Historical Distribution and Current Status of Steelhead/Rainbow Trout *(Oncorhynchus mykiss)* in Streams of the San Francisco Estuary, California

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Center for Ecosystem Management and Restoration

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FOREWARD

The document in your hands is the work of generations. When Dr. Robert Leidy first started walking the streams of the East Bay to make field observations of native fishes, he was following paths walked in previous centuries by other biologists. For years Rob made his way along brush- and concrete- covered stream banks, pulling nets and snorkeling in pools, and acquiring the written reports of his predecessors. Now, with the assistance of Gordon Becker and Brett Harvey, these decades of observations have been synthesized and analyzed in a scientifically authoritative manner and made publicly available.

Many Bay Area residents are surprised to discover that rainbow trout still inhabit our streams, and that every year steelhead (the ocean-going form of rainbow trout) enter our creeks from the ocean searching for spawning habitat. While the abundance of steelhead has been greatly diminished by the last 50 years of urban development, there still exist Bay Area streams where these magnificent fish make their way upstream to spawn in clear, clean, cold water.

Most fisheries scientists believe that with modest modifications to our water supply and flood control infrastructure, and revisions to the operations of certain facilities, we can return steelhead to many places they used to inhabit. Spurred by this knowledge, and the listing of steelhead as threatened pursuant to the Endangered Species Act, citizens and governmental agencies are at work in locations throughout our region on plans to restore these steelhead populations. The Center for Ecosystem Management and Restoration is pleased to provide the scientific information in this document to assist them in these restoration efforts.

The technical and political complexity of their task should not be underestimated. The responsibility for protection and restoration of these steelhead populations often rests with government agencies with no official mandate to restore or protect natural resources. These include flood control districts, water supply agencies, and public works departments, and these organizations are struggling to adapt to a new political environment in which they are responsible for managing lands and water resources to protect endangered species. The agencies face inevitable conflicts between their traditional mandates and these new responsibilities, and are working with local stakeholders to address conflicts, build new partnerships, and find supplemental funding opportunities.

Certainly, the fish appear willing to do their part. Adult steelhead have been found in downtown Hayward, after swimming 12 miles up a concrete flood control channel. Behind our major dams rainbow trout complete their lifecycle in human-made microcosms. Instead of their downstream migration leading to an oceanic journey of thousands of miles, these fish move downstream to reservoirs, where they live until it is time to return to the upper watershed to spawn.

If free to move downstream and back, there is every reason to assume these trout will resume the oceanic round trip of their ancestors, making these wild fish vital resources for restoration. In 2004 the National Marine Fisheries Service proposed that the rainbow trout in the Alameda Creek watershed be included in the officially threatened population, the first designation ever for a population located behind a dam. The report you hold provides for the first time an accessible and credible presentation of where these fish still survive, thanks in part to the maps prepared by the Center's cartographer David Asbury.

Restoration of steelhead in Bay Area watersheds is only just beginning, and their complex life cycle will test our capabilities. To be successful we must integrate management across political boundaries that make no ecological sense, encouraging diverse public and private entities to work together.

As with most challenging endeavors, there is much to be gained. The physical beauty and ecological integrity of San Francisco Bay and its watersheds are keys to our region's economic prosperity and quality of life. As Will Travis, Executive Director of the Bay Conservation and Development Commission, has noted "As the world's places deteriorate in quality, those that have been protected and enhanced will become even more precious. That is why enhancing the Bay Area's environment is such an important economic investment."

The return of one of nature's great spectacles to our counties will enrich the lives of Bay Area residents in non-monetary ways as well. The migratory journey of steelhead from stream to ocean and their indomitable return to their natal habitats have touched the human spirit for generations. Wallace Stegner argued that "something goes out of us as a people" when we drive species to extinction, and there can be no doubt that the restoration of wild creatures in our communities will return something to us and our children.

Critical policy decisions are presently being made that will shape the regional landscape for decades to come. Rob and his co-authors have shown that we have the opportunity to choose a path that includes the preservation and restoration of timeless and unique environmental resources for present and future Bay Area residents.

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INTRODUCTION

Five species of Pacific salmon (genus *Oncorhynchus*) are known from watersheds tributary to the San Francisco Estuary (Estuary), exclusive of the Sacramento and San Joaquin rivers and their tributaries that drain the Central Valley of California (Leidy 2004). Salmon species either historically or recently recorded from Estuary streams include coho salmon (*O. kisutch*), chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), and the non-anadromous and anadromous life-history forms of rainbow trout (*O. mykiss*). Recent status reviews indicate that natural populations of coho and chinook salmon and steelhead within coastal California have declined dramatically over the last 50 years, and populations apparently are continuing to decline in other regions (Brown et al. 1994; CDFG 2002; Myers et al. 1998; NMFS 1996, 1999, 2001). Status reviews have assisted the National Marine Fisheries Service in the identification of over 50 listed Evolutionary Significant Units (ESUs) for West Coast salmon and steelhead, including three ESUs that encompass the San Francisco Estuary[1].

The focus of this report is on the status of rainbow trout. However, information regarding coho salmon in Estuary streams was collected as part of the study that produced this report. Readers interested in the distribution of coho salmon are referred to the following: Leidy. R.A., G. Becker, and B.N. Harvey. In press. *Historical status of coho salmon in streams of the urbanized San Francisco Estuary, California*. California Fish and Game. Similarly, we researched the distribution of Chinook salmon in Estuary streams. The historical distribution and current status of chinook salmon in the Bay Area is the subject of research by G. Becker, to whom inquiries should be directed.

Anadromous rainbow trout, or steelhead, occur in California from the Smith River south along the coast to San Mateo Creek, San Diego County, and in streams of the San Francisco Estuary and Central Valley (Moyle 2002). Tributaries to the Estuary support the winter (ocean-maturing) steelhead ecotype, as well as non-anadromous, or resident, forms of rainbow trout[2]. We found historical records for the widespread occurrence of steelhead throughout the Estuary, but there is scarce information regarding the number of adult spawning fish. We also were able to locate information on resident rainbow trout or "landlocked" steelhead upstream from natural or man-made barriers, respectively. We were unable to locate any reliable estimates of the current population sizes of steelhead for any Estuary watershed, although we believe populations of adult spawning fish likely range between a few to less than 50 fish for many watersheds. In addition, documentation for the occurrence of steelhead in some streams consists of the sighting of one to a few migrating adults, often in non-consecutive years. In these instances, it is not clear whether these fish are members of viable "populations," particularly in the absence of other positive information on successful reproduction.

There is growing public interest in the conservation and restoration of anadromous salmonids in Estuary streams, especially steelhead (*O. mykiss*). Existing assessments of the historical status of anadromous salmonids in the Estuary generally have been cursory and incomplete. This is attributable largely to the lack of reliable qualitative information on the historical presence or absence of salmon in specific watersheds, as well as the absence of quantitative data on the number of spawning fish and population viability. In addition, the highly variable climatic conditions in watersheds surrounding the Estuary produce large ranges of intra- and inter-annual in-stream discharges. Estuary watersheds are characterized seasonally by intermittent stream flows and warm water temperatures, conditions not typical of salmonid streams of coastal northern California. This often has led biologists in the past to conclude that there is little or no suitable habitat present for anadromous salmonids within many Estuary watersheds. These factors have contributed to a perception that salmon and steelhead were never widespread or abundant, or where present, important members of Estuary fish assemblages. Consequently, until the mid-1980s management activities have been focused primarily on the planting of hatchery stocks of rainbow trout and steelhead into larger Estuary watersheds, or on the recovery of anadromous salmonids within other California watersheds, rather than the maintenance and restoration of habitat utilized by the remaining salmonid populations in the Estuary (Leidy 2002).

Initial steps in recovery planning efforts for threatened salmonids in the San Francisco Estuary requires an assessment of their historical and current status. The purpose of this paper, therefore, is to assess the historical and current status of steelhead in streams tributary to the San Francisco Estuary.

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Footnotes

[1] The North-central California Coast Recovery Planning Domain encompasses streams tributary to the San Francisco Estuary, exclusive of the Sacramento-San Joaquin rivers, which includes the Central California Coast Coho ESU (listed as threatened, October 1996), Central California Coast Steelhead ESU (threatened, August 1997), and California Coastal Chinook ESU (threatened September 1999).

[2] We follow the convention of McEwan (2001) when referring to anadromous and non-anadromous forms of rainbow trout (*O. mykiss*). We use “steelhead” and ‘”resident” when referring to anadromous and non-anadromous life history forms of rainbow trout, respectively. We use “rainbow trout” for populations where we are unable to determine the life history strategy. Individuals within populations of coastal rainbow trout exhibit varying life-history strategies and a continuum of migratory behaviors from anadromy (strong migratory) to residency (non-migratory).

METHODS

Determining Historical Distribution and Current Status

The primary goal of this study was to document the historical and current distribution and status of steelhead/rainbow trout (*Oncorhynchus mykiss*) within each watershed of the San Francisco Estuary. Sixty-eight watersheds were identified based on streams terminating in the tidal portion of the Estuary as shown on U.S. Geological Survey 7.5' maps. Within each watershed an effort was made to identify all primary and secondary tributary streams. Watersheds and their tributaries are discussed beginning with Marsh Creek, in eastern Contra Costa County, and continuing in clockwise direction around the Estuary to Suisun Creek, Solano County.

We assessed the past and present distribution of *O. mykiss* using historical and recent records. We also reviewed maps depicting historical conditions produced by the San Francisco Estuary Institute, as well as data collected during 1993-1998 surveys by the senior author, and more recent surveys and observations by various federal, state, and local biologists. We assumed that historically streams supported *O. mykiss* upstream to natural impassable barriers, or to the upstream-most point containing sufficient instream habitat, in two instances. The first instance is when reliable historical records are available but the stream currently does not support *O. mykiss*. The second is when reliable historical records are not available, but the stream currently supports *O. mykiss*.

Historical Records

We collected historical records on the distribution and abundance of *O. mykiss* from published literature, unpublished reports and studies, field notes and specimens housed at museums and universities, public agency files, and through interviews with individuals knowledgeable of *O. mykiss* within particular streams or watersheds. Historical records varied widely in the type, quality, and reliability of information. We categorized the information sources to reflect these characteristics (see description of "Data Type" below). We also distinguished between qualitative historical information and historical data that addressed fisheries resources quantitatively through population density estimates, fish counts or other measurements.

Fish Sampling

We conducted fish sampling between 1992-1998 as part of a more comprehensive project to determine the distribution and status of native stream fishes of the Estuary (Leidy 2004). The primary goal of fish sampling was to augment historical records and document the present distribution of native stream fishes, including *O. mykiss*, at a particular sampling location. Streams known to contain *O. mykiss* based on historical records were sampled, as well as additional sites representing habitats where historical information was incomplete.

At each location, an effort was made to sample the full range of habitat types (*e.g.*, riffle, run, pool) within representative stream reaches and geomorphic settings (*e.g.*, high-elevation, high- gradient, bedrock controlled; low-elevation, low gradient, alluvial unconsolidated bottom, *etc.*). Selection of sampling sites was stratified to maximize the diversity of habitat types in different geomorphic settings. Stream reaches typically were sampled above the influence of diel tidal fluctuations, but exceptions were made on a case-by-case basis. Selection of fish sampling techniques depended upon site-specific physical characteristics and conditions, and the sampling method that would most thoroughly sample a site was employed.

Fish sampling relied on one or more of the following techniques: electrofisher, minnow or beach seine, dip net, gill net, and snorkel and mask. Sampling with a Smith-Root Type XI backpack electrofisher was the technique we most often employed, primarily in reaches with depths of less than one meter and water velocities of less than three feet per second. Electrofishing was conducted in a downstream to upstream direction in a reach 30 meters in length, except where circumstances dictated other approaches. We sampled single or multiple pools less than 30 meters in length when the reach contained isolated pools less than 30 meters in length that were embedded in a matrix of dry stream channel materials.

In each reach, a minimum of 30 meters typically was sampled, and the sampled reach often exceeded this distance. Reach lengths greater than 30 meters were sampled when either no or few fishes were collected within the first 30 meters sampled. This additional sampling effort was directed at ensuring correct conclusions regarding presence or absence.

We attempted to sample all habitat types within a reach with equal effort (*i.e.*, sampling time and area sampled). However, habitats immediately adjacent to stream banks often received more intensive sampling because they typically provided the most heterogeneous habitat for fishes, as measured by instream structure and overhead riparian cover. Block nets were used at the upstream and downstream ends of the sampling site if physical conditions (*e.g.*, high water velocities, poor water clarity, *etc.*) warranted their use to capture fish more effectively. We electrofished using either two- or three-person crews, with all members of the crew collecting stunned fish by dip net.

Fish sampling at depths greater than one meter typically was accomplished using minnow and/or beach seines or gill nets, or by snorkeling with a mask. Sampling effort varied between these methods although we attempted to conform to the minimum 30 meter sampling distance. A student minnow seine was used to depths of one meter while depths of between one to two meters were sampled with a beach seine. Student and beach seines were constructed of 6 mm mesh and were 1.5 meters by 2 meters and 2 meters by 4 meters in depth and width, respectively. Very shallow habitats (typically less than five cm depth) where electrofishing and larger nets were not effective were sampled either with small size mesh dip nets (4-6 mm mesh) or fish were identified visually.

We recorded the following information at each collection site: sampling date and time; stream name(s) and narrative location; sampling station, numbered sequentially for all sites sampled on the same date; county name; elevation (m) from the USGS 7.5' topographic maps; and, USGS quadrangle name. We measured or counted all fish captured (mm FL or TL) unless more than 30 individuals of were caught, in which case a representative sample of 30 fish was measured. We estimated the abundance of young-of-the-year (YOY) and abundance (1-3 scale, 1 = less than 25 individuals, 2 = 25-50 individuals, and 3 = greater than 50 individuals). An estimate of the number of *O. mykiss* per 30 meters of stream based on captured fish and visual counts was made at each sampling site.

Additional characteristics of the habitat that were estimated or measured included substrate composition, water depth, channel cross section, other fish species, air and water temperature, discharge, cover, aquatic vegetation and others. Persons interested in detailed information for particular sampling locations are encouraged to contact the senior author.

All fish were identified using one or more of the following references: Moyle (1976); Moyle (1976 as per 1997 key revisions), and Lawrence and Burr (1991). All collected fish were released. Each sampling site was photo-documented by taking a minimum of two photographs with a wide angle lens. One photograph was taken looking upstream and one downstream from a location at the center point of the sampling reach. Unless otherwise noted, all habitat inventory protocols in this study followed those described in Flosi and Reynolds (1994).

Information Presented in the Report

The body of the report conveys information we use in determining the historical distribution and current status of *O. mykiss* in San Francisco Estuary streams. Typical attributes of the information include surveying organization or individual, survey month and year, survey location, and survey results such as fish presence/absence and fish or population characteristics (*e.g.*, size, density). Where we determine that additional information contained in surveys or other information sources is important to the analysis, we include it in the discussion provided in the body of the text.

Supplemental information most often includes descriptions of known migration barriers, relevant habitat descriptions, or habitat impairment factors. We do not restate most habitat descriptions contained in our information sources because of the changeable nature of the resource, and the amount of variability in the habitat assessment methods applied and the quality of the analyses. Rather, we note instances where reliable surveyors make statements we believe accurately characterize *O. mykiss* populations or habitat in particular watersheds. In particular, we summarize or quote statements that established the relative importance to a particular fishery of streams within a watershed.

A descriptive "assessment" also is provided for each watershed. Assessments are intended to distill the narrative describing a mainstem stream and its tributaries into a readily usable form. They summarize historical and current *O. mykiss* presence/absence determinations and factors affecting distribution and abundance over time. This study does not include a ranking of the relative importance of the various watersheds to the regional steelhead fishery. However, the assessment sections in some cases indicate where a watershed is clearly of regional significance.

Tables describing *O. mykiss* historical distribution and current status in San Francisco Estuary streams are presented in the report including key descriptors of the data used to draw these conclusions. Information on the *O. mykiss* status of all watersheds and streams is summarized by county at the end of each chapter. Table headings and terms are defined as follows.

Watershed: Name of the watershed designated by the primary stream that terminates in the tidal portion of the Estuary.

Stream/Tributary: Mainstem stream or the primary and secondary tributaries to the main watershed stream. Tributary streams are ordered in a downstream to upstream direction.

