Russian River Watershed Overview for CCC Steelhead

The following functionally independent and potentially independent populations of the Russian River (Spence *et al.* 2012), selected to achieve a low extinction risk for recovery scenarios, were assessed using the CAP protocols:

Essential Populations

- Austin Creek (Potentially Independent)
- Green Valley Creek (Potentially Independent)
- Mark West Creek (Potentially Independent)
- Maacama Creek (Potentially Independent)
- Dry Creek (Potentially Independent)
- Upper Russian River (Functionally Independent)

In addition, a number of dependent populations of the Russian River selected to meet redundancy and occupancy criteria, were assessed using the Rapid Assessment protocols:

Supporting Populations

- North Coastal Diversity Stratum: Russian River Populations Rapid Assessment
    - Willow Creek
    - Sheephouse Creek
    - Freezeout Creek
    - Dutchbill Creek
    - Porter Creek
    - Hulbert Creek

- Interior Diversity Stratum Rapid Assessment
    - Crocker Creek
    - Gill Creek
    - Miller Creek
    - Sausal Creek

The following sections provide a general overview of the abundance and distribution of CCC steelhead, history of land use, current resources and land management, and a brief summary of the CAP viability, current conditions, and threats results for the Russian River Watershed.

Abundance and Distribution

Information on the historic abundance and distribution of adult steelhead in the Russian River watershed are limited and poorly understood. Historically, winter-run (winter) steelhead are thought to have spawned and reared in the 6 independent populations, 10 dependent populations, the mainstem and all 240 named tributaries in the Russian River Watershed (Figure 1). Like other coastal populations throughout California, steelhead use of the Russian River estuary was undoubtedly extensive with multiple life stages utilizing the estuary throughout the year. The Potter Valley Project was completed in 1922, where regulated flow between Scott and Cape Horn dams via Lake Pillsbury has since provided year-round diversion of Eel River water into the East Fork Russian River. The construction of Coyote Dam forming Lake Mendocino (1959) eliminated significant portions of historic spawning habitat for steelhead in the east fork of the Upper Russian River population, while the construction of Warm Springs Dam forming Lake Sonoma (1982) eliminated all but the lower 14 miles of the Dry Creek population. Augmentation from the Eel River diversion, together with regulated flows from the two large reservoirs have altered river discharge characteristics significantly, increasing the average summer base flows to exceeding 125 cfs (USACOE 1982). Summer flows, once extremely low to intermittent, are greatly augmented and peak winter flows are artificially low under all but the highest flows. Aside from the loss of habitat upstream of the Coyote and Warm Springs Dams, which is estimated to be 143 and 159 miles respectively, steelhead remain widely distributed throughout the Russian River Watershed (Coey *et al.* 2002).

Statistically robust estimates of past adult steelhead abundance within the Russian River watershed do not exist; instead, most estimates are either a best professional judgement by a state or local field biologist, or an imprecise analysis of partial or incomplete data sets. That being said, a general trend of decreasing population abundance is apparent. In fact, the estimated number of returning adult steelhead within the Russian River watershed has likely dropped precipitously during the past several decades, from 65,000 in the 1960s to 1,750-7,000 in the 1990s (See Tables 18 and 19 in Busby *et al.* 1996). Based on amount of historic habitat available in the watershed, Spence *et al.,* (2012) estimates the historic run size approximated 40,000 adults per year. There are three long-term data series of adult returns to the Russian River Watershed— counts of hatchery fish at Warm Springs Hatchery (WSH) (Figure 2) and Coyote Valley Fish Facility (CVFF) (Figure 3), the two hatcheries operated by CDFW below the two reservoirs, and ladder counts at the rubber inflatable Mirabel Dam, operated by Sonoma County Water Agency since 2000 (Figure 4).

Figure 1: Russian River watershed overview map

Based on these records, and assuming the historic run size estimates above, steelhead runs in the Russian River Watershed have declined substantially with a precipitous decline since the 1960s. Annual adult returns to WSH have ranged from 423 in 1991 to 6,873 in 2004, and to CVFF from 371 in 2009 to 4,964 in 2004 (Figures 1 and 2). Overall, the trend of adult returns to the Russian has improved since the 1980's with recent peak counts in the mid-1990's and mid-2000's, and lowest counts in early 1990's and late 2000's. More recently, counts at SCWA Mirabel Dam which includes a video camera (which allow a partial counting of the run until turbidity and high flows prohibit counting), have incorporated wild fish into the picture, allowing an estimate of hatchery to wild fish to be made 4:1 in 2013, (Shawn Chase, SCWA, personal communication). Presumably, as a larger proportion of hatchery fish are released into Dry Creek, and the bulk of steelhead habitat resides in the upper river, the upper river may have a comparably larger wild component. Overall the Russian River population remains at a moderate risk of extinction (Spence *et al.* 2012).

