ASSESSMENT OF STEELHEAD HABITAT

IN UPPER MATILIJA CREEK BASIN

Stage One: Qualitative Stream Survey

Report Prepared For:

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INTRODUCTION

The upper Matilija Creek watershed and the Coyote/ Santa Anna Creek watershed have both provided historic steelhead spawning and rearing habitats in the Ventura River system. The Matilija Dam was constructed in 1947 on lower Matilija Creek for the purpose of supplying water storage and flood control, but reservoir sedimentation and construction of newer projects has reduced the necessity of the dam (Figure 1). When built, the Matilija Dam blocked access of anadromous steelhead (*Oncorhynchus mykiss*) to upstream spawning areas. In subsequent years, the Robles Diversion Dam was constructed downstream of Matilija Dam and further blocked access. Declines in local steelhead populations led to a federal listing of steelhead as "endangered" in the Southern California Steelhead ESU. In attempts to help restore the Ventura Basin steelhead population, efforts are underway to provide access across Robles Diversion Dam, which would again allow migratory fish to reach Matilija Dam as well as the Lower North Fork Matilija. Because of Matilija Dam's limited function, an Ecosystem Restoration Feasibility Study was conducted by a multidisciplinary team to determine the ecological benefits of removing Matilija Dam for steelhead and other riverine dependent species. One recommendation of the feasibility study was to acquire additional data assessing the habitat quality of the Matilija Basin above the existing dam for spawning and rearing steelhead.

STUDY OBJECTIVES

In recent years, information has been assembled indicating that Matilija Creek above the dam may provide an abundance of high quality habitat if access is provided to upstream migrant steelhead (Chubb 1997). This first stage survey will provide a qualitative assessment of habitat characteristics and quality that can be compared to previous studies.

The first-stage survey will be used to accomplish four principal goals:

1) to provide detailed first-hand knowledge of the entire study area
2) to provide qualitative evaluations of habitat characteristics and quality for comparison with earlier work (e.g., Chubb 1997)
3) to fully describe the length of habitat accessible to anadromous steelhead, and
4) to adequately describe the sampling "universe" for the second-stage survey; from this information, efficient habitat stratifications can be employed to accurately estimate stream habitat characteristics in a statistically rigorous manner (i.e., to produce valid and comparable total and mean values with minimal variances)

The first-stage survey encompassed the entire length of stream accessible to anadromous steelhead, from the lower reaches upstream to the first naturally occurring absolute (or, "definite") barrier to upstream migrating adult steelhead. The first-stage survey was conducted from March 9th through March 14th, 2003. This survey will be followed by a second-stage survey to collect more quantitative data within discrete reaches that will provide a more detailed assessment of habitat quantity and quality, however this report only describes the methodologies and preliminary results of the first-stage survey. A following report will detail results of the second-stage survey after it is completed, which is anticipated to occur by late-April 2003. Refer to the study proposal (TRPA 2003) for details regarding the methodologies anticipated for use in the second-stage survey.

METHODS

During the first-stage survey two fisheries biologists walked the full length of all targeted stream reaches, including the mainstem Matilija Creek above the reservoir and it's principal tributaries: Murietta Creek, Old Man Creek, the Upper North Fork Matilija Creek, and an unnamed tributary of the Upper North Fork. The Lower North Fork Matilija Creek (below Matilija Dam) was also surveyed in part (that survey will be completed in April 2003). First-stage surveys were used to visually assess the nature of and changes in the following habitat characteristics:

- stream flow
- water temperature (measured)
- pH (measured)
- channel type (gradient, confinement, dominant substrate)
- riparian type (dominant vegetation type and density)
- general appearance of adult steelhead resting pools

In addition to the above variables, the biologists also noted:

- number and size range of observed salmonids (and other significant aquatic species such as frogs and turtles)
- water diversions or other man-made structures
- tributary confluences
- average length of individual mesohabitat units

More detailed information was collected for the following habitat components:

- frequency, size, and quality of gravel deposits suitable for steelhead spawning
- potential barriers to upstream migration for adult steelhead

Each significant change in habitat characteristics or physical feature (i.e., barriers) was geo-referenced by pulling biodegradable hip chain while walking upstream, and by reference to topographical maps and Global Positioning System (GPS) coordinates (where coverage permitted). GPS waypoints and photographs were taken at (approximately) 1,000 ft intervals, which were also marked with a labeled flag. Water temperatures were measured with a hand-held thermometer at frequent intervals. Dissolved oxygen and pH were measured periodically using an YSI meter (model #550) and a Pinpoint pH monitor.

Channel Type

Channel types were visually classified as A, B, C, or D type channels (Rosgen 1994). The biologists used visual estimates of channel confinement, entrenchment, sinuosity, slope (calibrated with several measurements using a hand-held clinometer), and dominant substrate type to assess channel type.

Riparian Vegetation Type

The dominant vegetation observed along the streambanks was visually assessed using a simplified version of the Cowardin system (Cowardin et al. 1979) that was adapted for the Ventura Watershed (Mertes et al. 1995), by using the following categories:

Freshwater Marsh (FM): Emergents such as cattails, sedges, etc. in perennial/seasonal pools and ponds.

Alluvial Scrub (AS): Composed of drought tolerant chaparral species and scattered herbs in open cobble-dominated stream areas. Few willows and emergents only along water edge.

Riparian Scrub (RS): Composed of willow/mule fat thickets along channel and low flood benches. Most vegetation shorter than 6m (20 feet).

Riparian Forest (RF): Dominant cover of trees along stream with varying degrees of shrub and herbaceous understory. Common trees include cottonwood, alder, oak, bay laurel, maple, and willow.

Spawning Gravel

The approximate patch and particle size, percentage fines, and percentage embeddedness of spawning gravels were visually assessed if:

the dominant particle sizes were ½ to 3 inches in diameter
patches were at least 20 ft^2 in area
the deposit was no greater than (approximately) six inches above the water surface (at the time the survey was conducted)

The criteria for gravel particle and patch sizes were based on steelhead redd studies from a variety of locations (Orcutt et al. 1968, Reiser and White 1981, Raleigh et al. 1984, Hampton 1988, Pearsons et al. 1996), although comparative data was not found from the Southern California ESU. The criteria for gravel being no more than six inches above the water surface was subjectively chosen based on site-specific observations of gravel patch characteristics and professional judgment. Because streamflows in southern California streams are extremely “flashy” during the rainy season, and anadromous fish in general appear to avoid spawning in areas that are prone to dewatering (Shapovalov and Taft 1954), selecting an elevation criteria that is too high would likely result in an overestimation of gravel availability during most years, however a criterion too low would, on average, produce underestimates of gravel availability. Because spawning gravels need to be wetted with flowing water during an extended period of incubation for eggs and sac-fry (typically at least one month or more, Barnhart 1986, Moyle 2002), gravel deposits perched significantly above winter and spring base flow levels for a given year would not likely be usable by spawning steelhead.

A more accurate determination of the "optimal" height criterion would likely require the establishment of stage-discharge relationships in typical spawning areas, or repeated visits to gravel deposits under a variety of spring streamflows. Although neither of these options was feasible for this short-term study, one storm event did occur during data collection that allowed a qualitative evaluation of the stage-discharge relationship. During the March 15th storm event, a temporary gage placed in the Matilija above the reservoir increased from at height of 8 inches (at 12 cfs) to 18 inches (approximately 400 cfs according to the USGS gage), a difference of 10 inches. Thus, an increase of six inches (the gravel height criterion) from the existing base flow would likely result in flows of 200 cfs or more. Tracking the USGS gage data following the March storm event showed that flows dropped to below 200 cfs within one day and below 50 cfs within three days.