Years Surveyed/Quantitative Data: The first value in this column indicates the number of years that observations were made in a particular stream. The second value is the number of years for which quantitative data indicating presence exist. Surveys were said to have quantitative data when they included such measurements as fish counts, lengths and densities.

Period of Record: The time interval in years from the first record of the presence of *O. mykiss* to the most recent. If a more recent survey was conducted and did not find *O. mykiss*, its year is indicated in bold beneath the years of the period of record.

Data type: The value in this column is either "0," "1," "2," or "3," and corresponds to information types as described below.

0 *Anecdotal evidence*. Anecdotal evidence of the presence of *O. mykiss* typically consists of personal observations and verbal accounts. Anecdotal evidence often is indirect and in the form of "second hand" accounts passed between individuals. Anecdotal evidence typically is the least reliable for confirming presence/absence of *O. mykiss*, but may be useful in certain instances when combined with other more reliable information sources.

1 *Direct observational evidence*. Evidence is through direct observation by individuals competent in the identification of *O. mykiss*. Direct observation often includes semi-quantitative or quantitative data collected during visual stream surveys. Direct observation may include presence/absence data or abundance estimates based on counts of the number of juvenile/adult fish per standard length of stream. Direct observation often is the most common data type cited as evidence of use of a stream by *O. mykiss*.

2 *Electrofishing*. Sampling involves single or multiple pass electrofishing.

3 *Other*. These data include evidence collected from other standard sampling methods such as seining, dip netting, creel census and redd counts, carcass surveys, or snorkeling.

Life History Stage/Number of Years Data. The first value in this column is the life history stage for which there are data. Possible values are J = juvenile (including fry), S = smolt, R = resident, non-migrating adult, and M = adult migrant. The second value in this column is the number of surveys conducting on a stream that produced data relating to the life history phase.

Anadromy Possible. Values indicate whether streams support anadromous *O. mykiss* populations.

Y *Yes*. Current evidence indicates natural propagation is successfully occurring in the stream, or in upstream tributaries of the stream, and no complete barrier to upstream and downstream migration exists between the area of natural propagation and the ocean.

N *No*. Either a complete migration barrier exists between the ocean and any naturally propagating populations, or current evidence indicates *O. mykiss* are not present or are not naturally propagating in the stream.

UNK *Unknown*. The current status of passage conditions or *O. mykiss* populations is undetermined.

Historical, Current Status. Values indicate the probability of the existence of an historical and/or current spawning run or population. For purposes of this document, "historical" means before 1992, while "current" reflects status in the last ten years. The values are defines as follows.

DF *Definite Run or Population*. Streams for which there is reliable, direct evidence for fish use, such as collections made during stream surveys, published literature, unpublished biological or archaeological reports and surveys, and museum surveys. These sources may be combined with other historical and current evidence on the existence of suitable habitat.

PB *Probable Run or Population.* Streams for which there is some reliable direct evidence for fish use, and we were able to determine that suitable habitat existed historically. This determination was made using information concerning stream habitat characteristics based on reference data, or knowledge of the current presence of suitable habitat.

PS *Possible Run or Population.* Streams for which there is minimal or no direct reliable evidence of fish use, but suitable habitat existed historically or is currently present.

NP *No Population.* Streams for which there is no evidence of fish use and inferences from historical and current habitat conditions (*e.g.*, extreme ephemeral runoff conditions, barriers to upstream migration of fishes, lack of suitable spawning and/or rearing habitat, *etc.*) indicate the lack of suitable habitat.

UNK *Unknown/Insufficient Information.* Streams for which there is insufficient information on fish use and/or historical and current habitat conditions.

We used several sources of information to discern the status of *O. mykiss* in Estuary streams. Evidence of a run or the existence of a population did not require that fish be recorded every year. Rather, we used existing evidence, our best professional judgment, and the judgments of other researchers to assess the likelihood that *O. mykiss* either regularly or intermittently utilized a particular stream. Because *O. mykiss* within the San Francisco Estuary are adapted to highly variable climatic, rainfall, and stream discharge conditions, we assumed that a stream contained suitable habitat for steelhead even if fish were not recorded in successive years.

The population/run status designations assigned to Estuary streams also are indicated on plates at the end of this report. It should be noted that our coding system reflects the “blue line” stream location of our mapping data sources rather than the extent of habitat use by *O. mykiss*.

Current Population Status. Current status of a population in a stream is indicated by the following values: 0 = population absent or unknown, 1 = population present, 2 = population reproducing, as evidenced by the presence of age 0+ and 1+ juveniles, and 3 = multiple age classes present.

References. Values in this column correspond to bibliographic entries that present evidence or documentation of the status of *O. mykiss* in the given stream. Personal communication references are listed in parentheses.

Mapping Methods

The maps prepared for this publication were compiled with data from various sources. In order to make this dataset as widely accessible as possible and to permit future expandability, we choose a comprehensive, standardized data format based on the National Hydrography Dataset (NHD) produced by the United States Geological Survey (USGS). This dataset includes error and uncertainty, but is one of the most up to date and reliable sources available. We have modified the data to make them more accurate, as outlined below, but some uncorrected error likely remains. Please see the NHD metadata for more information about accuracy.[1]

We established individual map boundaries by grouping streams that enter the San Francisco Estuary within a particular county, and thus some “county” maps may include land from adjacent counties in the upper portions of the watershed. The watersheds of these streams were acquired from the CalWater 2.2 database[2] and checked for consistency with USGS Hydrologic Unit Codes (HUC) and a 7.5' Digital Elevation Model (DEM) from *National Geographic TOPO!*.[3] ArcMap's generalization tool, Dissolve, was used to create a single polygon for each "county".

In some instances (notably eastern Contra Costa County) the CalWater boundaries were either inaccurate or insufficient for the purposes of our report. In these cases we modified the boundaries to reflect reliable references and professional judgment. For example, historical East Bay stream reaches and names were determined using maps published by the Oakland Museum of California[4] as well as other sources.

The NHD is a reach-based dataset, but for this report we were interested in characterizing entire streams. Therefore, we merged reaches on the same stream (using the generalization tool, Dissolve) on the "GNIS_Name" field. We then coded each stream with a status designation from the report. Where stream reaches delineated in the NHD were discontinuous, we made digital connections primarily based on the Oakland Museum maps and USGS topographic data.

The maps were generated with ESRI's *ArcMap 9.0 (Build 538)*, using a Geographic Coordinate System based on the North American Datum of 1927 (NAD27). This datum was taken from the map's base layers, which are a subset of the *National Geographic TOPO!* California State dataset. The NHD and Calwater 2.2 data were projected to this datum from their native format, formerly NAD83, using ArcMap's projection algorithm. Metadata included in the geodatabase complies with Federal Geographic Data Committee standards.

We adopted naming conventions from the Geographic Names Information System (GNIS) except where a stream reach had not been listed in the database. In these instances, we substituted common names into the "GNIS_Name" field. We also accounted for misspellings, inaccuracies, and differences from common usage in the GNIS database in this manner. For example, "Positas, Arroyo Las" became "Arroyo las Positas".

A number of geoprocessing tasks were undertaken to manipulate the various input data into useful information for the purposes of this report. (A full description of the mapping protocol may be obtained by contacting CEMAR or referring to the CEMAR website.) The final dataset consists of the consolidated stream reaches, the modified GNIS naming information, and the designations of historical distribution and current status of *O. mykiss* from the report.

References

1. See http://nhd.usgs.gov for extensive information on the National Hydrography Dataset.

2. See http://www.ca.nrcs.usda.gov/features/calwater/ for information regarding the CalWater dataset.

3. National Geographic TOPO! (2003). California Seamless USGS Topographic Maps on CD-ROM.

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Marsh Creek Watershed

Marsh Creek flows approximately 30 miles from the eastern slopes of Mt. Diablo to Suisun Bay in the northern San Francisco Estuary. Its watershed consists of about 100 square miles. The headwaters of Marsh Creek consist of numerous small, intermittent and perennial tributaries within the Black Hills. The creek drains to the northwest before abruptly turning east near Marsh Creek Springs. From Marsh Creek Springs, Marsh Creek flows in an easterly direction entering Marsh Creek Reservoir, constructed in the 1960s. The creek is largely channelized in the lower watershed, and includes a drop structure near the city of Brentwood that appears to be a complete passage barrier. Marsh Creek enters the Big Break area of the Sacramento-San Joaquin River Delta northeast of the city of Oakley.

Marsh Creek

No salmonids were observed by DFG during an April 1942 visual survey of Marsh Creek at two locations: 0.25 miles upstream from the mouth in a tidal reach, and in close proximity to a bridge four miles east of Byron (Curtis 1942). In August 1975 DFG again surveyed the creek from Marsh Creek Reservoir upstream to the headwaters adjacent to Morgan Territory Road and did not observe salmonids (Curtis and Anderson 1975). In a 1978 memorandum, DFG characterized Marsh Creek as seasonal and probably lacking any significant fishery resource (Anderson 1978).

In May 1981, Marsh Creek was sampled by seine and gill net at ten locations between the mouth and mid-elevation sites adjacent to Marsh Creek Road. No salmonids were collected (Leidy 1984).

EBRPD electrofished two Marsh Creek sites upstream and downstream from the Round Valley Creek confluence in July 1996. No *O. mykiss* were found (EBRPD 1996-1999).

Several intermittent headwater tributaries to Marsh Creek, including Curry Canyon, Perkins Canyon, and Dunn creeks were surveyed within Mt. Diablo State Park by California Department of Parks and Recreation biologists during 1985, and were found to contain no fish (Taylor 1985). Curry Canyon and Perkins Canyon were noted as intermittent streams, while Dunn Creek receives permanent flow from springs at the headwaters of Horse Creek adjacent to the Mount Diablo Mercury Mine.

Assessment: Construction of the drop structure near Brentwood and the Marsh Creek Reservoir blocked any existing runs of *O. mykiss* from reaching suitable habitat in the headwaters of Marsh Creek. We could not find evidence of the presence of historical *O. mykiss* in the headwaters of Marsh Creek. However, *O. mykiss* runs may have occured prior to the construction of Marsh Creek Reservoir.

Mt. Diablo Creek Watershed

The headwaters of Mt. Diablo Creek consist of approximately 12 small, intermittent and perennial streams originating on the north slope of Mt. Diablo. From its headwaters, Mt. Diablo Creek flows in a northwest direction for 15.5 miles to its confluence with Suisun Bay. The watershed of Mt. Diablo Creek comprises about 56 square miles.

Mt. Diablo Creek

In 1855, Ayres presented specimens to the California Academy of Natural Sciences including a species he designated *Salmo rivularis.* According to Ayres, this form was "distinct" from *S. iridea*, the species described by Gibbons in 1855 from San Leandro Creek in Alameda County. Ayres' specimens were taken a few miles south of Martinez, toward the foot of Mount Diablo, and are believed to have been collected from either the Mt. Diablo Creek watershed or the Walnut Creek watershed. Ayres observed that the largest specimen was about 200 mm in length (Ayres 1855). The small maximum length is consistent with that of *O. mykiss* sampled in the headwaters of Mt. Diablo Creek (see discussion under Mitchell Creek, below).

According to staff at the Mt. Diablo Country Club golf course near Concord Naval Weapons Station, *O. mykiss* spawning migrations were observed during the1960s and 1970s (Leidy 2002). A November 1977 DFG visual survey of five sites along Mt. Diablo Creek between RM 7.6 and RM 11.5 concluded that although the reach was dry at the time of the survey, Mt. Diablo Creek had good potential for anadromous fish due largely to the presence of springs feeding portions of the mainstem and some tributaries (Reineck and Paulsen 1977). Management as an anadromous fishery was recommended. According to the survey report, the major limiting factor of the stream's productivity is its intermittent nature (Reineck and Paulsen 1977). The survey also noted that, according to the Contra Costa Flood Control and Water Conservation District and the city of Concord, Mt. Diablo Creek contained no downstream barriers to fish migration.

During September 1981, Mt. Diablo Creek was seined at the Kirker Pass Road crossing and immediately upstream of the tidally influenced portions of the stream in a large pool upstream from the Port Chicago Highway crossings. Neither site contained *O. mykiss* (Leidy 1984).

In August 1988, EBRPD and Mt. Diablo State Park staff noted surface flow in approximately 400 yards of Mount Diablo Creek near the confluence with Mitchell Creek, but did not find *O. mykiss* (Alexander 1988). EBRPD staff noted that this section of creek with its perennial flow was the most promising area for creek enhancement and the introduction of native rainbow trout (Alexander 1988). EBRPD staff further concluded that flows downstream of the perennial reach to at least Concord Naval Weapons Station were insufficient to provide salmonid habitat in normal water years.

Leidy sampled seven sites between the tidal portion of Mt. Diablo Creek and its headwaters near Clayton by electrofishing in June 1998. No *O. mykiss* were collected. (Leidy 2002).

Mitchell Creek (Mitchell Canyon Creek)

Mitchell Creek is an intermittent stream draining the northwest slopes of Mt. Diablo. It flows four miles from the Eagle Peak area generally north before entering Mt. Diablo Creek near the town of Clayton.

A 1977 DFG visual survey of Mitchell Creek immediately upstream from its confluence with Mt. Diablo Creek (near Clayton Road, Clayton) noted that the stream channel was dry, and rated Mitchell Creek as having "poor-fair" anadromous fishery value due in part to grazing and housing development (Reineck and Paulsen 1977).

In April 1985, the California Department of Parks and Recreation collected 13 *O. mykiss* from a 73-meter reach of Mitchell Creek located at about the 920-foot contour line in Mt. Diablo State Park (Taylor 1985). The sampled fish were age 1+ and ranged between 108-200 mm FL. It was concluded that YOY fish were not collected because they had yet to emerge from the gravels. The entire population of *O. mykiss* within the sampled area was estimated at approximately 190 individuals, with probably less than 500 fish for all of Mitchell Creek. An additional three *O. mykiss* were collected at a downstream pool where Mitchell Canyon Road crosses over the stream. The sampling report noted that the Mitchell Creek population was likely to be the only wild rainbow trout population in the San Ramon Valley and recommended monitoring and genetic studies (Taylor 1985). Park staff estimated that approximately 3,500 feet of stream channel maintained permanent flow.

During November of 1985, DFG electrofished pools in a 122-meter reach of Mitchell Creek approximately 1.5 miles upstream from the Mt. Diablo State Park ranger residence and collected six *O. mykiss* (75-198 mm FL) (Gray 1985). Three of the largest fish were found to be sexually mature (two males and one female), suggesting that these were resident fish.

In 1988, EBRPD staff estimated the *O. mykiss* population in Mitchell Creek at approximately 200 fish that were restricted during dry periods to a 0.25 mile reach of stream fed by springs in the upper canyon (Alexander 1988). Fish were reported to reach a maximum of about 200 mm TL, and EBRPD staff concluded that growth and size would be limited by the small volume of flow and useable habitat area. Riparian and substrate conditions were described as "good" to "very good" for salmonids from the headwaters to the confluence with Mt. Diablo Creek (Alexander 1988).

Leidy visually surveyed Mitchell Creek within Mt. Diablo State Park in December 1993, and observed *O. mykiss* (5-10: 50-100 mm FL) in small pools in a 30-meter reach (Leidy 2002). According to EBRPD staff, this population no longer persists (P. Alexander pers. comm.).

Irish Canyon

In November 1977, DFG conducted a visual survey of Irish Canyon Creek in the vicinity of an impassable drop structure at the crossing of Nortonville Road, approximately 1.25 miles upstream from its confluence with Mt. Diablo Creek (Reineck and Paulsen 1977). In the report, DFG noted that the stream channel was dry, and rated Irish Canyon Creek as having "poor" anadromous fishery value due to heavy grazing practices.

Donner Creek

In November 1977, DFG visually surveyed Donner Creek immediately upstream of Clayton Road. Anadromous fishery value was rated "fair," although past grazing and recent housing development were attributed as causing habitat degradation (Reineck and Paulsen 1977). Informal surveys of Donner Creek indicate that the watershed does not presently support an O. mykiss population (J. Hale pers. comm.).

Assessment: Anecdotal accounts of anadromous *O. mykiss* spawning migrations and the recent occurrence of *O. mykiss* in a headwater tributary, Mitchell Creek, is evidence for the historical use of Mt. Diablo Creek by anadromous *O. mykiss* as a migratory corridor. In addition to Mitchell Creek, suitable rearing habitat for *O. mykiss* also may be available within two perennial reaches of Mt. Diablo Creek and in the lower watershed near Concord Naval Weapons Station opposite the Mt. Diablo Country Club.