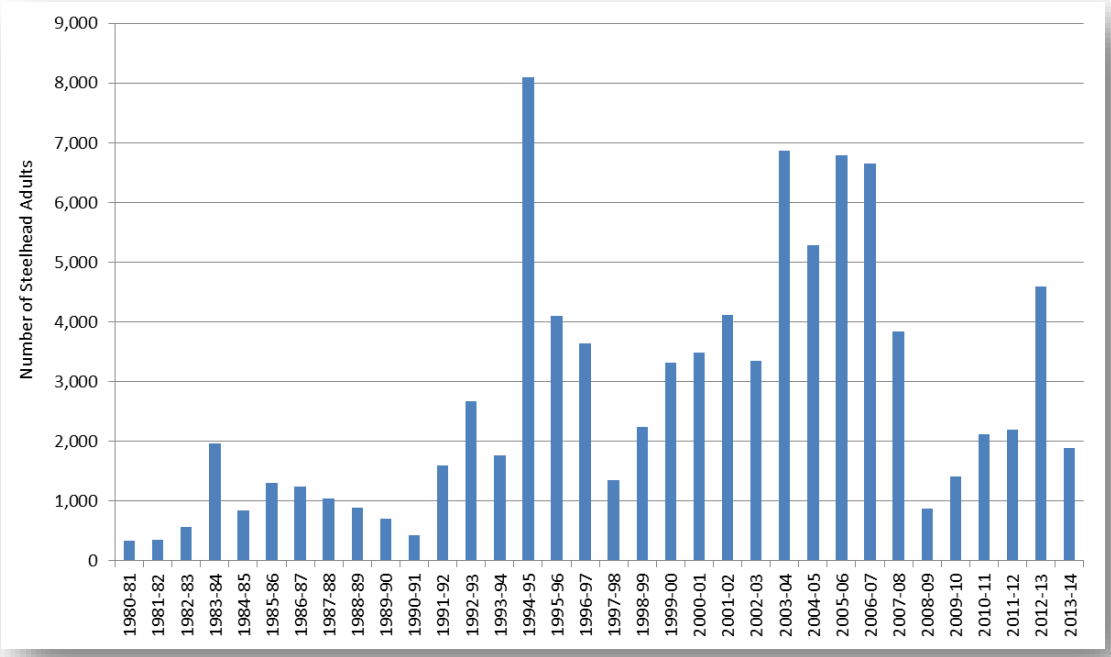

Figure 2: Adult steelhead returns counted at the Warm Spring Fish Hatchery 1980-81 on Dry Creek, 1980-81 through 2012-2014.

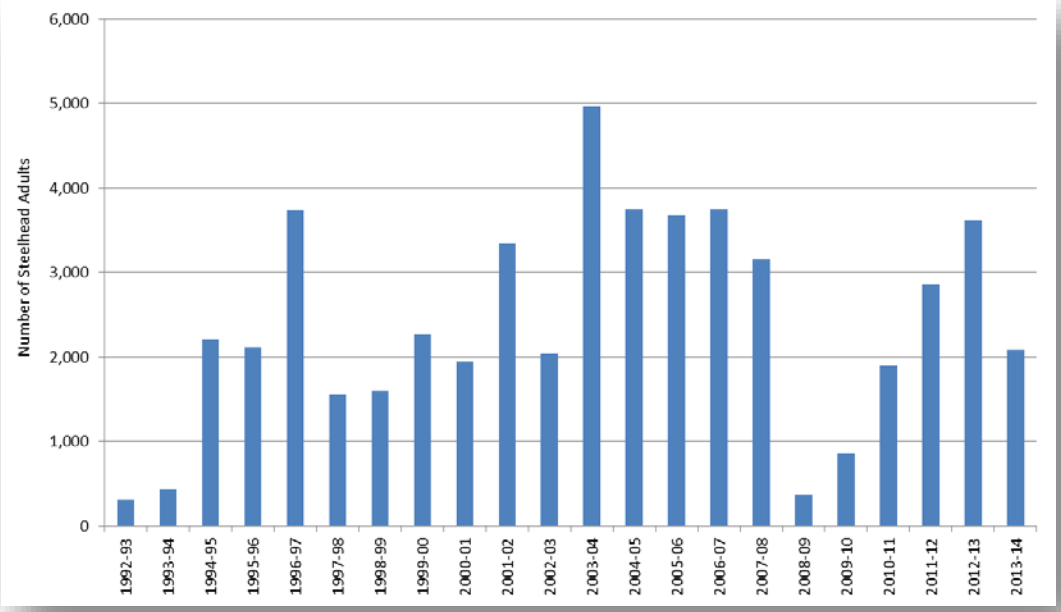

Figure 3: Adult steelhead returns counted at the Coyote Valley Fish Facility on the East Branch of the Russian River, 1992-93 through 2012-14.