Thus, under the dry conditions that existed in the spring of 2003, the six inch criteria would be expected to include the majority of spawning gravels potentially available to steelhead. However, under wetter years, higher base flows during the winter and spring and a more frequent occurrence of storm events could make gravels deposits perched at higher levels available for spawning. Although historical streamflow data shows that mean monthly flows in January, February, and March were less than 20 cfs in 11 to 13 of the 21 years of records, mean monthly statistics are not highly descriptive of the flashy, dynamic nature of streamflows in Southern California steelhead streams. Southern stocks of steelhead are thought to be particularly adapted to take advantage of seasonal and annual cycles of high precipitation, and thus evaluation of gravel deposits using two or more elevation criteria would likely provide more options for assessing gravel availability under a variety of water years.

Many of the gravel patches in the Upper Matilija Basin were "cemented" by mineral deposits. The degree of cementation was qualitatively assessed by dislodging particles in the streambed. Some cemented patches were assessed both before and after the March 15th storm event to determine if such deposits were physically loosened by the high flows.

Barriers to Upstream Migration

Whenever a potential barrier to upstream migration was encountered, the survey paused to conduct a detailed assessment of the barrier characteristics. Each potential barrier was photographed from several angles and sketched to clearly illustrate each barrier component including the barrier materials, the jump pool depth, the vertical and horizontal extent of each required jump or chute, etc. In addition, each barrier was evaluated in terms of its expected likelihood of blockage (e.g., "possible", "probable", or "definite"), while using professional judgment to attempt to account for a range of seasonal streamflows and adult jumping abilities.

All first-stage surveys were terminated at a definite barrier except in two circumstances:

1. the barrier was man-made, in which case it might be removed through future mitigation or enhancement measures, and
2. in the upper mainstem Matilija Creek where we were requested to survey up to the prominent "falls", which were approximately 2,000 ft above an impassable falls 18 ft in height

To assist the evaluation of each potential barrier, the biologists referred to a figure quantifying the relationship between jump height and jump distance for adult steelhead (Figure 2). The figure was a composite of data representing the jumping ability of steelhead in "bright" condition and in "good" condition (Orsborn 1985). It was further assumed that the maximum jumping height of a steelhead was no greater than the depth of the jumping location (for pools less than eight feet deep, Reiser and Peacock 1985). This 1:1 ratio is a liberal estimate compared to the traditional estimate of 0.8:1 from Stuart 1964. We then used the jumping charts for the "good" condition fish to distinguish between passable barriers and possible barriers. The jumping charts for bright steelhead were used to distinguish between possible barriers and definite barriers. Possible barriers were sometimes classified as "probable" barriers if additional factors, such as characteristics of the jumping or landing areas, appeared to reduce the efficiency of a jump.

Several barriers were revisited on 14 and 15 April 2003 immediately after a storm event in order to assess these barriers at a flow higher than observed during the March survey. However, the rapidly dropping flows were not substantially higher than the previous survey and thus were probably not representative of higher flows when steelhead migration would be expected to occur. Physical characters of these barriers were re-measured and photographed. Ideally, all barriers are best evaluated at higher flows, however such flows were so flashy during this survey that a complete reassessment of all barriers could not be accomplished within the scope of this study. Consequently, the ultimate evaluation of passage over "probable" or "possible" barriers will likely be dependent upon further study and the presence of migrating steelhead.

RESULTS

The upper Matilija Basin study area was divided into 22 reaches above the reservoir and two reaches for the Lower North Fork Matilija Creek. Reach boundaries were delineated based on stream channel characteristics, particularly streamflow, channel type, riparian type, and presence of definite barriers (Table 1). Figure 3 shows the upper basin study area with streamflow characteristics (flowing versus dry or intermittent), reach