Walnut Creek Watershed

The Walnut Creek watershed is the largest within Contra Costa County, covering a total of 183 square miles. The creek itself is formed by the confluence of Las Trampas and San Ramon Creeks near the downtown district of the city of Walnut Creek. Other important tributaries include Pine and Galindo Creeks, which join Walnut Creek in the lower watershed. From the confluence with San Ramon Creek, Walnut Creek flows north for approximately ten miles to where it enters Suisun Bay east of the Carquinez Strait. This portion of the watershed consists of about 20 square miles. A flood control drop structure between the Willow Pass Road and Highway 242 crossings limits anadromous fish migration to all direct tributaries of Walnut Creek except Pacheco, Grayson and Pine Creeks. The drop structure is maintained by the Contra Costa County Public Works Agency.

Walnut Creek

As discussed previously in the Mt. Diablo Creek section, Ayres described specimens believed to be *O. mykiss* from either the Mt. Diablo Creek or Walnut Creek watershed Ayres in 1855. Anecdotal evidence concerning Walnut Creek watershed fish species indicates that O. *mykiss* migrated into Walnut Creek tributaries between the 1950s and the mid-1960s (Cogger and Reineck 1977c; Johnson 1957; Leidy 1983)(see also Pine Creek discussion in the following text).

In July 1977, DFG visually surveyed Walnut Creek from its mouth to the confluence of San Ramon Creek. The survey noted that about 95 percent of the channel had been altered by construction of levees or concrete channels (Gillespie and Richardson 1977c). No salmonids were found throughout the stream. The survey also identified two drop structures as potential migration barriers to anadromous fish. The first, 12 feet high, is located 0.5 miles upstream of Willow Pass Road and the second, 15 feet high, is located immediately downstream from the Bancroft Road crossing. The DFG survey report recommended the construction of fishways on the two existing drop structures if the headwater streams were found to contain significant potential anadromous salmonid habitat (Gillespie and Richardson 1977c). The survey identified low summer flows as limiting fish survival, concluding that water diversion during the summer and fall months should be curtailed.

In June 1978, DFG electrofished and seined a pool below the Bancroft Road drop structure and found no salmonids (Paulsen 1978c). In November 1978, USFWS reported on the results of a Walnut Creek habitat evaluation conducted in relation to the Walnut Creek Project, which was started in 1964. No salmonids were noted during associated biotic resources surveys (McKevitt 1978). As part of a fish distribution study, three Walnut Creek sites were sampled by electrofishing in October and November 1980, and no salmonids were found (Leidy 1983).

In 1983, the USFWS completed a study of the Walnut Creek watershed basin in relation to the Walnut Creek Project. The study noted that the steelhead population declined markedly about the late 1950s, as reported by local residents, but that a small number of steelhead still entered the Walnut Creek basin each year, except for the 1976-1977 drought period (Ging 1983). The study also noted that between 1981 and 1983, both steelhead fishing effort and catch increased dramatically (Ging 1983). The USFWS observed steelhead redds downstream of the drop structure near the Willow Pass Bridge, but noted that the reach would likely have value only as a migratory corridor without the presence of barriers. Overall, the study rated existing steelhead habitat in the Walnut Creek basin as "fair to poor" (Ging 1983). In a planning aid letter associated with the study, USFWS stated the Walnut Creek Project had adversely affected habitat conditions for steelhead trout by reducing adult escapement by at least 100 fish (McKevitt 1983).

DFG conducted a pilot creel census in Walnut Creek from November, 1983 through February, 1984. During this period, four *O. mykiss* were observed downstream from the Willow Pass Road drop structure (Meyer 1984). The steelhead were deemed of hatchery origin. The report noted that steelhead do not spawn in Walnut Creek. Observations by anglers indicate that adult fish migrate to the reach below the first drop structure near Willow Pass Road, beginning with the first rains in October and continuing through early January. Adult fish then leave Walnut Creek after a few weeks (Meyer 1984). A September, 1984 electrofishing and seining survey at the Pine Creek confluence found no *O. mykiss* (Barlow 1984).

A 1990 fisheries enhancement study reviewed the historical and present distribution of salmonids in the Walnut Creek basin. The study concluded that steelhead historically used the entire Walnut Creek basin as spawning, nursery and rearing habitat (HRG 1990). The report noted that *O. mykiss* annually entered the lower reaches of Walnut Creek, and migrated upstream as far as the drop structure at Willow Pass Road (HRG 1990).

About 2,300 feet of Walnut Creek was studied for fish habitat potential in September, 1990 including electofishing at one location (HRG 1990). The study concluded that Walnut Creek provided little good habitat for salmonid fishes and noted that two drop structures downstream of the city of Walnut Creek probably allowed passage for few, if any, salmonid adults (HRG 1990). One *O. mykiss* (105 mm SL) was collected during the study upstream from the two drop structures, near the Lincoln Avenue Bridge proximate to downtown Walnut Creek. Observations reported in the study indicated that steelhead engaged in spawning activities downstream of the Willow Pass Road drop structure, including the building of about 25 redds in the winter of 1989-1990 (HRG 1990).

DFG *Scientific Collecting Permit Report Forms* and associated data sheets indicated that two *O. mykiss* fry were taken from Walnut Creek south of the Willow Pass Road crossing, downstream from the drop structures, in April 1990 (Williamson 1990-1993). Smolt trapping in May 1992 produced two *O. mykiss* (41 mm, 65 mm) at a site upstream of the Concord Ave. Bridge, which is below the drop structures.

Leidy electrofished seven sites in November-December 1993 and six sites in May-June 1997 throughout the reach between the mouth of Walnut Creek and the lower most drop structure. No *O. mykiss* were collected (Leidy 2002).

Staff of the city of Pleasant Hill and USFWS have observed adult migrant *O. mykiss* in Walnut Creek during the spring every year for the last ten years. These fish have been observed below the most downstream drop structure (J. Hale pers. comm.).

Grayson Creek

Grayson Creek is the only major tributary to lower Walnut Creek that flows from the west. The creek originates in the Briones Hills and runs through the highly urbanized city of Pleasant Hill to join Walnut Creek in its lower reach. Much of Grayson Creek is confined within a concrete or earthen flood control channel.

In 1978, an investigation of a fish kill caused by a chemical spill found no *O. mykiss* among the dead fish between Concord Avenue and Pacheco Avenue, in the city of Pleasant Hill (CDFG 1978). During October and November 1980, two sites were electrofished and seined on Grayson Creek as part of a fish distribution survey. No salmonids were found (Leidy 1983). A 1983 USFWS steelhead trout study concludes that the creek provides neither spawning nor rearing habitat due in part to channelization and channel clearing (Ging 1983).
Leidy sampled two reaches in August 1997 and June 1998, a 15 meter reach of Grayson Creek approximately 300 feet upstream from the confluence with Walnut Creek, and a 24 meter reach approximately 300 feet downstream from Interstate 680, respectively. Neither survey found *O. mykiss* (Leidy 2002).

Pine Creek

Pine Creek is formed by several small tributaries draining the northwest slopes of Mt. Diablo and flows through Ygnacio Valley, entering Walnut Creek in its lower reach. The lower portion of Pine Creek is largely channelized and contains several passage barriers. Access to anadromous fish is confined to the lowest 4.7 stream miles and Pine Creek Flood Control Dam, constructed in 1956 further upstream, also is a complete fish passage barrier.

Anecdotal evidence reported by DFG suggests that resident and anadromous *O. mykiss* were common in Pine Creek in the 1950s, but became rare in the late 1960s (Cogger and Reineck 1977c). A DFG survey of Pine Creek cited dam construction workers as reporting a few steelhead below the dam during January 1956 (Johnson 1957). *Oncorhynchus mykiss* were observed at Castle Rock Park in 1963 and 1964 (J. Hale pers. comm.).

In July 1977, DFG observed no salmonids during a visual survey of the seven miles of Pine Creek upstream of the Walnut Creek confluence. The report stated that channelization had eliminated suitable spawning and nursery habitat for salmonids, concluding that lower Pine Creek was essentially lost to anadromous salmonid use (Gillespie and Richardson 1977a). In August 1977, DFG surveyed the reach between RM 7.2 and RM 9.3, and again observed no salmonids. The report concluded that this reach of Pine Creek appeared to have limited value as a spawning and nursery stream for anadromous salmonids, but could provide access to Little Pine Creek and Arroyo Cerro, both of which provided fair to excellent steelhead salmonid habitat (Cogger and Reineck 1977c).

As part of a fish distribution study, one location on Pine Creek was sampled by pole seine in September 1981 and produced no *O. mykiss* (Leidy 1984). For a 1983 USFWS steelhead habitat study of the Walnut Creek basin, staff visually surveyed the lower four miles of Pine Creek. The USFWS found that all but 0.25 miles of the surveyed reach was channelized and confined with concrete or earthen sides, and concluded that Pine Creek had no steelhead habitat of any significance (Ging 1983).

A report concerning the aquatic resources of Mt. Diablo State Park stated that steelhead and silver salmon once ascended Pine Creek at least to the vicinity of Castle Rock Park, but that the construction of Pine Creek Flood Control Dam in 1956 closed off Pine Creek to anadromous fish (Taylor 1985).

Galindo Creek

Galindo Creek is the lowermost tributary of Pine Creek. It begins on the east slopes of Lime Ridge and west slopes of Mt. Zion, and flows north and west for 6.5 miles before joining Pine Creek approximately one mile above the confluence of Pine and Walnut Creeks.

In January 1976, an investigation of a fish kill found no *O. mykiss* among the dead fish between Treat Boulevard and Monument Boulevard in the city of Concord (Schmidt 1976). The downstream four miles of the Galindo Creek from the Pine Creek confluence to Wharton Way were assessed for steelhead habitat in January 1983. While no *O. mykiss* were observed, many pools suitable for steelhead rearing were noted (Ging 1983). The report concluded that channelization, low summer flows, lack of spawning gravel, and high water temperatures may preclude steelhead use of Galindo Creek (Ging 1983).

Little Pine Creek

Little Pine Creek drains an area of approximately 2.2 square miles. It flows from the northwest slopes of Mt. Diablo about three miles to the confluence with Pine Creek.

In August 1977, DFG visually surveyed a 2.4-mile reach of Little Pine Creek upstream of the confluence with Pine Creek. The survey noted that spawning potential was very good in the upper reach and fair to poor in the lower reach, and that the frequency of pools in the upper reach was excellent (Cogger and Reineck 1977b). The survey characterized Little Pine Creek as having good anadromous fishery potential limited by downstream urbanization and associated alterations to Pine and Walnut Creeks. An August 1977 DFG survey report for Pine Creek concluded that Little Pine Creek provided fair to excellent steelhead habitat (Cogger and Reineck 1977c). Informal surveys of Little Pine Creek indicate that the watershed does not presently support an O. mykiss population (J. Hale pers. comm.).

Arroyo del Cerro

Arroyo del Cerro drains an area of approximately 3.8 square miles. The creek originates on the north slope of Mt. Diablo and meets Pine Creek in the city of Walnut Creek.

DFG surveyed a 1.9-mile reach of Arroyo del Cerro in August 1977. The survey concluded that despite the creek's history as a steelhead stream, it did not appear to support an anadromous fishery at that time (Cogger and Reineck 1977a). The report cited barriers in Walnut Creek and lower Pine Creek, as well as the removal of riparian vegetation and the effects of grazing to Arroyo del Cerro, as potentially contributing to the decline of anadromous salmonids. The survey concluded that re-establishment of an anadromous fishery would require the removal of downstream barriers and the return of stream flow throughout the system (Cogger and Reineck 1977a). An August 1977 DFG survey report for Pine Creek concluded that Arroyo del Cerro provided fair to excellent steelhead habitat (Cogger and Reineck 1977c). Informal surveys of Arroyo del Cerro indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Las Trampas Creek

Las Trampas Creek is formed from several intermittent tributaries near Las Trampas Peak and flows north and east to its confluence with San Ramon Creek. No salmonids were recorded in a 1978 report by DFG on a fish kill in Las Trampas Creek near Carol Road (Young 1978). No salmonids were collected at two sites that were seined in Las Trampas Creek as part of a study of fishes in the Walnut Creek basin in October-November, 1980 (Leidy 1983).

As part of a 1983 USFWS steelhead habitat study, staff visually surveyed the lower 2.1 miles of Las Trampas Creek. The report noted limited pool habitat, barriers to migration, sedimentation, and high water temperatures as potential limiting factors for steelhead (Ging 1983). However, the report concluded that upper Las Trampas Creek perhaps had the greatest potential for steelhead re-establishment because of good streamside shading and the availability of gravel (Ging 1983).

A September 1984 survey of Las Trampas Creek by seine and dip net at the Pleasant Hill Road Bridge found no *O. mykiss* (Barlow 1984). In April 1986, DFG noted 12-14 healthy looking rainbow trout in Las Trampas Creek and its tributary, Lafayette Creek (Gray 1987b).

A 1990 fisheries study reviewed the historical and present distribution of salmonids in the Walnut Creek basin. The study noted a 15-foot high drop structure on Las Trampas Creek between the Main Street and California Street bridges in the city of Walnut Creek that probably represented a complete barrier to upstream fish migration (HRG 1990). Electrofishing in a 35-meter reach of Las Trampas Creek near the Interstate 680 bridge did not produce salmonids (HRG 1990).

Leidy electrofished a 40 meter reach upstream from the Pheasant Hill Road Crossing in June 1998. No *O. mykiss* were collected (Leidy 2002).

Tice Creek

Tice Creek, tributary to Las Trampas Creek, drains an area of about 3.9 square miles between Las Trampas Creek to the west and San Ramon Creek to the east. It flows generally north through Tice Valley.

DFG visually surveyed about 4.6 miles of Tice Creek upstream from the Walnut Creek confluence in July 1976. No *O. mykiss* were observed, but the survey report concluded that the stream "probably" supported a steelhead population until the introduction of downstream barriers (Scoppettone and Curtis 1976). Two culverts (~750 feet and ~1,500 feet in length) occur in the watershed. Both structures serve as barriers to fish passage.

During October-November 1980, lower Tice Creek was seined and no salmonids were found (Leidy 1983). During January-March 1983, USFWS staff visually surveyed steelhead rearing and spawning habitat in the lower two miles of Tice Creek. The study described "little" fish habitat downstream of Orchard Lane, with some suitable rearing habitat between Orchard Lane and the Rossmor Parkway (Ging 1983).

Lafayette Creek

Lafayette Creek is formed from several tributaries near Happy Valley and Lafayette Reservoir. It flows east for approximately three miles to its confluence with Las Trampas Creek.

During October-November 1980, Lafayette Creek was sampled immediately upstream of the confluence with Las Trampas Creek and no salmonids were found (Leidy 1983). In April 1986, DFG noted that 12-14 “healthy looking” rainbow trout were found in Las Trampas Creek and Lafayette Creek (Gray 1987b).

Leidy found no *O. mykiss* when he electrofished at the confluence of Layfayette Creek and Oak Creek in April 1999 (Leidy 2002). According to DFG staff, *O. mykiss* have been seen in Lafayette Creek by construction crews as recently as 2002. These fish are believed to come from Lafayette Reservoir and to be transported by spill events during high winter flows (N. Kozicki pers. comm.).

Grizzly Creek

Grizzly Creek’s headwaters are on the northeast slopes of Las Trampas Ridge. The creek flows northwest for approximately 2.5 miles before entering Las Trampas Creek in Burton Valley.

As part of a 1983 steelhead habitat study, USFWS staff visually surveyed 0.5 miles of Grizzly Creek upstream from its confluence with Las Trampas Creek. The study concluded that an abundance of fine sediments, shallow pools, lack of instream cover, and seven “major” passage barriers downstream in Las Trampas and Walnut creeks made Grizzly Creek of “little value” to steelhead (Ging 1983).

Reliez Creek

Reliez Creek flows southeast from Lafayette Ridge approximately 3.5 miles to its confluence with Las Trampas Creek. As part of a 1983 steelhead habitat study, USFWS staff visually surveyed 1.25 miles of Reliez Creek upstream from its confluence with Las Trampas Creek. The study concluded that the creek would provide “marginal” habitat for steelhead and noted 15 sites that could preclude fish passage at some or all stream flows (Ging 1983).