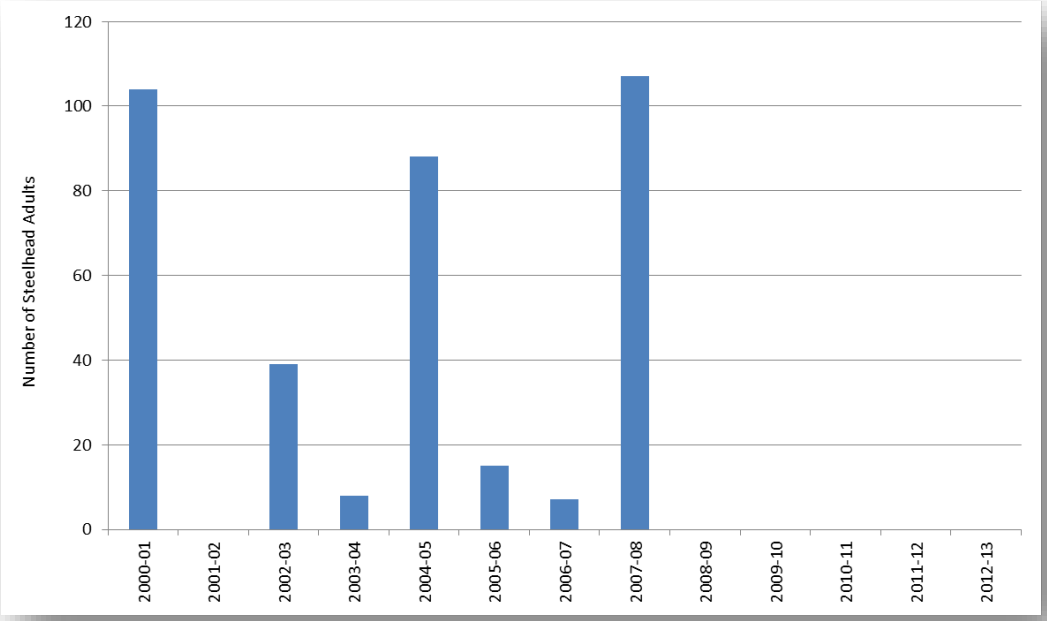

Figure 4: Adult steelhead observed at the Mirabel Dam Fish ladder on the middle reach of the Russian River, 2000-2012 (years without data indicate video counter was pulled prior to steelhead run).

History of Land Use

The Russian River Watershed is centrally located in California and the largest watershed within the CCC Steelhead ESU, with a drainage area of approximately 1,485 square miles (approximating almost 1 million acres) covering 12 major subbasins populations spanning two counties (Figure 3). The basin's fog-influenced coastal region, which extends 10 miles inland, typically has cool summers and abundant summer fog moisture. The drier interior region, on the other hand, experiences hot, dry summers with temperatures increasing to upwards of 100º F in the northeastern valleys most isolated from coastal influence (Coey *et al.* 2002). Winter temperatures can reach the low 20ºs F, though snowfall is uncommon, and rainfall in the basin ranges from 22-80 inches, with a basin-wide average of 41 inches (SEC 1996). The Franciscan lithology is very unstable and landslides are common throughout most mountain regions within the basin.

The history of resource use in the Russian River area began with the Pomo Indians, who occupied the river basin for as long as 5,000 years prior to European settlement, living in numerous settlements of up to 1,000 people (Wilson 1990). These tribes altered their environment with the regular burning of oak woodlands and grasslands as a means of promoting new growth of their food sources and increasing wildlife habitat. In the late 1700's, the Spanish landed at Bodega Bay to find the river basin a virtual paradise, followed by the Russians who established colonies at Fort Ross and Bodega Bay in the 1800's (Ferguson 1931).

The arrival of many land-hungry "American" settlers soon decimated the Native Americans living in villages throughout the river valley (Wilson 1990), and at that time, the sheer size and density of the old growth redwood forests were almost unfathomable. In 1865 intensive logging in the lower watershed began with the outside markets, dramatically boosting the production of the timber industry (Stindt 1974). Salmon (Chinook, coho and pink) and steelhead were once so prevalent in the Russian River that they supported a commercial fishery (USBOFF 1888). Cannery records give no mention of species, but fish weighed between eight and 20 pounds, suggesting steelhead were a large part of the catch. In 1888, 183,597 pounds of fish were caught near Duncan Mills for cannery and personal use (USBOFF 1888). Assuming an average fish weight of 12 pounds, 15,300 fish were taken (Coey *et al.* 2002).

