0.0
		TOTAL	234.2

[1]Habitat Units = Habitat Value x Acres

II. WITH PROJECT HABITAT UNITS FOR STEELHEAD HABITAT COMPONENT

STABILIZE ON-SITE ALTERNATIVE - STEELHEAD HABITAT UNITS

Target Year 5

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.55	49.83	27.4
7	.4	17.00	6.8
8	.7	129.00	90.3
9	.84	200.00	168.0
		TOTAL	496.8
[1]Habitat Units = Habitat Value x Acres			

Target Year 20 & 50

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.6	49.83	29.9
7	.6	17.00	10.2
8	.7	129.00	90.3
9	.84	200.00	168.0
		TOTAL	502.7
[1]Habitat Units = Habitat Value x Acres			

NATURAL EROSION & MECHANICAL REMOVAL ALTERNATIVES
- STEELHEAD HABITAT UNITS

Target Year 5

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.55	49.83	27.4
7	.4	48.00	19.2
8	.7	129.00	90.3
9	.84	200.00	168.0
		TOTAL	509.2
[1]Habitat Units = Habitat Value x Acres			

Target Year 20

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.6	49.83	29.9
7	.6	48.00	28.8
8	.7	129.00	90.3
9	.84	200.00	168.0
		TOTAL	521.3
[1]Habitat Units = Habitat Value x Acres			

Target Year 50

STEELHEAD HABITAT COMPONENT			
Reach	Habitat Value	Acres	Habitat Units[1]
1	.42	45.34	19.0
2	.42	166.49	69.9
3	.6	53.93	32.4
4	.4	134.67	53.9
5	.35	83.14	29.1
6	.6	49.83	29.9
7	.73	48.00	35.0
8	.7	129.00	90.3
9	.84	200.00	168.0
		TOTAL	527.5

[1]Habitat Units = Habitat Value x Acres

III. Total Steelhead Habitat Units With & Without Project

	Steelhead Habitat Units (HUs)[1]		
Target Year (TY)	**No Action**	**Stabilize onsite**	**Mech. Removal & Nat Erosion**
TY-0	182	182	182
TY-5	234	497	509
TY-20	234	503	521
TY-50	234	503	528
AAHUs2	229	471	488 (460)[3]

[1]Total of all Habitat Units per given Target Year
[2]Average Annual Habitat Units (AAHUs) over 50 years.
[3]The AAHUs if Dam removal would not occur until TY 10.

Action Alternative	Future With-Project (AAHUs)	Future without Project (AAHUS)	Net Change* in AAHUs
Stabilize onsite	471	229	+242
Mechanical Removal/ Natural Erosion	488 (460)**	229	+259 (+231)**

*Net Change = (Future with project) - (Future without project)
**The AAHUs if Dam removal would not occur until TY 10.