San Ramon Creek

San Ramon Creek drains an area of approximately 30 square miles, flowing generally north to its confluence with Las Trampas Creek, when it becomes Walnut Creek. Complete barriers to anadromous fish passage occur in the channel, the lowest being located about 2.7 miles above the Walnut Creek confluence. Primary tributaries to San Ramon Creek include Sycamore and Green Valley creeks, which drain the southwestern slopes of Mt. Diablo and join San Ramon Creek near Danville.

DFG visually surveyed San Ramon Creek in July 1977. The survey noted six concrete drop structures that were complete barriers to fish migration and rated spawning areas for salmonids as “poor throughout” (Gillespie and Richardson 1977b). During October-November 1980, nine reaches along the entire length of San Ramon Creek were seined as part of a fish distribution study. No salmonids were collected (Leidy 1983).

USFWS visually surveyed steelhead rearing and spawning habitat in San Ramon Creek in January-March 1983. The survey focused on the lower portion of the creek, where staff found an absence of suitable spawning habitat (Ging 1983). The report concluded that extensive channelization (*i.e.*, concrete-lined channels and drop structures), as well as insufficient spawning and rearing habitat preclude the restoration of steelhead in San Ramon Creek.

In February 1984, Leidy sampled San Ramon Creek by pole seine at the bedrock falls at 29 Palms Drive and caught two *O. mykiss* (198, 185mm FL) (Leidy 2002). A September 1984 survey including electrofishing, seining and dipnetting on San Ramon Creek at Livorna Road in the city of Walnut Creek found no *O. mykiss* (Barlow 1984). One *O. mykiss* was dipnetted at the 29 Palms Drive site in March 1985 (J. Hale pers. comm.).

As part of a 1990 fisheries enhancement study, six reaches along a total of approximately 0.8 miles of San Ramon Creek were visually surveyed in September 1990. One site was electrofished. *Oncorhynchus mykiss* was not recorded (HRG 1990). Within San Ramon Creek, the report noted "marginal" passage conditions attributed to the downstream concrete box channel, as well as limited spawning and rearing habitat (HRG 1990).

Sans Criante Creek

Sans Criante Creek is tributary to San Ramon Creek, entering from the east upstream from the Los Trancos Creek-San Ramon Creek confluence. It drains an area southeast of the city of Walnut Creek.

During January-March 1983, USFWS staff visually surveyed steelhead rearing and spawning habitat in Sans Criante Creek. The study concluded that Sans Criante Creek did not provide steelhead habitat because it lacked rearing pools of sufficient depth, suitable instream cover, spawning gravels, and streamside shading (Ging 1983).

Sycamore Creek

The West and East forks of Sycamore Creek join to form Sycamore Creek in the Black Hills on the southern slopes of Mt. Diablo. Sycamore Creek runs south then northwest six miles to join San Ramon Creek.

During October-November 1980, Sycamore Creek was sampled at two upstream locations and at the San Ramon Creek confluence. No O. mykiss were found (Leidy 1983).

Green Valley Creek

Green Valley Creek is formed by several intermittent tributaries on the southwest slopes of Mt. Diablo. The east branch joins Green Valley Creek near Green Valley School.

A long-time resident stated this currently intermittent stream once maintained perennial flow and supported trout (Banks and Fredrickson 1977). An unnamed tributary to upper Green Valley Creek near the Stone Valley Road crossing also was said to support "trout."

During October-November 1980, Green Valley Creek was seined at two sites. No *O. mykiss* were collected (Leidy 1983). An April 1985 visual survey of the portion of Green Valley Creek within Mt. Diablo State Park also recorded no *O. mykiss* (Taylor 1985).

San Catanio Creek

San Catanio Creek is a perennial headwater tributary to San Ramon Creek. It begins in Norris Canyon and flows north for approximately three miles before entering San Ramon Creek.

Leidy surveyed three locations on San Catanio Creek by seine and dip net during August 2002 but did not record *O. mykiss* (Leidy 2002). However, habitat for steelhead spawning and rearing (*i.e.*, well-shaded pools with adequate water temperatures and instream cover) was assessed as fair to good.

Bollinger Canyon Creek

Bollinger Canyon Creek is a headwater tributary to San Ramon Creek that flows southwest between Las Trampas Ridge and Rocky Ridge for approximately five miles before abruptly turning east at the mouth of Bollinger Canyon. Bollinger Canyon Creek becomes San Ramon Creek after leaving Bollinger Canyon.

EBRPD staff has observed *O. mykiss* in Bollinger Canyon Creek, and speculates that the fish may be of hatchery origin that escaped from a created pond (P. Alexander pers. comm.). The presence of fingerlings in sites adjacent to Bollinger Canyon Road indicates that reproduction likely is occurring.

Assessment: Development in the Walnut Creek watershed, in particular related to flood control, has resulted in the extirpation of self-sustaining anadromous salmonid populations in Walnut Creek and its tributaries. While the historical use by *O. mykiss* of individual tributaries is difficult to document due to a paucity of available information, we assume that the species was widely distributed in the basin. Currently, *O. mykiss* regularly enter the lower reaches of Walnut Creek and migrate as far as the drop structure at Willow Pass Road.

Efforts to restore *O. mykiss* to Walnut Creek watershed depend on providing passage through lower Walnut Creek and into tributaries with potential spawning and rearing habitat, several of which have additional barriers. Las Trampas Creek and its tributaries probably hold the greatest potential to serve as habitat for a restored *O. mykiss* population.

Alhambra Creek (Arroyo del Hambre) Watershed

Alhambra Creek is formed by several tributaries in the Briones Hills and Franklin Ridge areas. The creek flows east through Vaca Canyon and north through Alhambra Valley and the city of Martinez before entering the San Francisco Estuary at the Carquinez Straight.

Alhambra Creek

DFG visually surveyed Alhambra Creek in October 1946 from near Martinez upstream two miles. No fish were found and the survey report declared that Alhambra Creek had no importance as a fishing stream (Calhoun 1946). A 1946 DFG correspondence concluded that there was no salmon run in Alhambra Creek (Croker 1946).

In August 1981, three Alhambra Creek sites were sampled by dip net and pole seine as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984). A 1983 DFG memo cited local newspaper reports of adult steelhead commonly encountered in winter and in the streets of Martinez after flooding (Emig 1983). A 1987 DFG memorandum noted that Alhambra Creek had a small annual run of steelhead (Gray 1987a).

Two to three adult *O. mykiss* were observed in Alhambra Creek near downtown Martinez in the early 1990s by staff of EBRPD (P. Alexander pers. comm.). Based on the size (>560 mm) and condition of the fish, they were assumed to be anadromous and to be of Central Valley hatchery origin.

Restoration project staff discovered *O. mykiss* on two occasions in mid-September 2004, while dewatering Alhambra Creek as part of a habitat improvement project. A total of eight *O. mykiss* (200-300mm) were captured adjacent to Martinez Adult School and transferred downstream. The project fisheries biologist stated that all fish were in excellent condition (Thomas 2004).

Assessment: Alhambra Creek historically supported a small run of steelhead. It continues to be visited by in-migrating *O. mykiss* in some years and may support a resident population. Barriers in the lower watershed and siltation may present limitations to the amount of salmonid habitat remaining in this system. However, the creek's major tributaries, Arroyo del Hambre and Franklin Creek, are perennial, which may help support steelhead restoration in the watershed.

Rodeo Creek Watershed

Rodeo Creek is a small, intermittent stream formed from the contributions of numerous tributaries originating on the south west slopes of Franklin Ridge. The creek flows in a generally north to northwesterly direction approximately seven miles to San Pablo Bay.

Rodeo Creek

In February 1974, DFG electrofished four sites on Rodeo Creek near Interstate 80 and Highway 4. Salmonids were not recorded during the survey and DFG concluded that Rodeo Creek did not support a viable steelhead population (Strohschein 1974a). Sampling was repeated at one location near Interstate 80 in March 1974, and at two additional sites upstream and downstream from Highway 4. *Oncorhynchus mykiss* were not recorded during the second survey and DFG concluded that Rodeo Creek did not appear suitable for supporting a steelhead population (Strohschein 1974b).

As part of a fish distribution study, 11 sites were seined on Rodeo Creek during June 1981(Leidy 1981-1984, 1984). No salmonids were collected. Leidy electrofished Rodeo Creek at 4th Street and at View Point Road in October 1994. No *O. mykiss* were found (Leidy 2002).

Assessment: We did not find evidence that the Rodeo Creek watershed has supported salmonids in the past, or is used currently by steelhead or salmon. The small relative size of the watershed and condition of salmonid habitat as assessed by DFG staff suggest that Rodeo Creek does not present a significant habitat resource for native *O. mykiss* populations.

Refugio Creek Watershed

The headwaters are of Refugio Creek are east of Pinole Ridge north of the Briones Hills. The creek flows northwest for approximately four miles to San Pablo Bay.

Refugio Creek

As part of a fish distribution study, Leidy sampled Refugio Creek during June 1981(Leidy 1981-1984, 1984). No salmonids were collected.

Assessment: We did not find evidence for historical or current use of the Refugio Creek watershed by steelhead or salmon. The small relative size of the watershed and condition as assessed by DFG staff indicate that it is not of regional significance to the native *O. mykiss* population.

Pinole Creek Watershed

Pinole Creek's watershed is about 35 square miles. The headwaters of Pinole Creek consist of numerous seeps and intermittent and perennial streams, in the Briones Hills. Pinole Creek is intermittent toward the headwaters but perennial upon reaching Pinole Valley, where it flows southeast to northwest for approximately nine miles into San Pablo Bay. The 1.6-mile reach below Interstate 80 is channelized. A natural bedrock falls downstream of the junction of Alhambra Valley and Bear Creek roads limits migration to the upper watershed under most flow conditions.

Pinole Creek

In April 1975, DFG documented fish mortality resulting from a chemical spill that caused a "complete" fish kill in the lower 1.5 miles of Pinole Creek. A total of 101 *O. mykiss* carcasses were collected (69 0+ and 1+: 38-65 mm FL; 29 "smolt steelhead": 130-208 mm FL; and 3 resident adults 274-305 mm FL)(Anderson 1975). A newspaper report from 1979 stated that many of the fish had been planted in Pinole Creek in March 1974 during an earlier re-stocking (Lattin 1979).

In May 1976, DFG surveyed 6.5 miles of Pinole Creek between the Simas Avenue Bridge and a headwater fork at RM 9.1. The survey report noted that Pinole Creek supported a small steelhead run and that fish passage was limited by a natural barrier 0.4 miles downstream from the intersection of Alhambra Valley and Bear Creek roads (Scoppettone 1976). Several juvenile steelhead were observed during the survey below the natural barrier.

During June 1976, DFG electrofished two reaches of Pinole Creek, one upstream and one downstream of the natural bedrock falls identified above. The downstream site yielded 14 "steelhead trout" (9 1+: 117-150 mm FL; 5 2+: 190-213 mm FL)

(Anderson et al. 1976). No fish were collected in the upstream sampling. The survey report cited the probability that the falls constituted an upstream migration barrier in most years.

In November 1978, DFG sampled Pinole Creek by electroshocking three sites to document steelhead spawning during the winter/spring of 1978. No *O. mykiss* were found. The survey report concluded that successful reproduction had not occurred the previous year (Paulsen 1978a). In April 1979, DFG stocked 3,152 YOY steelhead in Pinole Creek as part of a settlement related to the 1975 spill discussed above (Nagel 1979). Staff from DFG sampled Pinole Creek at three sites by electroshocking again in November 1979. No *O. mykiss* were collected, and the resulting report stated that steelhead had not successfully reproduced in Pinole Creek since 1976 (Paulsen 1979).

As part of a fish distribution study, Pinole Creek was sampled at 12 stations in June and August 1981. No *O. mykiss* were encountered in this effort (Leidy 1981-1984, 1984). The Department of Fish and Game surveyed a 3.7-mile reach of Pinole Creek upstream from the mouth in October 1982. Staff did not find *O. mykiss*, and stated that few *O. mykiss* were likely to use Pinole Creek due to low flow barriers and heavy siltation (Berthelsen 1982). According to DFG, the most substantial Pinole Creek barrier is the concrete box culvert under Interstate 80, which is over 100 feet in length (Berthelsen 1982). The report stated that Pinole Creek was the last stream in west Contra Costa County that could support a steelhead run (Berthelsen 1982).

In April 1984, 11,760 *O. mykiss* fingerlings were planted in Pinole Creek. (Gray 1988). Subsequent electrofishing by DFG near Alhambra Road in August 1988 was performed to determine if steelhead trout were found at the site. No *O. mykiss* were observed (Gray 1988).

Leidy electrofished five reaches of Pinole Creek in October-November 1994. *Oncorhynchus mykiss* (3: 65, 75, 135 mm FL) were collected in a 30 meter reach located 300 feet upstream of the Interstate 80 crossing (Leidy 2002).

EBMUD staff electrofished two areas of Pinole Creek in July 1996. *Oncorhynchus mykiss* (2 1+: 100, 110 mm; 1 3+: 300 mm) were found near "the old bridge" on EBMUD property and were deemed to be wild steelhead capable of anadromy (Nuzum 1996). Genetic analysis of *O. mykiss* from Pinole Creek indicated that fish sampled there are part of the Central California coast steelhead ESU (Nielsen 1999).

Three *O. mykiss* were seen in Pinole Creek immediately downstream of the Interstate 80 crossing in February 2001. These fish are believed to be native steelhead due to their size (>200 mm) and appearance (C. Arnold pers. comm.). EBMUD staff noted two *O. mykiss* (92, 102 mm) downstream from the Pinole Valley Road Bridge in March 2001 (Setka 2001).

Simas Creek

Simas Creek enters Pinole Creek from the north approximately 4.6 miles upstream of San Pablo Bay. A dead female *O. mykiss* (650 mm) was seen in April 2002 in Simas Creek 0.1 miles upstream of the confluence with Pinole Creek (Setka 2002).

Assessment: The Pinole Creek watershed historically supported *O. mykiss*. Steelhead continue to enter the Pinole Creek watershed, although the size of the run has not been documented. The limited development of the upper watershed and the presence of native trout in the creek indicate that Pinole Creek is a good candidate for additional restoration efforts, including addressing the impediment to passage posed by the culvert beneath Interstate 80 and sedimentation issues in the upper watershed.

Garrity Creek Watershed

Garrity Creek begins on the western slopes of Sobrante Ridge. It flows west, then north, for approximately three miles to San Pablo Bay.

Garrity Creek

As part of a fish distribution study, Garrity Creek was sampled at three stations in July 1981. No *O. mykiss* were encountered in this effort (Leidy 1984).

Assessment: We did not find evidence of historical or current use of the Garrity Creek watershed by steelhead or salmon. The small relative size of the watershed and condition as assessed by DFG staff indicate that Garrity Creek does not have potential to support significant *O. mykiss* populations.

San Pablo Creek Watershed

San Pablo Creek originates as an intermittent stream in the coastal hills southeast of Orinda. The creek flows northwest for approximately 2.5 miles where it is joined by the west fork of San Pablo Creek near the town of Orinda. Another smaller perennial tributary that drains the east slope of the Berkeley Hills joins San Pablo Creek near the Moraga Road crossing. Further downstream, the West Fork of San Pablo Creek, a perennial spring-fed tributary originating in the Berkeley Hills, flows north for a distance of approximately one mile before entering a culvert under Highway 24. This fork flows 1.7 miles before joining San Pablo Creek. Bear Creek is San Pablo Reservoir's other major tributary.

Flows in the upper portion of San Pablo Creek are impounded in San Pablo Reservoir (between approximately RM 10 and RM 15) constructed in 1918 and managed by EBMUD. The drainage area above San Pablo Reservoir is about 32 square miles. A concrete drop structure is located on San Pablo Creek just upstream from Bear Creek Road (and upstream of San Pablo Reservoir) that is a barrier to fish migrating upstream from San Pablo Reservoir in most years.

Since the 1980s, EBMUD and DFG have planted large numbers of *O. mykiss* in San Pablo Reservoir for recreational fishing, totaling a contribution of approximately 400,000 fish per year. In 2001, EBMUD began planting only sterile, triploid *O. mykiss* to minimize potential genetic contribution to the Central California steelhead ESU from hatchery origin fish. However, elementary school programs continue to plant small numbers of fertile *O. mykiss* fry of American River steelhead origin in San Pablo Creek upstream of the reservoir (R. Hartwell pers. comm.).