Prolific Russian River steelhead runs once ranked as the third largest in California behind the Klamath and Sacramento rivers (USCOE 1982). During the 1930's and on through the 1950's, the Russian River was renowned as one of the world's finest steelhead rivers, and a healthy economy thrived on the sport fishing activity. Estimates of the sport catch of steelhead ranged from 15,000 in 1937 (Burghduff 1937), to 25,000 in 1957 (Christensen 1957). A population estimate of 57,000 steelhead in the Russian River was given in 1957 by Prolysts Inc and Beak Consultants Inc (1984).

Although logging and fishing continued through the early 20th Century, three of the more significant anthropogenic changes to the watershed during this period were the construction of the two dams as discussed previously, which were constructed without fish ladders, and the advent of gravel mining in the 1940's to supply a burgeoning population and hunger for aggregate in the SF Bay Area.

Most of the land along the Russian River was already under cultivation by 1900 (SEC 1996) and this early agriculture focused mainly on the production of grapes, apples, hops and prunes. Farmers removed riparian vegetation and filled in sloughs and side channels in order to maximize their usable agricultural lands. These practices continued until the late 1940's when very few wetlands remained (SEC 1996). At that time, the river valley was leveled, creeks were channelized and, in an attempt at flood control, agricultural operations began removing small in-channel islands and gravel bars. In the 1940's in-channel gravel extraction began and, in the years to follow, the production of sand and gravel was the principal industry from Healdsburg through Ukiah. The removal of Russian River gravels from in-channel was used for concrete construction and roads from Santa Rosa to Ukiah and throughout the entire Bay Area. "In the 1950s, bank stabilization measures began in response to headcutting, with the river bottom dropping as much as 22' in the middle reach" (SEC 1996). Ultimately, these practices resulted in mass channelization of the mainstem.

In the 1970's, in-channel gravel mining slowed and operations moved to the adjacent terraces where floodplain pits are constructed amidst agricultural operations. Agriculture is still the dominant land use within the basin, with the recent trend being conversion of historic crop lands, livestock, dairy lands, and forest lands to vineyards. Today, the upper reaches of the Russian River flow south through southern Mendocino County and the towns of Redwood Valley, Calpella, Ukiah, and Hopland south to Sonoma County, and the towns of Healdsburg, Windsor and Santa Rosa, which support a highly productive and successful wine growing region which is supported by a healthy and economically valuable tourism industry.

Throughout the 20th Century, both coho and Chinook salmon and steelhead were propagated and released into the Russian River. In 2001 NMFS recommended ceasing Chinook spawning at WSH and CVFF due to concerns over genetic bottlenecking from too few returning adult fish (NMFS 2008). Today, both steelhead and coho salmon are reared and released at the facilities according to a Hatchery and Genetic Management Plan.

Current Resources and Land Management

Approximately 92% of the Russian River Watershed is privately owned, with the remaining managed as federal, state and county lands. A majority of the federally managed lands are within the jurisdiction of BLM and USCOE dam recreation areas.

Nearly 38% of the watershed is forested with montane hardwoods, annual grasslands (18%), shrub (9%) and Douglas fir (7%) being the most common forest communities. Urban areas represent less than 7% of the watershed area with the largest developments located inland in developed floodplain areas of the Santa Rosa plain. Agriculture, which comprises 13 percent of the land acreage within the Russian River watershed, is predominantly located in low-lying, flat landscapes adjacent to and within the historic floodplain of the Russian River mainstem.

The Russian River Estuary

The Russian River estuary is utilized by every steelhead in the Russian River Watershed at some point in its lifecycle. Some use the lagoon extensively (over one year) while other use it for brief transition periods coming or going to the sea. Thus the Russian River estuary is especially important in the recovery of multiple populations. Past management activities within the Russian River estuary have likely degraded parr and smolt steelhead rearing habitat. The altered flow regimes caused by regulated flows out of Coyote Dam and Lake Sonoma has changed the natural hydrology of the Russian River mainstem and estuary, and artificial breaching of the barrier beach at the mouth of the river is often required to prevent flooding adjacent to the estuary. Prior to these projects, the river's estuary likely closed during summer months with a barrier beach that formed a large freshwater lagoon, providing high-quality rearing habitat for steelhead and coho salmon (NMFS 2008). The elevated Dry Creek flows present a challenge to managing water levels in the lagoon, requiring a balance between flooding adjacent low lying properties in Jenner and providing highly productive summer rearing habitat for juvenile salmonids, including steelhead. Recent monitoring conducted by SCWA indicate that a large number of juvenile steelhead originating in Austin Creek utilize the Russian River estuary for extended juvenile rearing at a much greater rate than the six other Russian River steelhead populations. This heavy reliance on estuarine rearing may be due to Austin Creeks' proximity to the estuary.