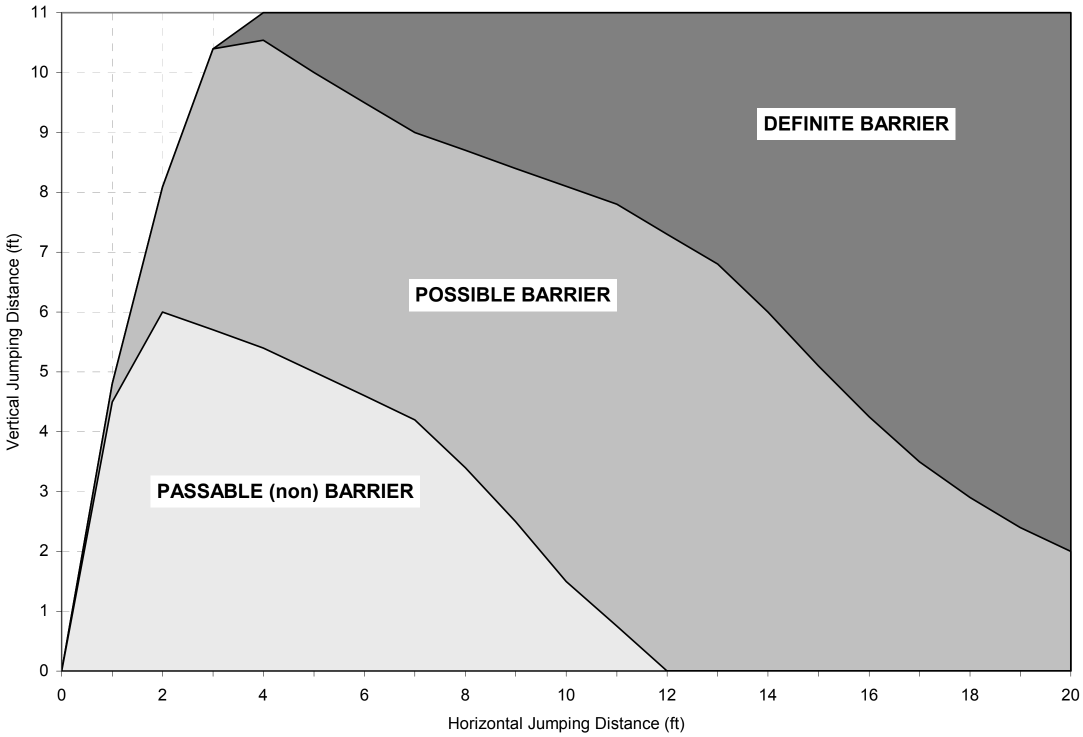

Figure 2. Barrier jumping chart used to assess degree of passage for upstream migrating adult steelhead. Based on data from Orsborn (1985).

boundaries, approximate river miles, and all identified barriers (possible or definite). Barriers are identified by the GPS waypoint number associated with each barrier (Table 2). See Appendix A for a list of waypoint information, Appendix B for stage-one mapping data, and Appendix C for photos of barriers. Approximate boundaries of channel types and riparian types in the upper basin are shown in Figures 4 and 5, respectively. Data pertaining to the Lower North Fork is shown in Figure 6. Physical and biological characteristics of each reach will be described individually. All data (except for the upper portion of the Lower North Fork) were collected during March 2003 following one of the driest water years in the past 100 years, consequently the following descriptions of streamflows, barrier dimensions, and fish populations should be interpreted in light of the existing drought conditions.

Upper Matilija Creek (mainstem)

The mainstem Matilija was mapped for 8.60 miles on 9, 10, and 13 March 2003, by two biologists. Water temperatures measured throughout the day ranged from 59-66^{o}F in the lower mainstem (above the reservoir) and 53-58^{o}F in the upper mainstem (above the Upper North Fork). Dissolved oxygen (D.O.) and pH were measured in the lower mainstem at 10.2 mg/l and 8.25, respectively. In the upper mainstem, D.O. was 8.4 mg/l. Measured streamflows during the survey were 12.4 cfs in the lower mainstem, 0.9 cfs above the Upper North Fork confluence, and approximately 5 cfs (eye-estimated) in the upper mainstem above Old Man Creek.