San Pablo Creek

As part of a study of rainbow trout in Mexico and California, researchers collected *O. mykiss* in the upper West Fork of San Pablo Creek near the Highway 24 crossing in January 1953 (30: 96-217 mm) (Needham and Gard 1959). The study concluded that the sampled fish were ancestors of steelhead stocks that had not hybridized with introduced fish. The study also noted that steelhead were known to ascend San Pablo Creek during winter and spring, and that a steelhead fishery existed in the unblocked stream areas below San Pablo Dam (Needham and Gard 1959). In their classic study, Needham and Gard noted that "Formerly [San

Leandro Creek] flowed into San Francisco Bay near the City of Alameda and, like nearby San Pablo Creek, originally had runs of both steelhead and silver salmon" (Evans 1957). A long time resident of the City of El Sobrante provides anecdotal accounts of steelhead being caught downstream of San Pablo Dam in the late 1940s and early 1950s (C. Leggitt pers. comm.).

In June 1976, DFG visually surveyed 2.1 miles of San Pablo Creek from the Bear Creek confluence above San Pablo Reservoir, upstream to the Lauterwasser Creek confluence. The survey report found "good" to "excellent" spawning gravel, but no *O. mykiss* were observed (Curtis and Scoppettone 1976). The Department of Fish and Game noted that the EBMUD filtration plant's operational procedures and the large drop structure upstream from Bear Creek Road as limiting the potential for a substantial reproductive population of *O. mykiss* using San Pablo Reservoir and spawning in San Pablo Creek (Curtis and Scoppettone 1976). The Department of Fish and Game electroshocked three sites in this study reach later in June 1976 and did not encounter *O. mykiss* (Scoppettone et al. 1976).

DFG revisited the 1.3-mile section of San Pablo Creek between the Bear Creek confluence and the EBMUD filtration plant in July 1981. Staff observed one *O. mykiss* (254 mm) in the reach beginning at the reservoir and extending upstream 0.35 miles. The survey report concluded that this fish presumably migrated from the reservoir (Jong 1981). The survey report included recommendations for removing the 15-foot drop structure upstream from San Pablo Reservoir and changing filtration plant operations to allow use of the habitat by fish migrating out of the reservoir. In November 1981, an EBMUD-commissioned reconnaissance survey of San Pablo Creek above San Pablo Reservoir was performed. The resulting report stated that no juvenile *O. mykiss* were observed, but surveyors noted about ten large trout from the Bear Creek Road barrier downstream to the reservoir (Kelly 1981).

EBMUD conducted approximately bimonthly *O. mykiss* spawning surveys from the winter of 1989/90 to the winter of 1994/95. Surveys were limited to the approximately 0.5 miles of stream between San Pablo Reservoir and the drop structure at the Bear Creek Road Bridge. Large numbers of adult *O. mykiss* and redds were observed regularly over the course of each spawning season, with the 1990/91 season totaling 288 observed adults and 365 redds. Investigators noted that surveys did not necessarily count all redds each season because scour and deposition associated with frequent high flow events tended to destroy all or most redds constructed since the previous high flow event (EBMUD 1989-1995).

In the EBMUD surveys, adult *O. mykiss* occasionally were measured with sizes up to 477 mm FL. On two occasions (1989/90 and 1993/94), water clarity allowed identification of all observed adults as hatchery fish. Electrofishing in August 1993 and February 1994, and visual observations in April 1995, identified juvenile *O. mykiss*. These survey efforts verified successful natural propagation, although EBMUD fisheries biologists speculated that these juveniles may have migrated from upstream reaches, since all observed redds in this reach were destroyed by high flow events. The August 1993 electrofishing survey yielded 17 *O. mykiss* (66-108 mm) from 60 meters of stream. The February 1994 electrofishing study observed YOY averaging 40 mm, but recorded only two YOY (29 mm) in addition to about 20 unmeasured adults. Visual observations in April 1995 estimated at least 25 YOY to be 21-25 mm FL (EBMUD 1989-1995). EBMUD believed *Oncorhynchus mykiss* occurring in tributaries may contain a hatchery-strain genetic component from fish planted into San Pablo Reservoir (Hartwell 2002).

Leidy sampled San Pablo Creek in October 1993, upstream from the Avenida de Orinda crossing, and did not find *O. mykiss* (Leidy 2002). In April 1999, he electrofished San Pablo Creek at three locations below San Pablo Reservoir: at the EBMUD water treatment plant, at Via Verde and Minuet Way, and at a location just above Interstate 80. This latter station produced a single *O. mykiss* (175 mm) that was silver with no parr marks and little pink coloration (Leidy 2002).

Bear Creek

Bear Creek, the largest tributary to San Pablo Creek, begins in the Briones Hills as several intermittent tributaries that join and flow west to enter Briones Reservoir. Bear Creek flows from Briones Reservoir for 0.5 miles before entering San Pablo Reservoir. A natural, bedrock barrier is located about 0.5 miles upstream of Briones Reservoir preventing fish migration to upstream portions of Bear Creek.

DFG visually surveyed five miles of Bear Creek upstream of the mouth at San Pablo Reservoir in September 1960, before filling of Briones Reservoir. The survey report indicated finding "a few" *O. mykiss* in pools in the lower stream areas, and deemed Bear Creek to be of minor value in contributing to a sport fishery (Hayden and Morehouse 1960).

Lauterwasser Creek

As part of a fish distribution study, three sites were seined on Lauterwasser Creek during July 1981. No salmonids were collected (Leidy 1984, Leidy, 1981-1984).

Assessment: Habitat for *O. mykiss* using the San Pablo Creek watershed was limited severely by construction of San Pablo Dam in 1960. The historical steelhead run was extirpated from above the reservoir as a result of its construction. Existing spawning runs in streams tributary to San Pablo Reservoir consist of *O. mykiss* of hatchery and possibly wild origin.

Wildcat Creek Watershed

Wildcat Creek flows generally northwest through the valley between the Berkeley Hills and San Pablo Ridge. The lower portion of the creek passes through the city of San Pablo to enter the San Francisco Estuary at San Pablo Bay. Passage barriers in lower Wildcat Creek consist of a concrete-lined culvert beneath the K-mart parking lot and a drop structure at Interstate 80, maintained by CalTrans. These barriers may be passable at some flows. Two dams, both managed by EBRPD, are present in the upper watershed, forming Jewel Lake and Lake Anza (~RM 10). These dams block all upstream fish migration.

Wildcat Creek

DFG sampled Wildcat Creek by electrofishing in November 1978 but did not find *O. mykiss* (Paulsen 1978b). In July 1981, another fish distribution study sampled six Wildcat Creek locations below San Pablo Dam Road. No *O. mykiss* were found (Leidy 1984).

In September 1983, EBRPD planted 615 native, coastal *O. mykiss* from Redwood Creek (tributary to San Leandro Creek) into Wildcat Creek between Alvarado Park and the University of California, Berkley, Botanic Gardens (Alexander 1984). EBRPD reported that no trout were present in Wildcat Creek prior to this stocking, so that the newly established population would provide a second and separate source for a "precarious" and "unique" genetic stock (Alexander 1990b). In July 1985, DFG and EBRPD electrofished Wildcat Creek for evidence of spawning of the stocked fish. A total of 51 *O. mykiss* were caught, ranging in size from 37-222 mm FL, which suggested that successful reproduction was occurring (Gray 1986b).

In May 1986, DFG and EBRPD electrofished Wildcat Creek at three locations: upstream from Lake Anza, just downstream from Lake Anza, and upstream from Lake Jewel at the Orchard Campground. Each site had *O. mykiss*, with a total of 12 individuals. Fish caught ranged in size from 27-465 mm FL (Gray 1986b). Numerous YOY were observed at the uppermost station, but not at other stations (Gray 1986b). Also in May 1986, five Wildcat Creek locations were electrofished, with two *O. mykiss* (195, 175 mm) collected upstream from Jewel Lake, five *O. mykiss* (50-70 mm) downstream from Jewel Lake, six *O. mykiss* (153-271 mm) at Alvarado Park, and 14 *O. mykiss* (9: 130-140 mm; 5: 51-71 mm) at the northwestern boundary of Wildcat Canyon Park. The remaining site was near the Rifle Range Road Bridge, where no *O. mykiss* were observed (Gray 1986a).
To determine the downstream-most distribution of *O. mykiss* in Wildcat Creek, a follow-up electrofishing survey was conducted in June 1986 at three sites between Davis Park in Richmond and the 29th Street Bridge. *Oncorhynchus mykiss* were found only at the 29th Street Bridge location (6: 2 YOY, ~45mm; 4 188-250 mm). The survey report cited the presence of YOY as evidence of successful spawning, despite degraded habitat due to urbanization (Alexander 1986).

In May 1987, EBRPD visually surveyed Wildcat Creek from Alvarado Park upstream to the Botanic Garden. YOY were abundant throughout the survey area. Twelve "larger rainbow trout" were observed between Alvarado Park and Jewel Lake, while above Jewel Lake "several" larger trout were also seen (Alexander 1992).

In August 1988, EBRPD electrofishing documented 23 YOY and 11 "larger" *O. mykiss* below the Botanical Garden, and no *O. mykiss* below Jewel Lake (Alexander 1992). Electrofishing at the site below Jewel Lake in October 1989 found three YOY *O. mykiss* and 15 "larger" rainbow trout. Between Lake Anza and Jewel Lake, two "larger" *O. mykiss* were found, while 59 YOY and 14 "larger" *O. mykiss* were collected below the Botanical Garden (Alexander 1992). In July 1990, EBRPD electrofished five Wildcat Creek locations and obtained 50 *O. mykiss* (42-209 mm FL) (Alexander 1990a).

In April 1991, a student at the University California, Berkeley electrofished the two perennial reaches of Wildcat Creek to determine the condition of *O. mykiss* populations. The upper reach was located above Lake Anza, while the lower reach was at the northwest edge of Wildcat Canyon Regional Park. The upper reach produced 46 *O. mykiss* (86-283 mm FL). In the lower reach, 71 *O. mykiss* were caught (71-194 mm). The resulting study reported that the presence of multiple age classes in both the upper and lower reaches indicated successful spawning in the two areas (Cohen 1991). The study also noted age 3+ *O. mykiss* from Lake Anza spawning in upper reaches of Wildcat Creek.

Leidy electrofished several ten-meter reaches of Wildcat Creek at the lower end of Wildcat Regional Park in July 1992. One station yielded four *O. mykiss* (188-224 mm FL), while a second station yielded 11 *O. mykiss* (66-210 mm) plus 31 unmeasured YOY (Leidy 2002). Leidy also electrofished a 30 meter reach immediately downstream of the Verde Avenue Bridge in North Richmond in June 1993, but did not find *O. mykiss* (Leidy 2002).

EBRPD conducted a study of Wildcat Creek *O. mykiss* populations in summer 2001. Six sites were sampled by electrofishing between the most downstream, "Alvarado," and the most upstream, "Upper," inclusive. *Oncorhynchus mykiss* was present at all locations, with densities ranging from less than 0.05 per square meter to over 0.4 per square meter (Alexander et al. 2002). The study report concludes that Wildcat Creek appears to have "ample" over-summering habitat for trout, although sedimentation was noted as a limiting factor (Alexander et al. 2002).

EBRPD again electrofished multiple Wildcat Creek sites in 2002. The resulting report notes low numbers of *O. mykiss* YOY in relation to previous years (Alexander et al. 2002). Total YOY (<100 mm) collected varied from five at the most downstream site

(“Alvarado”) to 35-45 at the “Lower,” “Middle,” and “Upper” locations (Alexander et al. 2002). Staff cited an established native *O. mykiss* population in the drainage that may be experiencing negative effects from human activities in the riparian corridor (Alexander et al. 2002).

Assessment: Wildcat Creek supported a steelhead run historically, but the introduction of passage barriers and habitat destruction have limited substantially the ability of the watershed to sustain a viable population. *Oncorhynchus mykiss* (probably derived from plantings of coastal anadromous stock in 1983) successfully reproduces in the portion of Wildcat Creek below Jewel Lake. *Oncorhynchus mykiss* are known to reproduce successfully in the area above Lake Anza. Passage improvements in lower Wildcat Creek that ensure sufficient, available habitat are necessary for a self-sustaining anadromous population of steelhead to persist in the drainage.

Cerrito Creek Watershed

Cerrito Creek drains a portion of the East Bay hills with high levels of residential and commercial development, and large sections of the creek are channelized or underground. The creek consists of approximately two miles of channel between the headwaters and the mouth at the north side of Albany Hill.

Cerrito Creek

As part of a fish distribution study, Cerrito Creek was sampled at five locations in July 1981. No *O. mykiss* were found (Leidy 1984). Leidy sampled Cerrito Creek just upstream from Interstate 80 in December 1993. *Oncorhynchus mykiss* was not found (Leidy 2002).

Assessment: While anadromous salmonids may have used Cerrito Creek historically, no direct evidence of a viable run occurring in the watershed exists. The system has been altered severely by development and flood control facilities, and appears incapable of supporting a viable *O. mykiss* population.

Table III-1. Distribution status of O. mykiss in San Francisco Estuary streams of Contra Costa County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss Hist.	O. mykiss Current	Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
Marsh Creek	Marsh	5/0	0 **2001**	1, 2	-	N	DF	DF	Y	0	9, 22, 23, 26, 48, 70
Mt. Diablo Creek	Mt. Diablo	6/0	1855-1970s **1998**	0, 1, 2, 3	R1; M/1	UNK	DF	PS	Y	0	3, 11, 48, 49, 61
	Mitchell	4/1	1985-1998	1, 2	J/1; R/1	N	DF	NP	Y	0	3, 33, 49, 61, 70 (1)
	Irish Canyon	1/0	0 **1977**	1	-	N	UNK	NP	-	0	61
	Donner	1/0	0 **1977**	1	-	N	PB	NP	-	0	61 (5)
Walnut Creek	Walnut	16/1	1950s-2002	0, 1, 2, 3	J/1; M/14	N	DF	DF	Y	1	13, 19, 31, 32, 41, 42, 47, 49-52, 59, 72 (4)
	Grayson	5/0	0 **1998**	1, 2, 3	-	N	PS	NP	-	0	16, 32, 47, 49
	Pine	6/0	1956-1964 **1983**	0, 1, 3	M/1	N	DF	NP	Y	0	19, 29, 32, 42, 48, 70 (5)
	Galindo	2/0	0 **1983**	1, 3	-	N	PS	NP	-	0	32, 62
	Little Pine	1/0	0 **1977**	1	-	N	DF	NP	Y	0	18, 19 (5)
	Arroyo del Cerro	1/0	0 **1977**	1	-	N	DF	NP	Y	0	17, 19 (5)

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Las Trampas	7/0	1986 **1998**	1, 2, 3	-	N	PB	NP	-	0	13, 32, 37, 41, 47, 49, 73
	Tice	3/0	0 **1983**	1, 2, 3	-	N	PB	NP	Y	0	32, 47, 64
	Lafayette	4/0	1986-2002	1, 2	-	N	PB	NP	Y	0	37, 47, 49 (7)
	Grizzly	1/0	0 **1983**	1	-	N	UNK	NP	-	0	32
	Reliez	1/0	0 **1983**	1	-	N	UNK	NP	-	0	32
	San Ramon	5/1	1984-1985 **1990**	1, 2, 3	R/1	N	DF	UNK	Y	0	13, 30, 32, 41, 47, 49 (5)
	Sans Criante	1/0	1983	1	-	N	UNK	NP	-	0	32
	Sycamore	1/0	0 **1980**	3	-	N	UNK	NP	-	0	47
	Green Valley	2/0	0 **1985**	0, 1, 3	-	N	DF	NP	Y	0	12, 47, 70
	San Catanio	2/0	0 **2002**	1, 3	-	N	PB	NP	Y	0	49
	Bollinger Canyon	0	0	-	-	N	DF	DF	Y	1	(1)
Alhambra Creek	Alhambra	4/1	1983-2004	0, 1, 3	M/2; R/1	UNK	DF	DF	Y	1	15, 21, 27, 36, 48, 71 (1)

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
Rodeo Creek	Rodeo	3/0	0 **1994**	2, 3	-	N	UNK	NP	-	0	46, 48, 49, 68, 69
Refugio Creek	Refugio	1/0	0 **1984**	3	-	N	UNK	NP	-	0	46, 48
Pinole Creek	Pinole	8/4	1975-2001	0 , 1, 2, 3	J/4; S/1; R/3	Y	DF	DF	Y	1, 2, 3	8, 10, 14, 38, 45, 46, 48, 49, 53, 55-57, 60, 63, 66 (2)
	Simas	1/1	1999	3	M/1	Y	PB	DF	-	1	67
Garrity Creek	Garrity	1/0	0 **1981**	3	-	UNK	UNK	UNK	-	0	48
San Pablo Creek	San Pablo	10/6	1959-99	1, 2, 3	J/4; S/1; R/8	UNK	DF	DF	Y	1, 2, 3	24, 25, 39, 43, 44, 49, 54, 65 (6)
	Bear	1/0	1960	1	-	N	DF	NP	Y	0	40
	Lauter-wasser	1/0	0 **1981**	3	-	N	PS	NP	Y	0	46, 48
Wildcat Creek	Wildcat	13/7	1978-2002	1, 2	J/10; R/10	Y	DF	DF	Y	1, 2, 3	1, 2, 4-7, 20, 34, 35, 48, 49, 58
Cerrito Creek	Cerrito	2/0	0 **1993**	2, 3	-	N	PS	NP	Y	0	48, 49

[a] Table headings and codes are defined in the Methods section of this report.