Estuarine residency has been shown to improve juvenile salmonid growth rates, which can, in turn, increase ocean survival and return rates of adult salmonids. The NMFS (2008) Russian River Biological Opinion calls for implementation of a suite of measures by the Sonoma County Water Agency to improve conditions for rearing juvenile steelhead including modification of its approach to managing water levels and flood protection in the Russian River estuary. These

activities should be implemented to improve estuarine habitat. Monitoring of estuarine water quality, fisheries, aquatic biota, and physical conditions in the estuary (depth, beach contours, etc.), continued public education, and full implementation of recommended alternatives in the Biological Opinion are all important elements to estuarine health and are critical elements to the recovery of Austin Creek steelhead, as well as all other populations of steelhead and Chinook in the Russian River basin.

Salmonid Viability and Habitat Conditions

A summary of attributes and indicator ratings for Russian River populations of CCC steelhead are presented in Table 1 and Table 2. Across the Russian River Watershed, attribute indicators frequently rated Poor for multiple populations and life stages were:

- Estuary: Quality and Extent;
- Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios;
- Habitat Complexity: Large Wood & Shelter;
- Riparian Vegetation: Tree Diameter;
- Sediment: Gravel Quality Embeddedness;
- Sediment Transport: Road Density;

Across all populations in the Russian River Watershed, winter rearing juveniles are the most threatened life stage with 82% of attribute indicators rated Poor or Fair, and 41% rated as Poor alone (Figure 5). Summer rearing juveniles are a close second with 80% of attribute indicators rated Poor or Fair, of which 39% were rated Poor. Of the Watershed Processes, streamside road density was identified as the most significant impact to instream and riparian habitat quality with all populations except Upper Russian River rated Poor (Table 2). Urbanization was also rated Poor for the Mark West and Green Valley Creek populations. The extent and impact of passage barriers, impervious surfaces, and timber harvest within tributary populations are minimal today as all populations were rated Fair or better with many rated Good or Very Good.

The Russian River populations are split between the two diversity strata of the North Coastal and Interior. The ESU and Diversity Strata results from the CAP viability analysis are described in greater detail in the section above, CCC steelhead CAP results. Population-specific results are described below in the population profiles and rapid assessments.

Table 1: CCC steelhead DPS CAP Viability Summary by Attribute for Russian River populations.