Table 1. Physical characteristics of reaches in the upper Matilija Basin and the Lower North Fork Matilija Creek based on first-stage surveys, March 2003 (April for LNF 2). Gravel density is in ft^2/1,000 lineal feet, and only includes deposits within six inches of the March/ April water surface elevation. Refer to map for reach and barrier locations. Reaches not included for selection of HSI study sites are shown with an asterisk, the reason for exclusion is given in the notes (additional HSI details will be in a following report). Riparian types are FM=freshwater marsh, AS=alluvial scrub, RS=riparian scrub, RF=riparian forest. Fish are NGF=non-game fry, RBT=rainbow trout.

Stream	Reach	Waypoints	River Mile	Reach Length (ft)	Flow Status	Barrier ID #'s poss / definite	Channel Type	Riparian Type	Gravel Density	Gravel Cementation	Fish Observed	Notes
Matilija (mainstem)	* MAT 1	1-4	0.00-0.36	1,900	flowing	- / -	C - D	RS, FM	372.1	low	0	1
	* MAT 2	4-11	0.36-1.14	4,100	flowing	- / -	C - D	RS	0	high	10 NGF	2
	MAT 3	11-22	1.14-2.80	8,779	flowing	- / -	C	RS	14.2	medium	~ 900 NGF	3,4
	* MAT 4	22, 500	2.80-4.10	6,860	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5
	MAT 5	500-517	4.10-5.01	4,826	flowing	- / -	B	AS,RS,RF	50.6	high	0	
	MAT 6	517-535	5.01-6.48	7,731	flowing	- / -	B	AS, RS	67.8	low	0	
	MAT 7	535-550	6.48-8.18	9,018	flowing	"steepchut",544 / 550	B	RF	67.2	low	4 RBT	
	* MAT 8	550-"Falls"	8.18-8.60	2,171	flowing	552 / "falls"	B - A	RF	0	low	0	6
Old Man	* OLD 1	64-70	0.00-0.37	1,960	intermittent/dry	65 / -	A - B	AS	0	high	0	7
	OLD 2	70-79	0.37-1.16	4,146	flowing	74 / -	B	RF	50.7	medium	2 RBT	
	* OLD 3	79-85	1.16-1.67	2,737	dry	- / -	A - B	AS	135.9	medium	0	7
	* OLD 4	85-90	1.67-2.15	2,532	flowing	- / -	A	RF	11.1	medium	0	8
	* OLD 5	90-91+	2.15-2.29 *	710	dry	91 / -	A	AS	n/a	n/a	0	7,12
Upper NF Matilija	UNF 1	23-34	0.00-1.26	6,649	flowing	- / -	B	RF	81.1	medium	5+ RBT	9
	UNF 2	34-39	1.26-1.99	3,851	flowing	- / -	C	AS	0	high	1 RBT	
	UNF 3	39-47	1.99-2.70	3,743	flowing	45 / -	B	RF	17.6	medium	1 "fish"	9
	UNF 4	47-63	2.70-4.08	7,291	flowing	49,51,62 / 63	B - A	RF	15.9	medium	12 RBT	10
Upper NF Trib	UNFT 1	92-99	0.00-0.82	4,318	flowing	- / 100	B	RF,AS	42.6	low	5 RBT	10
Murietta	* MUR 1	600-601	0.00-0.17	909	flowing	- / -	B	RF,RS	0	none	1 RBT	11
	* MUR 2	601-602	0.17-0.26	467	dry	- / -	B	RS	0	none	0	7
	MUR 3	602-620	0.26-1.62	7,154	flowing	611,612,613,617 / -	B	RF	82.9	none	1 RBT	
	* MUR 4	620-627+	1.62-2.13 *	2,700	intermittent/dry	622 / 625	B	RF	0	none	0	7,12
Lower NF Matilija	LNF 1	101-123,701-710	0.00-4.26	22,493	flowing	- / 710	B	RF	416.1	medium	26 RBT, redds	
	LNF 2	710-728	4.26-6.85	13,675	flowing	721,722	B-A	RF,RS	0.02	medium	7 RBT	13