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CONTRA COSTA COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Contra Costa County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Contra Costa County, Caliornia.

Codornices Creek Watershed

Codornices Creek drains an urbanized watershed of about 1.1 square miles. The creek is channelized or lies underground through a large portion of its 2.9-mile length. It flows west from the Berkeley Hills, entering central San Francisco Bay at the border of the cities of Albany and Berkeley.

Codornices Creek

As part of a fish distribution study, three sites on Codornices Creek were sampled in July 1981 (Leidy 1984). No *O. mykiss* were collected.

In June 1996 a resident reported two "foot-long" *O. mykiss* just downstream of Stannage Avenue (Harvey 2003). *Oncorhynchus mykiss* (50-200 mm) have been observed regularly between the BART tracks and10th Avenue from 1997 to the present (Harvey 2003).

A group supporting urban creek restoration has been monitoring Codornices Creek since at least 1997, when trout were observed where the creek passes under the BART tracks. In November 1999, the group electrofished the creek and collected one *O. mykiss* (S. Schwartz pers. comm.). *Oncorhynchus mykiss* juveniles and adults (to 300 mm) are apparently seen regularly throughout the year in several holes from just upstream from 9th Street to Monterey Street, and the population is believed to be increasing (S. Schwartz pers. comm.).

As part of a watershed restoration project, downstream migrant trapping for *O. mykiss* was conducted on Codornices Creek in April and May 2002. A total of 33 *O. mykiss* were trapped, including 29 YOY (<75 mm FL), one *O. mykiss* between 76 and 105 mm FL, and three larger steelhead greater than 105 mm FL (Kier 2002).

Assessment: Codornices Creek likely supported *O. mykiss* historically. *Oncorhynchus mykiss* have been recorded in Codornices Creek since 1997. While habitat modification such as channelization has limited the amount of suitable habitat and created migration barriers that prevent access of *O. mykiss* to the upper watershed, successful reproduction occurs in the lower reaches of the creek. Although many of these fish are resident, anecdotal accounts suggest small numbers of anadromous spawners may sporadically enter the stream.

Strawberry Creek Watershed

Strawberry Creek drains a largely urbanized watershed. It flows west from the Oakland-Berkeley Hills, where it enters central San Francisco Bay near the Berkeley Marina. The Department of Fish and Game estimates that only 5,000 feet of the stream's more than two-mile length flows above ground (Cleugh 2002).

Strawberry Creek

Needham and Gard, in their classic study of geographic variation in coastal rainbow trout of California and Mexico, noted that Strawberry Creek on the Berkeley Campus contained steelhead runs originally (Needham and Gard 1959).

Assessment: Strawberry Creek historically supported *O. mykiss* before the cumulative effects of urbanization (*e.g.,* pollution, channelization, *etc.*) contributed to the species' extirpation from the watershed. The upper south fork of Strawberry Creek still provides fish habitat, some of which is suitable for *O. mykiss*; however, underground culverts in the lower watershed are complete barriers to upstream migration. A 2002 DFG report stated that obstacles to steelhead restoration in the watershed include frequent sewage spills and the lack of aboveground habitat (Cleugh 2002).

Temescal Creek Watershed

Temescal Creek is a 2.7-mile perennial stream that originates in the Oakland Hills. The dam forming Lake Temescal is a complete barrier to fish passage, dividing the creek into upper and lower sections. Below Lake Temescal, the creek is largely culverted as it passes through heavily urbanized portions of Oakland before entering central San Francisco Bay at the city of Emeryville.

Temescal Creek

In August 1856, at a meeting of members of the California Academy of Natural Sciences in San Francisco, Mr. D. E. Hough donated to the cabinet a specimen of *Salmo rivularis* (= *O. mykiss*) from Temescal Creek (Donations 1854-1862). No additional information was provided on the collection location or the morphology of the specimen. Trout are stocked in Lake Temescal, although successful reproduction in tributary areas has not been documented (P. Alexander pers. comm.).

Assessment: Similar to several other small streams flowing from the Berkeley-Oakland Hills, Temescal Creek supported viable populations of *O. mykiss* before the cumulative effects of urbanization led to the species' extirpation from the watershed. Temescal Creek upstream from Lake Temescal and Highway 13 contains short, remnant reaches of habitat suitable for *O. mykiss*. However, underground culverts and the dam at Lake Temescal in the lower watershed serve as complete barriers to upstream migration.

Glen Echo Creek Watershed

The headwaters of Glen Echo Creek are in the Oakland Hills upstream of Blair Park. The creek has been placed in culverts under the park, under Mountain View Cemetery, and at points in the lower watershed. It enters Lake Merritt before joining the Oakland Estuary.

Glen Echo Creek

Glen Echo Creek was sampled in June 1998 as part of an aquatic resource inventory for the city of Oakland. *No O. mykiss* were found (Hagar and Demgen 1998).

Assessment: Insufficient information is available to determine the historical status of anadromous salmonids in the Glen Echo Creek watershed. It is likely that small numbers of *O. mykiss* utilized the system historically, but that habitat degradation led to the species' extirpation from the drainage.

Sausal Creek Watershed

Sausal Creek consists of approximately 5.1 miles of stream channel. The creek has two main tributaries in the Oakland Hills, Shephard Creek draining Shepard Canyon, and Palo Seco Creek, which originates in Joaquin Miller Park. Although main stem Sausal Creek is largely channelized, an approximately two-mile reach is above ground in the vicinity of Dimond Canyon Park. Sausal Creek enters central San Francisco Bay at the Oakland/Alameda Estuary near the Fruitvale Avenue Bridge.

Sausal Creek

As part of a fish distribution study, three Sausal Creek sites were sampled in July 1981. No fish were collected (Leidy 1984). The above ground portions of Sausal Creek were surveyed in June 1998 as part of an aquatic resource inventory for the city of Oakland. No *O. mykiss* were found. The survey report concluded that the culvert under Highway 13 was impassable for upstream movement of fish (Hagar and Demgen 1998). A subsequent electrofishing survey from Dimond Canyon Park upstream into Palo Seco Creek (to the Montclair golf course) and Shephard Creek along Scout Road did not find *O. mykiss* in Sausal Creek (Lowe 2000).

In November 1999, a dead *O. mykiss* (est. TL 100 mm) was found upstream of the Leimert Boulevard Bridge (Richardson 2000). EBRPD staff concluded that successful propagation had occurred since the 1998 survey (P. Alexander pers. comm.).

Since then, numerous sightings of *O. mykiss* have occurred. A 125 mm *O. mykiss* was observed at El Centro Avenue within Dimond Canyon Park in May 2000. In August 2000, an approximately 300 mm TL *O. mykiss* was observed in the same location (Friends of Sausal Creek 2002; Lowe 2000). Two "large" *O. mykiss* were observed at El Centro Avenue on numerous occasions throughout the spring and summer of 2001 (Friends of Sausal Creek 2002). In addition, 12 juvenile *O. mykiss* (~50 mm TL) and a single 200 mm *O. mykiss* were noted within Dimond Canyon Park during a June 2001 fish survey conducted by the Friends of Sausal Creek. Three adult *O. mykiss* (300+ mm, 330 mm, 355 mm TL) were found dead on different occasions between November 2001 and February 2002; three *O. mykiss* (125-230 mm TL) were observed at El Centro Avenue in June 2002 (Friends of Sausal Creek 2002; Lowe 2000).

DFG conducted a partial survey of Sausal Creek in November 2001, but ended the survey "due to low potential to restore salmonids" (Cleugh 2002). The Department of Fish and Game staff apparently deemed the quality of the habitat in Sausal Creek to be insufficient to support an *O. mykiss* population.

Shepherd Creek

Shepard Creek was surveyed in June 1998 as part of an aquatic resources inventory of Oakland streams. A 240 mm *O. mykiss* was collected downstream of the Scout Road crossing, and was deemed to be of hatchery origin due to the lack of a reproducing population in the stream (Hagar and Demgen 1998). A subsequent electrofishing survey from Dimond Canyon Park upstream into Palo Seco Creek (to the Montclair golf course) and Shephard Creek along Scout Road did not find *O. mykiss* in Shephard Creek (Lowe 2000).

Palo Seco Creek

Although portions of the upper watershed of Palo Seco Creek are relatively undeveloped, upstream migration from lower reaches of Sausal Creek is believed to be prevented by a culvert under the Montclair Golf Club grounds (Hagar and Demgen 1998).

In October 1997, EBRPD reported finding 15 juvenile *O. mykiss* in Palo Seco Creek (P. Alexander pers. comm.). During an aquatic resources inventory in June 1998, four *O. mykiss* (150-200 mm TL) were observed in Palo Seco Creek near Palos Colorados trailhead (Hagar and Demgen 1998). The survey report noted that the *O. mykiss* "generally gave the appearance of wild fish" (Hagar and Demgen 1998, p. 21). Another wild *O. mykiss* (190 mm TL) was found downstream from Highway 13 in 1998 (Lowe 2000). In June 2000, a 100-125 mm TL trout was spotted in Palo Seco Creek by a bird monitoring team, and two trout (~50 mm, ~100 mm TL) were observed in June 2001 during a fish survey**.**

Assessment: Sausal Creek historically supported *O. mykiss*, and it appears that currently wild fish may persist in the upper watershed, although individuals with hatchery characteristics have been found in the population as well. There is no evidence of anadromy. Barriers existing near the Montclair Golf Course separate the lower and upper watershed in terms of salmonid populations. An assessment of downstream barriers within urbanized Oakland is recommended for this drainage.

Peralta Creek Watershed

Peralta Creek originates in the Oakland hills and has a watershed consisting of low- and high-density urban residential and commercial areas (Hagar and Demgen 1998). The stream enters a culvert under Wisconsin Avenue that may be a barrier to upstream migration of fish, and additional culverted and channelized portions of the creek are found downstream of this point that may impede migration (Hagar and Demgen 1998).

Peralta Creek

As part of a fish distribution study, one site was sampled on upper Peralta Creek in July 1981. No fish were collected (Leidy 1984).

Peralta Creek was surveyed in June 1998 from Wisconsin Avenue upstream to near Jordan Avenue as part of an aquatic resource inventory of Oakland streams. No fish were seen during the survey (Hagar and Demgen 1998).

Assessment: Insufficient information is available to assess the historical occurrence of anadromous salmonids in the Peralta Creek watershed. *Oncorhynchus mykiss* has not been seen in the creek during the surveys for which we have records, and we believe that the species is absent from the drainage.

Lion Creek Watershed

Lion Creek originates in the Oakland Hills, flowing largely through culverts and channels to its mouth at San Leandro Bay. A culvert under Highway 13 is believed to be a barrier to upstream fish migration (Hagar and Demgen 1998).

Lion Creek

Lion Creek was electrofished during June 1998 from the upper end of the culvert under Highway 13 upstream for a distance of approximately 240 meters, extending to the culvert emerging from under Carson Road. No fish were collected or observed (Hagar and Demgen 1998). A city of Oakland employee reported seeing three trout in Lion Creek, probably in 1997. Two of the *O. mykiss* were adults and the third fish measured 100-125 mm TL (Trapp 1997).

Horseshoe Creek

Horseshoe Creek joins Lion Creek under Highway 13. The uppermost 0.7 miles of Horseshoe Creek on the Merritt College campus are channelized in an underground culvert (Hagar and Demgen 1998).

Electrofishing was performed for an aquatic resources inventory of Oakland streams in June 1998. A pool just below Mountain Boulevard produced ten *O. mykiss* (221-295 mm FL) (Hagar and Demgen 1998). Eroded dorsal fins on two of the fish suggested a hatchery origin. Further upstream, eight *O. mykiss* (168-262 mm) were captured in a 308-meter reach (Hagar and Demgen 1998). The largest of these fish also bore eroded pectoral, dorsal and caudal fins, again suggesting a hatchery origin. All other fish "had the appearance of wild stream fish" (Hagar and Demgen 1998, p. 11).

Chimes Creek

Chimes Creek extends from the Oakland Hills and under Highway 13. It is a tributary to Lion Creek near Seminary and MacArthur Boulevard (Demgen 1998 # 765). A June 1998 visual survey along about 270 meters of Chimes Creek conducted on behalf of the city of Oakland found no fish and the study report concluded that "the stream may be too small to support fish species" (Hagar and Demgen 1998).

Assessment: We conclude that the Lion Creek watershed historically supported anadromous *O. mykiss*. Suitable habitat upstream from Highway 13 in the Oakland Hills supports a small, isolated and apparently self-sustaining population of what may be wild *O. mykiss*, originally derived from steelhead. Further, if the trout in Horseshoe Creek are not of hatchery origin then they represent a "unique and valuable resource" (Hagar and Demgen 1998, p. 2). Extensive channelization and culverting of Lion Creek between the Bay and Horseshoe Creek near Highway 13 likely serve as barriers to migrating steelhead, although an assessment of possible downstream barriers is recommended (Hagar and Demgen 1998).

Arroyo Viejo Watershed

Arroyo Viejo drains a portion of the Oakland hills including low-density residential areas and park land in the upper reaches and highly urbanized lands in the lower drainage. The creek enters the San Francisco Estuary near San Leandro Bay.

Arroyo Viejo

As part of a fish distribution study, four Arroyo Viejo sites were sampled in July 1981. No salmonids were collected (Leidy 1984).

Two branches of Arroyo Viejo were surveyed in June 1998 as part of an aquatic resources inventory of Oakland streams. The main branch survey was upstream 1.2 miles from the Oakland Zoo, while the "Country Club" branch survey began at Calafia Avenue and was conducted upstream to the culvert at the base of Oak Hill Road. No fish were seen during the survey (Hagar and Demgen 1998).

Assessment: Arroyo Viejo likely historically supported *O. mykiss* given suitable remnant habitats remaining in the upper watershed above Highway 13. A future assessment of downstream barriers within urbanized Oakland and sampling of the upper watershed are recommended.

San Leandro Creek Watershed

San Leandro Creek is located on the eastern side of the Berkeley-San Leandro Hills and western slopes of Rocky Ridge near Moraga. The watershed is 44 square miles including areas drained by Moraga, Indian, Redwood, Buckhorn, Kaiser, Miller, and Grass Valley creeks. The construction of Chabot Reservoir in 1874-5 at approximately RM 6 completely blocked steelhead migration to these tributaries. Construction of Upper San Leandro Reservoir in 1926 further isolated the tributaries with the exception of Grass Valley Creek. Below Chabot Reservoir, San Leandro Creek passes through the highly urbanized San Leandro, entering central San Francisco Bay at the southern end of the Oakland Estuary.

San Leandro Creek

San Leandro Creek flows from its headwaters about five miles to Upper San Leandro Reservoir. From Upper San Leandro Reservoir the creek runs another 3.5 miles to Lake Chabot. San Leandro Creek consists of six miles of channel below Lake Chabot, with perennial flow occurring from Chabot Dam downstream approximately one mile to near Bancroft Street.

In March 1855, Dr. W.P. Gibbons, founder of the California Academy of Sciences described and named a new coastal variety of rainbow trout as *Salmo iridia* (later changed to *irideus*, Latin for rainbow) based on three specimens from San Leandro Creek (Ayres 1855).