CCC Steelhead by Diversity Strata and Population - Russian River Watershed			North Coastal		Interior			
Target	Attribute	Indicator	Austin Creek	Green Valley Creek	Mark West Creek	Dry Creek	Maacama Creek	Upper Russian River
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	P	P	P	P	P
Smolts	Estuary/Lagoon	Quality & Extent	F	F	F	F	F	F
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	P	F	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	P	F	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	P	F	P
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	F	P	P	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	F	P	P	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	F	P	P	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	F	F	P	P	F	P
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	P	P	F	F	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	P	P	F	F	P
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	P	P	F	F	P
Adults	Habitat Complexity	Shelter Rating	F	P	P	P	P	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	F	P	P	P	P	P
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	F	F	P	P	P	P
Smolts	Habitat Complexity	Shelter Rating	F	P	P	P	P	P
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	F	P	F	F	P	F
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	V	F	G	F	P	F
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	F	P	F	F	F	F
Watershed Processes	Hydrology	Impervious Surfaces	V	V	F	V	V	V
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	F	F	G	F	F	F
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	F	F	F	F	F	F
Adults	Hydrology	Passage Flows	V	G	F	F	F	F
Smolts	Hydrology	Passage Flows	G	P	F	F	F	F
Eggs	Hydrology	Redd Scour	G	P	F	F	F	F
Watershed Processes	Landscape Patterns	Agriculture	V	F	G	P	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	F	G	G	V	G	V
Watershed Processes	Landscape Patterns	Urbanization	V	P	P	V	V	G
Adults	Passage/Migration	Passage at Mouth or Confluence	G	G	F	F	F	G
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	G	P	G	P	F	F
Smolts	Passage/Migration	Passage at Mouth or Confluence	G	F	V	V	F	G
Adults	Passage/Migration	Physical Barriers	G	F	G	V	V	F
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	G	P	V	V	F	F
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	G	G	G	G	F	G
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	F	V	P	F	P	P
Watershed Processes	Riparian Vegetation	Species Composition	G	F	P	G	F	P
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	P	P	P	P	P
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	P	P	P	P	P
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	P	P	P	P	P
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA
Eggs	Sediment	Gravel Quality (Bulk)	G	F	P	F	F	F
Eggs	Sediment	Gravel Quality (Embeddedness)	G	P	P	P	F	P
Adults	Sediment	Quantity & Distribution of Spawning Gravels	V	P	P	G	G	G
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	P	F	P
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	P	F	P
Watershed Processes	Sediment Transport	Road Density	G	P	P	G	V	F
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	G
Smolts	Smoltification	Temperature	F	G	F	G	G	V
Adults	Velocity Refuge	Floodplain Connectivity	G	P	P	G	F	P
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	G	P	P	F	F	F
Smolts	Viability	Abundance	F	P	F	F	F	F
Adults	Viability	Density	F	P	P	F	F	F
Summer Rearing Juveniles	Viability	Density	F	F	F	F	F	F
Summer Rearing Juveniles	Viability	Spatial Structure	G	G	G	P	G	F
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	G	F	P	F	F	P
Adults	Water Quality	Toxicity	G	F	P	F	F	F
Summer Rearing Juveniles	Water Quality	Toxicity	F	P	F	F	F	F
Winter Rearing Juveniles	Water Quality	Toxicity	F	F	F	F	F	F
Smolts	Water Quality	Toxicity	G	F	F	F	F	F
Adults	Water Quality	Turbidity	G	F	F	F	F	F
Summer Rearing Juveniles	Water Quality	Turbidity	V	F	G	G	F	F
Winter Rearing Juveniles	Water Quality	Turbidity	F	F	G	F	F	F
Smolts	Water Quality	Turbidity	G	F	G	F	F	F

Table 2: CCC steelhead DPS CAP Viability Summary by Life Stage for Russian River populations.

CCC Steelhead by Diversity Strata and Population - Russian River Watershed			North Coastal		Interior			
Target	Attribute	Indicator	Austin Creek	Green Valley Creek	Mark West Creek	Dry Creek	Maacama Creek	Upper Russian River
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	P	F	P
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	F	P	P	F	P	P
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	P	P	F	F	P
Adults	Habitat Complexity	Shelter Rating	F	P	P	P	P	P
Adults	Hydrology	Passage Flows	V	G	F	F	F	F
Adults	Passage/Migration	Passage at Mouth or Confluence	G	G	F	F	F	G
Adults	Passage/Migration	Physical Barriers	G	F	G	V	V	F
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	P	P	P	P	P
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA
Adults	Sediment	Quantity & Distribution of Spawning Gravels	V	P	P	G	G	G
Adults	Velocity Refuge	Floodplain Connectivity	G	P	P	G	F	P
Adults	Water Quality	Toxicity	G	F	P	F	F	F
Adults	Water Quality	Turbidity	G	F	F	F	F	F
Adults	Viability	Density	F	P	P	F	F	F
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	V	F	G	F	P	F
Eggs	Hydrology	Redd Scour	G	P	F	F	F	F
Eggs	Sediment	Gravel Quality (Bulk)	G	F	P	F	F	F
Eggs	Sediment	Gravel Quality (Embeddedness)	G	P	P	P	F	P
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	P	P	P	P	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	P	F	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	F	P	P	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	F	F	P	P	F	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	P	P	F	F	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	F	P	P	P	P	P
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	F	P	F	F	P	F
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	F	P	F	F	F	F
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	F	F	G	F	F	F
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	G	P	G	P	F	F
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	G	P	V	V	F	F
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	F	V	P	F	P	P
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	P	P	P	P	P
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	P	F	P
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	G	F	P	F	F	P
Summer Rearing Juveniles	Water Quality	Toxicity	F	P	F	F	F	F
Summer Rearing Juveniles	Water Quality	Turbidity	V	F	G	G	F	F
Summer Rearing Juveniles	Viability	Density	F	F	F	F	F	F
Summer Rearing Juveniles	Viability	Spatial Structure	G	G	G	P	G	F
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	P	F	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	F	P	P	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	P	P	F	F	P
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	F	F	P	P	P	P
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	G	G	G	G	F	G
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	P	P	P	P	P	P
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	G	P	P	P	F	P
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	G	P	P	F	F	F
Winter Rearing Juveniles	Water Quality	Toxicity	F	F	F	F	F	F
Winter Rearing Juveniles	Water Quality	Turbidity	F	F	G	F	F	F
Smolts	Estuary/Lagoon	Quality & Extent	F	F	F	F	F	F
Smolts	Habitat Complexity	Shelter Rating	F	P	P	P	P	P
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	F	F	F	F	F	F
Smolts	Hydrology	Passage Flows	G	P	F	F	F	F
Smolts	Passage/Migration	Passage at Mouth or Confluence	G	F	V	V	F	G
Smolts	Smoltification	Temperature	F	G	F	G	G	V
Smolts	Water Quality	Toxicity	G	F	F	F	F	F
Smolts	Water Quality	Turbidity	G	F	G	F	F	F
Smolts	Viability	Abundance	F	P	F	F	F	F
Watershed Processes	Hydrology	Impervious Surfaces	V	V	F	V	V	V
Watershed Processes	Landscape Patterns	Agriculture	V	F	G	P	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	F	G	G	V	G	V
Watershed Processes	Landscape Patterns	Urbanization	V	P	P	V	V	G
Watershed Processes	Riparian Vegetation	Species Composition	G	F	P	G	F	P
Watershed Processes	Sediment Transport	Road Density	G	P	P	G	V	F
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	G