Notes:
1 reach appeared to be backwater (lake) influenced
2 most of reach w/in historic lake zone and thus likely to be modified after dam removal
3 4,909 ft of this mapped reach is private, HSI study site selection restricted to remaining 3,870 ft
4 HSI study site will be approximately 3,000 ft long due to longer habitat unit lengths (all other sites are ~2,000 ft long)
5 private land, not mapped, reach length estimated from map
6 reach above definite barrier, will not provide steelhead habitat
7 channel dry or intermittent during spring survey, therefore not expected to provide summer rearing habitat
8 flow minimal during spring survey, therefore not expected to provide summer rearing habitat
9 reaches 1 and 3 similar, therefore combined prior to selection of HSI study site
10 5,870 ft of UNF above a highly probable barrier, therefore HSI site selected from lower 1,421 ft and UNFT 1 (tributary) combined
11 flowing section short, therefore excluded from selection of HSI study site
12 reach length includes additional dry channel above last WP
13 LNF 2 survey completed in April 2003

Table 2. Physical characteristics of potential barriers in the upper Matilija Basin and the Lower North Fork Matilija Creek. See Figures 3 and 6 for barrier locations.

Reach	Barrier ID#	River Mile	Barrier Type	Barrier Composition	Jump Pool Depth (ft)	Jump Distances (ft) Vertical	Horizontal	Barrier Category	Notes
MAT 7	"steepchut"	7.09	chute	bedrock	n/a	n/a	n/a	possible	45 ft long chute at 30 deg.; 2 ft wide, 3-4 in deep
MAT 7	544	7.51	chute	bedrock	n/a	n/a	n/a	probable	50+15 ft long chutes at 30-50 deg.; 3 ft wide, 2-3 in deep
MAT 7	550	8.18	falls	bedrock	4	18	40	definite	
MAT 8	552	8.38	falls	bedrock	3	10	5	probable	
MAT 8	"falls"	8.6	falls	bedrock	n/a	50*	n/a	definite	* visual estimate
OLD 1	65	0.02	falls	boulder	3*	7.5*	8*	possible	* dry channel; possible side channel at high flows
OLD 2	74	0.66	falls	boulder	2.5	6	12	possible	
OLD 5	91	2.14	falls	bedrock	1.2 / 1.2	4.5 / 3.8	11 / 7.5	probable	two distinct jumps at current flow
UNF 3	45	2.43	falls	bedrock	5	5	12	possible	
UNF4	49	2.85	falls	bedrock	2.0 / 2.0	8.5 / 3.5	22 / 10	probable	two distinct jumps at current flow
UNF4	51	2.97	falls	bedrock	2	5.7	29	probable	
UNF4	62	4.00	falls	bed/bldr	5	7.5	14	probable	
UNF4	63	4.08	falls	bedrock	5	11	16	definite	
UNFT	100	0.82	falls	bedrock	5	100*	190*	definite	* visual estimate of several large drops combined
MUR 3	611	0.89	falls	boulder	2	4	8	possible	
MUR 3	612	0.94	falls	boulder	2	5	12	possible	
MUR 3	613	1.01	falls	boulder	4	7	7	probable	
MUR 3	617	1.5	falls	boulder	4.5	4	8	possible	
MUR 4	622	1.74	falls	boulder	1	5	6	possible	
MUR 4	625	1.94	falls	boulder	1.5	11	10	definite	after rain distance was 7.3' vert & 15' horiz, depth 4.3'
LNF 1	710	4.26	road Xing	concrete	2.5	11	18	definite	man made
LNF 2	721	~6.00	cascade	boulder	1.3	8	13	probable	
LNF 2	722	6.07	falls	boulder	2.6	6.5	28	probable	