The Sportsman Gazetteer for 1877 reported that rainbow trout could be caught at "San Leandro" immediately upstream from the waterworks (Hallock 1877). The reference likely pertains to San Leandro Creek above Lake Chabot.

A February 1957 letter from Willis Evans, DFG, to Dr. Paul Needham, U. C. Berkeley, noted that DFG Warden George Smalley, a 30-year resident of the San Leandro Creek area, reported that runs of steelhead occurred in San Leandro Creek "in the early days" (Evans 1957). Mr. Evans further noted that after the completion of Upper San Leandro Reservoir, a run persisted to the base of the dam for many years (Evans 1957). Needham and Gard, in their 1959 study of geographic variation in coastal rainbow trout of California and Mexico, noted that San Leandro Creek originally supported steelhead runs (Needham and Gard 1959).

A study of *O. mykiss* spawning activity in the San Leandro Creek watershed involved weekly visual observations of fish between April and September 1972. A San Leandro Creek site consisted of a 90-meter reach located upstream from Upper San Leandro Reservoir near the culvert immediately downstream from the intersection of Pinehurst and Canyon roads. Qualitative observations along the study section verified the presence of *O. mykiss* fry, and adults were seen throughout the study period (Arnold 1973).

In August 1975, DFG visually surveyed 6.2 miles of San Leandro Creek from the mouth to Lake Chabot. In the survey report, DFG noted that the study reach supported a remnant steelhead run, which was considered the only known viable steelhead trout population on the east shore of San Francisco Bay (Curtis and Scoppettone 1975a). The report also stated that a resident rainbow trout population existed upstream from Lake Chabot. The survey found numerous 50-75 mm steelhead trout between Lake Chabot to approximately 100 yards downstream from Interstate 580 (Curtis and Scoppettone 1975a). Also, the report cited accounts by local anglers of age 1+ and 2+ steelhead taken frequently. The report noted a four-foot high flashboard barrier 0.3miles upstream from Interstate 580 that is passable for steelhead during winter flows with the flashboards removed. The survey observed that spawning habitat was "fair" and shelter "good" and further concluded that San Leandro Creek should be managed to protect the remnant steelhead resource, including obtaining minimum in-stream releases from Lake Chabot (Curtis and Scoppettone 1975a).

As part of fish a distribution study, ten sites were sampled on San Leandro Creek during July and August 1981. Approximately 100 feet downstream from the Chabot dam spillway, seven *O. mykiss* ranging from 42-106 mm FL, and one fish of 311 mm FL, were collected (Leidy 1981-1984, 1984). Approximately 0.45 miles upstream from the Canyon post office, 27 *O. mykiss* (40-68 mm FL) were collected. At a site approximately 0.5 miles upstream from Upper San Leandro Reservoir, 12 YOY *O. mykiss* (33-72 mm FL) and one larger fish (212 mm FL) were collected from a series of isolated pools. No *O. mykiss* were found at seven sampled sites near and downstream from MacArthur Boulevard and Interstate 880 (Leidy 1981-1984, 1984).

DFG surveyed San Leandro Creek between Interstate 880 and 2.3 miles above Lake Chabot in December 1982 (Berthelsen 1982). Two *O. mykiss* (~300 mm TL) were observed under the Interstate 880 overpass and were presumed to have been washed out of Lake Chabot (Berthelsen 1982). The survey report noted that San Leandro Creek below Lake Chabot supported the last known steelhead run on the east shore of San Francisco Bay and that rainbow trout were known to move up the creek from Lake Chabot. The report concluded that Lower San Leandro Creek appeared to provide good spawning habitat for steelhead except for siltation problems. It further recommended investigating summer flow releases into the creek from Upper San Leandro Reservoir (Berthelsen 1982).

In September 1983, EBRPD electrofished three upper San Leandro Creek reaches. The first reach, located 100 yards downstream from the Indian Creek confluence, yielded 25 *O. mykiss* including YOY (not measured) and adults to 178 mm FL (Alexander 1984a). Sampling in various pools along the creek adjacent to Pinehurst Road produced 26 trout, including YOY (not measured) and adults to 198 mm FL. The third reach was more than 300 yards below a complete barrier to fish passage at the abandoned Southern Pacific railroad crossing. This reach yielded three *O. mykiss* year classes, including "many" YOY (not measured), age 1+ (>15), and age 2+ (8: 125-200 mm FL) (Alexander 1984a).

In April and June 1984, EBRPD electrofished two reaches on upper San Leandro Creek. The first site, a 90-meter reach upstream from the intersection of Pinehurst and Moraga roads produced nine *O. mykiss* (89-369 mm FL). The second site, a single pool above Canyon Road at RM 4.0, produced 13 trout (89-445 mm FL) (Alexander 1984b).

During June 1986, EBRPD electrofished upper San Leandro Creek at three locations. Station 1, a 90-meter reach upstream of Pinehurst Road did not produce any *O. mykiss*, and staff noted that a culvert under Pinehurst Road was a barrier to upstream fish passage (Alexander 1984b). At stations 2 and 3, reaches downstream from Pinehurst Road, abundant YOY *O. mykiss* and adults (14: <200 mm FL; 1: 400-600 mm TL) were found (Alexander 1987).

In June 1989, EBMUD observed abundant *O. mykiss* YOY at five different locations on upper San Leandro Creek, including upstream from "The Farm", at McCosker Ranch Road, downstream from McCosker Ranch Road, immediately upstream from the Canyon Post Office, at Canyon School, and at the Redwood Trail crossing (Hagar 1989a). During July 1989, EBMUD followed up with an electrofishing survey at two sites and visual surveys at several other locations. YOY were abundant at all locations. At the Redwood Trail crossing, 37 YOY were caught but not measured (Hagar 1989a). At Canyon School, 16 YOY (not measured) and nine older *O. mykiss* (101-337 mm FL) were caught (Hagar 1989a).

From March through July 1990, EBMUD trapped upstream- and downstream-migrating *O. mykiss* in tributaries of the upper San Leandro Creek watershed. Within upper San Leandro Creek, the trapping effort found 1,524 individuals captured and measured, yielding the following age class distribution: 1,316 YOY, 141 juveniles and 67 adults (EBMUD 1991). Age determinations were made by analyzing scales from a sample of the population, leading the researchers to characterize YOY as 70 mm TL or below, juveniles as 71-220 mm TL, and adults as fish larger than 220 mm TL. The study found that more than 90% of the adult spawners, and YOY and older juvenile trout, in the study area were trapped in San Leandro Creek (EBMUD 1991).

In July and August 1990, EBRPD electrofished 28 randomly chosen sites on upper San Leandro Creek in conjunction with habitat surveys to estimate the total *O. mykiss* population size. *Oncorhynchus mykiss* sampled had a mean length of 62 mm TL (Holsinger et al. 1991). Densities ranged from 4-237 fish per 86 square meters, and the *O. mykiss* population in San Leandro Creek was estimated at between approximately 6,000-11,000 individuals (Holsinger et al. 1991).

During March 1993, EBMUD electrofished three sites on San Leandro Creek from immediately downstream from the spillway of upper San Leandro Reservoir at the confluence with Miller Creek downstream to approximately 400 yards upstream from the Willow Park Golf Course. No *O. mykiss* were caught or observed (Hartwell 1993).

In June 1993, Leidy electrofished three sites on San Leandro Creek. One site was below Chabot Reservoir immediately downstream from the bridge at the entrance to San Leandro City Park, where Leidy collected four *O. mykiss* (68-82 mm FL) (Leidy 2002). Leidy also electrofished three sites on San Leandro Creek above upper San Leandro Reservoir. In one reach approximately 50 meters downstream from the confluence of Indian Creek, he caught 23 *O. mykiss* (42-82 mm FL). In the reach immediately downstream from this station, also downstream from a major intersecting fire road culvert along Pinehurst Road, Leidy caught 41 *O. mykiss* (26-110 mm FL) and one larger *O. mykiss* (154 mm FL) which was an age 1+ fish (Leidy 2002). At a site 0.3 miles upstream from the lower Pinehurst Road crossing he caught 24 *O. mykiss* (33-123 mm FL).

In February 1997, Leidy electrofished a 30 meter reach on lower San Leandro Creek centered on the footbridge upstream of East 14^{th} Street and the school in San Leandro. He caught one *O. mykiss* (465 mm FL) that exhibited spawning coloration (Leidy 2002). Results of the EBMUD sampling of San Leandro Creek upstream of Upper San Leandro Reservoir between 1996 and 2001 are offered in Table IV-1.

Table IV-1. EBMUD *O. mykiss* sampling results from San Leandro Creek, 1996-2001

Date	No.	Size (mm)	Date	No.	Size (mm)
June 1996	9	40-142	April 1999	12	119-370
Sept. 1997	59	43-189	July 1999	66	26-215
June 1998	18	34-175	Feb. 2001	2	410-420
Dec. 1998	20	45-215	Feb. 2001	5	331-490
Dec. 1998	9	48-139			

(Source: Hartwell 2002b; Setka 2003c)

EBMUD conducted electrofishing on San Leandro Creek below Chabot Dam on three dates in 2000. All surveys occurred at San Leandro City Park. In April 2000, 32 *O. mykiss* (188-350 mm) were collected. Thirteen *O. mykiss* (73-220 mm) were collected in October, one of which displayed smolt characteristics. In December, 12 *O. mykiss* (74-218 mm) were collected, with two displaying smolt characteristics (Setka 2000).

In November 2001, DFG surveyed the San Leandro Creek channel below Lake Chabot and identified a possible migration barrier consisting of a four-foot concrete weir off Marlow Avenue, 0.3 miles upstream from Interstate 80 (Cleugh 2002).

Grass Valley Creek

Grass Valley Creek flows into the northern-most arm of Lake Chabot. EBRPD staff noted *O. mykiss* in this creek, and speculated that their likely source was introduced fish of hatchery origin (P. Alexander pers. comm.).

Miller Creek

In March 1993, EBMUD electrofished the lower 98 meters of Miller Creek above its confluence with San Leandro Creek. No *O. mykiss* were caught or observed (Hartwell 1993).

Kaiser Creek

Kaiser Creek is a tributary of Upper San Leandro Reservoir. In November 1983, EBRPD electrofished Kaiser Creek from the area surrounding its confluence with Upper San Leandro Reservoir upstream approximately 60 meters. Staff from EDRPD also electrofished the upper sections of the creek. Two *O. mykiss* were caught at each sampling site (79 and 89 mm and 183 and 188 mm, respectively) (Alexander 1984a). However, the possibility exists that the creek sampled was actually Buckhorn Creek (Alexander 1988).

During May 1984, EBRPD electrofished two Kaiser Creek locations. Four *O. mykiss* YOY (38-42 mm FL) were collected within a 400-meter reach upstream from the "Old Orchard" (Alexander 1984b). Fifteen individuals from two age classes (13 YOY; 2 1+: <220 mm FL) were collected 0.25 miles upstream from the "Old Orchard" reach, immediately downstream from a debris dam (Alexander 1984b).

In August 1986, EBMUD obtained 52 yearling *O. mykiss* from Kaiser Creek for genetic analysis. Allele frequencies for 17 biochemical marker-loci were compared between the Kaiser Creek fish and *O. mykiss* from 13 present and former California steelhead streams including Redwood Creek. The study report stated that *O. mykiss* from Redwood and Kaiser creeks represents a unique population of non-hybridized coastal rainbow trout that has been isolated from migrating steelhead for over 112 years (*i.e.,* since construction of Chabot Dam in 1875) (Bentley and Gall undated; Gall et al. 1990).

In June 1989, Jeff Hagar, a consulting fisheries biologist to EBRPD, sampled three sites on Kaiser Creek. Adult *O. mykiss* (2: 337, 466 mm FL) were caught upstream from the confluence with Buckhorn Creek, and downstream from the confluence with Callahan Creek (2: 221, 380 mm FL) (Hagar 1989a). YOY *O. mykiss* (2: 45, 55 mm FL) also were sampled at the Callahan Creek site, indicating that trout were able to spawn successfully despite drought conditions (Hagar 1989a).

From March through July 1990, EBRPD trapped migrating *O. mykiss* in several tributaries to Upper San Leandro Reservoir. Although 1,670 *O. mykiss* were collected in other tributaries, none were caught in Kaiser Creek (EBMUD 1991). The study report stated that trout occurred in Kaiser Creek though none utilized the creek during the study period (EBMUD 1991).

In July and August 1990, EBRPD electrofished 43 randomly chosen sites on Kaiser Creek in conjunction with habitat surveys to estimate the total *O. mykiss* population size. *Oncorhynchus mykiss* sampled had a mean length of 176 mm TL (Holsinger et al. 1991). Densities ranged from 3-25 per 86 square meters, and the *O. mykiss* population in Kaiser Creek was estimated to be 35-68 individuals (Holsinger et al. 1991).

Staff from EBRPD electrofished Kaiser Creek on seven occasions between March 1998 and January 2000. *Oncorhynchus mykiss* were found at six locations throughout the watershed, with sizes ranging from 35-308 mm. Multiple age classes were identified in each year (Setka 2003a).

Buckhorn Creek

Buckhorn Creek is a tributary of Upper San Leandro Reservoir. In November 1983, EBRPD electrofished what staff thought was Kaiser Creek (but may have been Buckhorn Creek) at its mouth and also in its upper sections. Two *O. mykiss* were caught near the mouth (79 and 89 mm), and two *O. mykiss* were caught in the upper sections (183 and 188 mm) (Alexander 1984a, 1988).

In June 1989, DFG electrofished two sites on Buckhorn Creek, 0.3 miles upstream and 0.2 miles downstream from "Buckhorn Barn." No fish were observed or collected (Hagar 1989a). The survey report concluded that Buckhorn Creek did not provide suitable summer habitat conditions for juvenile and older trout during the on-going drought (Hagar 1989a).

From March through July 1990, EBRPD trapped upstream and downstream migrating *O. mykiss* in tributaries to Upper San Leandro Reservoir. Although 1,670 *O. mykiss* were collected in other tributaries, none were caught in Buckhorn Creek (EBMUD 1991). The study report concluded that Buckhorn Creek did not support trout, especially in dry years (EBMUD 1991). During July and August 1990, EBRPD electrofished two sites on Buckhorn Creek in conjunction with habitat surveys to determine the total *O. mykiss* population size. No *O. mykiss* were caught and the total population in Buckhorn Creek was estimated to be zero (Holsinger et al. 1991).

EBMUD staff visually observed *O. mykiss* spawning in the lower portions of the Buckhorn Creek in winter 2001-2002<Setka, 2003 #25>. While successful reproduction may occur in some years, this tributary is believed to have limited habitat value, due to low flows in most water years, and high levels of sedimentation occurring in the basin (J. Setka pers. comm.).

Redwood Creek

Redwood Creek is a tributary of Upper San Leandro Reservoir and is formed by two tributaries, west branch and east branch, which originate in Redwood Regional Park. A study of *O. mykiss* spawning activity in the San Leandro Creek watershed involved weekly visual observations of fish between April and September 1972. A Redwood Creek site consisted of a 90-meter reach located upstream from Upper San Leandro Reservoir beginning at the culvert at the intersection of Pinehurst and Redwood roads. Adult and fingerling *O. mykiss* were noted between the intersection of Pinehurst and Redwood roads and Redwood Park throughout the study period (Arnold 1973).

In March 1978, EBRPD and DFG electrofished several reaches of Redwood Creek in Redwood Regional Park. Five *O. mykiss* were collected (351–399 mm FL) downstream of a barrier formed by a masonry bridge with an inoperative fish ladder (Paulsen et al. 1978b).

In June 1978, EBRPD and DFG electrofished two reaches of Redwood Creek immediately downstream from the Redwood Creek Fire Station on Redwood Road. One 45-meter reach yielded 38 *O. mykiss* (25-64 mm FL) (Paulsen et al. 1978a). The other 45-meter reach yielded 64 *O. mykiss* (23–65 mm FL). According to the study report, the estimated *O. mykiss* density in the main fork of Redwood Creek was 180 fish per 45 meters of stream. The report concluded that Redwood Creek below the masonry road bridge crossing within Redwood Regional Park was “excellent” nursery and spawning habitat for rainbow trout (Paulsen et al. 1978a).

In March 1979, DFG, EBRPD and CALTROUT electrofished seven reaches in the Redwood Creek watershed above Upper San Leandro Reservoir to verify the presence of spawning adult *O. mykiss*. Young of the year *O. mykiss* were observed in all sampled reaches (23: 58-127 mm FL) (Paulsen 1979). Adults were found below the masonry road crossing to Redwood Regional Park, and in the west fork (11: 201-445 FL) (Paulsen 1979).