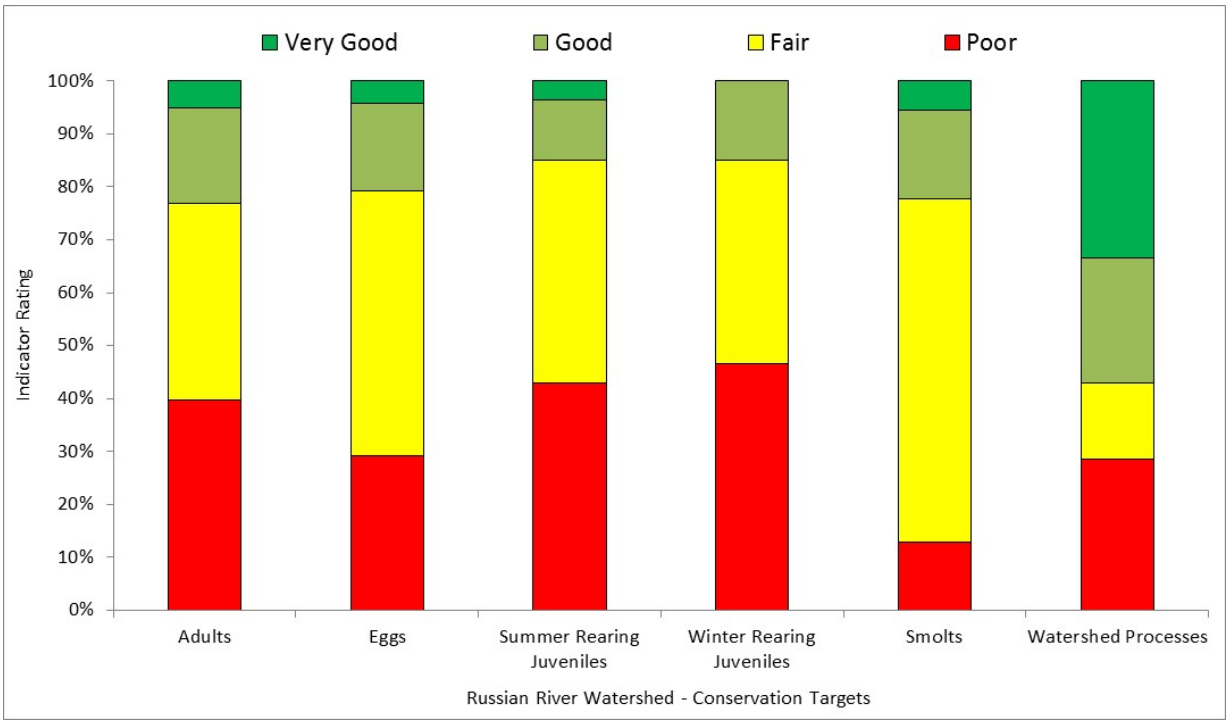

Figure 5: CAP Attribute Indicator ratings for the CCC steelhead life stages in the Russian River Watershed.

Current Conditions

The current conditions were rated for each life stage within six functionally independent or potentially independent populations of the Russian River Watershed. Based on the three current conditions rated the worst in each of the six populations, the three current conditions most frequently identified (in order) were Habitat Complexity: Large Wood and/or Shelter (6 populations), Sediment: Substrate/Food Productivity (5 populations) and Estuary: Quality and Extent (3 populations). Other current conditions, identified in the top three for each population were, Hydrology: Water Flow & Passage Flows (2 populations), Habitat Complexity: Percent Primary Pools & Pool/Riffle/Flatwater Ratios (1 population), and Viability: Reduced Density, Abundance, and Diversity (1 population). Overall, the Green Valley, Upper Russian River and Mark West Creek populations had the highest number of poorly ranked current conditions, while Austin Creek had the lowest. Population-specific results for current conditions are described in greater detail below under each population profile.

Threats

Table 3 summarizes the CAP threat results across the Russian River populations. The threats of greatest concern throughout the Russian River Watershed are Roads and Railroads, and Agriculture with 5 of 6 populations each rated High and 1 rated Medium. This was followed by Channel Modification (5 High, 2 Medium), Residential and Commercial Development, and Water Diversions and Impoundments (both with 3 High, 3 Medium). The Green Valley Creek and Upper Russian River populations received the highest rated threats amongst all Russian River populations. Population-specific results of threats and actions to ameliorate them are described in greater detail below under each population profile.

Table 3: CCC steelhead Threat Summary Table for Russian River Populations, where L=Low, M=Medium, H=High, and VH=Very High threat. Cells with [-] were not rated or not applicable.

Diversity Strata	Northern Coastal		Interior			
CCC Steelhead Threat/Population	Austin Creek	Green Valley Creek	Mark West Creek	Dry Creek	Maacama Creek	Upper Russian River
Agriculture	M	H	H	H	H	H
Channel Modification	M	H	H	H	M	H
Disease, Predation and Competition	L	L	M	L	M	M
Fire, Fuel Management and Fire Suppression	M	L	L	L	M	M
Fishing and Collecting	L	L	L	L	L	L
Hatcheries and Aquaculture	L	L	L	L	L	L
Livestock Farming and Ranching	L	M	L	L	M	M
Logging and Wood Harvesting	H	M	M	L	M	M
Mining	M	M	L	L	L	M
Recreational Areas and Activities	L	-	M	L	L	L
Residential and Commercial Development	M	H	H	M	M	H
Roads and Railroads	H	H	H	M	H	H
Severe Weather Patterns	L	H	M	M	M	M
Water Diversion and Impoundments	M	H	M	H	M	H

Literature Cited

Burghduff, A. E. 1937. Russian River improvement. California Department of Fish and Game. Sacramento, CA.

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Largomarsino. 1996. Status review of West Coast steelhead from Washington, Idaho, Oregon, and California. National Marine Fisheries Service, Northwest Fisheries Sceince Center and Southwest Region Protected Resources Division, NOAA Technical Memorandum, NMFS-NWFSC-27.

Christensen, W. 1957. Steelhead season longest in history. Press Democrat, February 10. Santa Rosa, CA.

Coey, R., S. Nassaman-Pearce, C. Brooks, and Z. Young. 2002. California Department of Fish and Game 2002 Draft Russian River Basin Fisheries Restoration Plan. California Department of Fish and Game,.

Ferguson, R. A. 1931. The Historical Development of the Russian River Valley, 1579-1865. Master's Thesis. University of California Berkeley.

NMFS (National Marine Fisheries Service). 2008. Biological Opinion. Water supply, flood control operations, and channel maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Ageny, and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River watershed. PCTS Tracking Number: F/SWR/2006/07316. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Region, PCTS: 2006/07316, Santa Rosa, California.

Prolysts Inc, and Beak Consultants Inc. 1984. Coyote Valley Dam fish mitigation study. Prepared for the U.S. Army Engineer District, Sacramento, CA.

Spence, B. C., E. P. Bjorkstedt, S. Paddock, and L. Nanus. 2012. Updates to biological viability criteria for threatened steelhead populations in the North-Central California Coast Recovery Domain. National Marine Fisheries Service, Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, CA.

SEC (Steiner Environmental Consulting). 1996. A History of the Salmonid Decline in the Russian River. Prepared for the Sonoma County Water Agency and the California Coastal Conservancy. Steiner Environmental Consulting, Potter Valley, CA.

Stindt, F. A. 1974. Trains to the Russian River. Pacific Coast Chapter of the Railway and Locomotive Historical Society, Inc. April 1974.

USACE (United States Army Corps of Engineers). 1982. Russian River Basin Study: Northern California Streams Investigation. U.S. Army Corps of Engineers, San Francisco District.

USBFF (United States Bureau of Fish and Fisheries). 1888. Fisheries of the Pacific Coast. Report of Commissioner of Fish and Fisheries for 1888. Washington, D.C.

Wilson, S. 1990. Sonoma County: River of Time. American Historical Press, Sun Valley, California.