In April 1979, DFG and EBRPD electrofished a 420 meter reach of Redwood Creek upstream from the mouth at Upper San Leandro Reservoir. One sexually mature *O. mykiss* (404 mm) was collected as well as 70 juveniles (76-170 mm FL) (Paulsen 1979). In March 1980, DFG and EBRPD electrofished five sites in Redwood Creek as part of an on-going monitoring program on spawning success of adfluvial rainbow trout using the Upper San Leandro Reservoir. The sampling documented 68 *O. mykiss* ranging in size from 76-437 mm FL (Paulsen 1980).

In April 1981, DFG and EBRPD electrofished three stations on Redwood Creek and the West Fork of Redwood Creek upstream from Upper San Leandro Reservoir. The first sampling station on Redwood Creek from the masonry bridge to the confluence with the West Fork yielded 33 fish (51-381 mm FL) (Burger 1981). A second station on Redwood Creek from Pinehurst Road upstream to the confluence of the West Fork produced 108 fish (66-417 mm FL). The station on the West Fork adjacent to Redwood Road near Big Springs yielded 17 trout (94-381 mm FL). Three stations yielded a total of 158 *O. mykiss* representing 5-year classes according to scale analyses (66-417 mm FL). The final report concluded that Redwood Creek had value as a nursery for immature fish as well as providing spawning habitat. Summer "carryover" of young rainbow trout in isolated pools was considered to be good (Burger 1981).

As part of a fish distribution study, Redwood Creek was sampled by seine in August 1981. *Oncorhynchus mykiss* (14: 41-127 mm FL) was confined to one of five isolated pools sampled 3.7 miles downstream from the junction of Redwood and Pinehurst Roads (Leidy 1984). Forty-six *O. mykiss* (22-62 mm FL) along with two larger *O. mykiss* (146, 146 mm FL) were found in the pool immediately below the second bridge crossing within the main entrance to Redwood Regional Park. *Oncorhynchus mykiss* also were found in pools at the first upstream crossing above the main park entrance (16: 40-130 mm FL), immediately above the parking lot bridge at the McDonald Trail entrance (27: 35-76 mm FL), at the bridge 0.8 miles downstream from the junction of Skyline and Redwood Road (10: 42-80mm FL), and on the McDonald Branch of Redwood Creek 0.25 miles upstream from its confluence with main stem Redwood Creek (3: 40, 52, 56 mm FL) (Leidy 1984).

Redwood Creek upstream of Upper San Leandro Reservoir was sampled by DFG and EBRPD in April 1982. Eight sites were electrofished from Redwood Road marker 2.48 upstream to the confluence of the east and west branches, and up the north branch to the masonry bridge, yielding 37 *O. mykiss* ranging from 29-438 mm FL (Alexander 1982). Scale analysis later found the following relationship between age and size: 1+, 153.5 mm; 2+, 191.3 mm; and, 3+, 291.5 mm. Only one age 4+ individual (328 mm) and one age 5+ (438 mm) individual were analyzed (Alexander 1982).

In September 1983, EBRPD electrofished Redwood Creek to procure *O. mykiss* for stocking into Wildcat Creek within Tilden Regional Park. An estimated 30-40 percent of "trout bearing areas" within Redwood Creek were shocked, yielding 615 individuals (Alexander 1984a).

In April 1984, the EBRPD and DFG electrofished Redwood Creek at five locations below and three locations above a newly installed Denil fishway. Results are listed in Table IV-2.

Table IV-2. EBRPD and DFG Redwood Creek *O. mykiss* sampling results, April 1984

Location	**Number Juveniles (number YOY)**	**Size Range (mm FL)**
Main stem		
Pinehurst and Redwood roads	24	45-156
	(1)	
Below fire station	38	95-358
Fire station to east and west branch confluence	13	38-332
	("several")	
East branch		
Confluence up to masonry bridge	19	83-297
Below and in fishway	3	142-168
Above fishway near Laurel Grove	1	317
	(10)	
At old church	7	84-190
West branch		
At Grass Valley water tank tributary	27	81-320
	("many")	

(Source: Alexander 1984b).

In October 1984, EBRPD obtained 53 yearling *O. mykiss* from Redwood Creek for genetic analysis. As discussed in the Kaiser Creek section, above, these fish appeared to be non-hybridized descendants of coastal *O. mykiss* (Bentley and Gall undated; Gall et al. 1990).

In April 1985, DFG and EBRPD electrofished five Redwood Creek stations upstream of Upper San Leandro Reservoir. Sampling stations were along Redwood Road, as well as in the east branch within Redwood Regional Park. A total of 68 *O. mykiss* were collected and numerous fry were observed at all stations sampled (Burger 1986). Age/length analysis based on scale samples from ten *O. mykiss* revealed the following mean lengths for each age class: 1+, 132 mm FL; 2+, 332 mm FL; and, 3+, 356 mm FL (Burger 1986).

In June 1986, EBRPD electrofished three sites on Redwood Creek. One site located in the east branch near the Prince Road intersection within Redwood Regional Park produced 45 YOY and ten adults (100-180 mm FL) (Alexander 1987). A second site located on the west branch at Redwood Road yielded abundant YOY and six adults (105-360 mm FL). The third site in a nearby pool produced four adults (105-335 mm FL) (Alexander 1987).

In July 1989, EBRPD electrofished seven sites on Redwood Creek upstream from upper San Leandro Reservoir. The total collection of *O. mykiss* from pools at these locations was approximately 193 individuals representing at least three age classes (Hagar and English 1989). Sampling in May 1990 by EBRPD at the same stations yielded 35 *O. mykiss* likely consisting of YOY, 1+ and 2+ fish (Hagar and English 1990).

From March through July 1990, EBRPD trapped upstream and downstream migrating *O. mykiss* in Redwood Creek upstream of San Leandro Reservoir. According to the trapping report, 144 individuals were captured and measured, and 125 fish (almost 87 percent) were found to be downstream-migrating juveniles. Only eight adults were captured and only five of these fish were upstream migrating. The study report cited a possible near failure of trout reproduction in Redwood Creek in 1990 (EBMUD 1991).

In July and August 1990, EBRPD electrofished 44 randomly chosen sites on Redwood Creek in conjunction with habitat surveys to estimate the total *O. mykiss* population size. *Oncorhynchus mykiss* sampled had a mean TL of 133 mm (Holsinger et al. 1991). Densities ranged from 4-74 fish per 86 square meters, and the *O. mykiss* population in Redwood Creek was estimated to be 266-484 individuals in the west branch and 50-152 in the east branch (Holsinger et al. 1991).

Leidy electrofished three stations on Redwood Creek in June 1993. Thirty-nine *O. mykiss* (33-90 mm FL) were caught in a 42 meter reach at the junction of Redwood Road and Pinehurst Road, three *O. mykiss* (41, 45, 48 mm) in the 30 meter reach at the Old Church picnic site in Redwood Regional Park, and 61 *O. mykiss* (38-82 mm FL) in the 54 meter reach downstream from the culvert at the East Bay/Skyline Trail intersection with Redwood Road (Leidy 2002).

In July and August 1994, EBMUD electrofished three stations on Redwood Creek upstream of upper San Leandro Reservoir. Electrofishing on the main stem and north fork yielded 52 *O. mykiss* (39-161 mm FL). A follow-up visual survey of the same reach found an estimated 495 YOY. Electrofishing on the west fork yielded 59 *O. mykiss* (48-187 mm FL) (EBMUD 1994).

Staff from EBRPD electrofished Redwood Creek on five occasions between March 1999 and April 2002. *Oncorhynchus mykiss* were found at four locations upstream from upper San Leandro Reservoir, with sizes ranging from 28-445 mm. Multiple age classes were observed in each year (Setka 2003b).

Moraga Creek

Moraga Creek is a tributary of Upper San Leandro Reservoir and is formed by three branches that together drain the sub-urbanized Moraga Valley. In August and September1974, DFG electrofished eight sites on the north and six sites on the west branch of Moraga Creek from their confluence upstream. No *O. mykiss* were caught or observed. The survey report concluded that the stream reaches observed did not appear to provide good spawning or nursery habitat for salmonids (Strohschein and Anderson 1974).

As part of a fish distribution study, ten sites on Moraga Creek were sampled by seine in August 1981. No *O. mykiss* were found (Leidy 1984). In June 1987, DFG electrofished Moraga Creek near Miramonte High School. The survey collected 57 *O. mykiss* ranging in size from 25-275 mm FL. Many of the fish were characterized as YOY, and the largest fish was determined to be age 2+ (Gray 1987a).

From March through July 1990, EBRPD trapped migrating fish in the tributaries to San Leandro Reservoir. Water delivery operations and possibly chlorination activities made results obtained in Moraga Creek unreliable for characterizing typical *O. mykiss* use of the creek. Two individuals were trapped and dead and five *O. mykiss* individuals were noted outside the trap (EBMUD 1991). In July and August 1990, EBRPD electrofished several sites on Moraga Creek to determine fish species composition. Five *O. mykiss* were caught with a mean length of 114 mm TL (Holsinger et al. 1991).

An EBMUD memo from March 1992 included a photograph of a 445 mm *O. mykiss* caught in Moraga Creek adjacent to Miramonte High School (English 1992). EBMUD sampled Moraga Creek upstream of Upper San Leandro Reservoir in June 1999, finding seven *O. mykiss* (50-195 mm FL), and in December 2000, when 13 *O. mykiss* (54-152 mm FL) were collected (Hartwell 2002a).

Indian Creek

Indian Creek flows primarily southeast, parallel to San Leandro Creek, before turning to merge with San Leandro Creek approximately 0.5 miles upstream from Upper San Leandro Reservoir. In August 1981, a dipnet and seine survey of Indian Creek found one living *O. mykiss* (172 mm FL) and one dead *O. mykiss* (140 mm) in an isolated pool immediately upstream from the confluence with San Leandro Creek (Leidy 1984). A second sampling site approximately 0.5 miles upstream from the above site, in a pool below the Canyon Road crossing, contained no fish (Leidy 1984).

In September 1983, EBRPD electrofished Indian Creek from the San Leandro Creek confluence to the Canyon Road intersection. Multiple age classes of *O. mykiss* were found, including YOY and 11 older individuals (81-356 mm FL) (Alexander 1984a). In June 1984, EBRPD electrofished Indian Creek at the upper San Leandro Creek confluence and below an upstream barrier. Each location supported YOY *O. mykiss* and other age classes (18: 72-170 mm FL) (Alexander 1984b). In June 1986, EBRPD electrofished Indian Creek at Canyon Road. No YOY *O. mykiss* were found in a pool below the road crossing that contained older individuals (7: 195-345 mm FL) (Alexander 1987).

In July 1989, DFG electrofished a pool on Indian Creek just below Canyon Road. No *O. mykiss* were found (Hagar 1989a). In July and August 1990, EBRPD electrofished the lower 160 meters of Indian Creek in conjunction with habitat surveys to determine the total *O. mykiss* population size. No *O. mykiss* were caught (Holsinger et al. 1991).

In June 1993, Leidy electrofished 30 meters of stream immediately above Pinehurst Road and caught five *O. mykiss* (146-190 mm FL) (Leidy 2002). He also electrofished a 30 meter reach approximately 0.3 miles upstream along Canyon Road, but caught no fish (Leidy 2002). Leidy electrofished the 30 meter reach immediately upstream from Pinehurst Road again in February 1997 and caught four *O. mykiss* (75-130mm FL) (Leidy 2002).

Assessment: Coastal steelhead were isolated in the Upper San Leandro Creek watershed when Chabot Dam was constructed in 1875. Steelhead were isolated further in the upper reaches of several fragmented drainages following the construction of Upper San Leandro Reservoir in 1926 (Hagar 1989b). Genetic analysis performed on *O. mykiss* from Redwood Creek and Kaiser Creek found the fish to be unique populations of non-hybridized, coastal rainbow trout (Gall et al. 1990).

Adult *O. mykiss* migrate out of Upper San Leandro Reservoir to spawn in several streams including Redwood, San Leandro, Indian, Moraga, Kaiser and Buckhorn Creeks. Redwood and San Leandro creeks support the highest quality and greatest area of suitable spawning and rearing habitats, and the largest populations of *O. mykiss* in the upper watershed. Indian, Moraga, Kaiser and Buckhorn creeks also support populations of *O. mykiss*, although they are much smaller than those found in Redwood and San Leandro creeks. All creeks in the upper watershed are contained largely within protected watershed lands administered by EBRPD and EBMUD. The exception is Moraga Creek, which flows through suburbanized portions of the town of Moraga.

The status of *O. mykiss* within the portions of San Leandro Creek, including Miller Creek, between Upper San Leandro Reservoir and Lake Chabot, is uncertain, although suitable habitat appears to be available in both streams. The status of *O. mykiss* in Grass Valley Creek, which flows into the northern-most arm of Lake Chabot, also is unknown.

San Leandro Creek below Lake Chabot supports a small run of *O. mykiss* of unknown size. Depending largely on the timing and amount of annual rainfall, lower San Leandro Creek supports suitable spawning and rearing habitat for anadromous *O. mykiss* from approximately 0.5 miles downstream of Interstate 580 to Chabot Dam. Restoration of streamflows between December and April below Lake Chabot could benefit *O. mykiss* by expanding the quality and quantity of available spawning and rearing habitats, and providing water for downstream migrating smolts.

San Lorenzo Creek Watershed

San Lorenzo Creek flows generally west, entering central San Francisco Bay near Roberts Landing, west of the city of San Lorenzo. The watershed consists of about 48 square miles, with highly urbanized lower and middle watershed areas. A 4.6-mile concrete channel runs from the mouth upstream. The upper watershed, including areas tributary to Crow and Palomares creeks, is less urbanized. Cull Creek Dam, located at RM 8.9 approximately 0.25 miles upstream from the Crow Creek confluence, was constructed in the early 1960s. The dam created a complete barrier to fish migration. Don Castro Dam, located immediately downstream of the Palomares Creek confluence, also was built in the early 1960s and also created a complete barrier to upstream migration.

San Lorenzo Creek

DFG surveyed San Lorenzo Creek from the mouth upstream 8.3 miles in April 1946. At an upper station near the B Street Bridge (RM 7.77), steelhead (35-50 mm TL) were found to be abundant in shallow gravel areas (Shapovalov 1946). A local resident reported observing adult in-migrants in the year of the survey. The DFG survey also observed two steelhead, one each above and below tide gates near the mouth of San Lorenzo Creek. *Oncorhynchus mykiss* also were observed approximately 0.5 miles upstream from the tide gates. The survey report cited observations made by a local resident in 1941 or 1942 of 400 adult steelhead trying to ascend the concrete apron under the bridge on E. 14th Street in one day. The Department of Fish and Game estimated that about 100 of these fish passed the apron (Shapovalov 1946).

DFG rescued 770 fingerling steelhead from drying portions of San Lorenzo Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

A 1960 DFG stream survey of Crow Creek noted that small, sporadic steelhead runs occurred in the San Lorenzo Creek drainage (Allen and Moore 1960a). A 1961 DFG memo assessing the probable effects of several proposed Corps' flood control projects in the watershed also stated that the San Lorenzo Creek drainage appeared to support a minor steelhead run (Elwell 1961). The assessment estimated that there were 2.5 miles each of available spawning and nursery area of "mediocre" quality in the middle reach of San Lorenzo Creek (Elwell 1961). The assessment estimated a total of approximately 10.5 to 13.5 miles of spawning area considered "mediocre" and seven miles of "mediocre" nursery area scattered throughout the drainage. The Department of Fish and Game considered the winter steelhead fishery to be of little or no value as it did not attract many anglers, and did not propose actions to conserve steelhead as part of mitigation for water and flood control developments in the watershed (Elwell 1961).

In a 1962 report, Skinner indicated that San Lorenzo Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In August 1975, DFG visually surveyed San Lorenzo Creek from Don Castro Dam downstream to the inland limit of the concrete flood control channel at the Highway 238 crossing, a distance of 3.1 miles (Curtis and Scoppettone 1975b). Although no salmonids were observed, the survey report noted that San Lorenzo Creek was a historic steelhead stream (Curtis and Scoppettone 1975b). The report further noted that channelization, dam construction, flow regulation and urbanization of the basin, and siltation of gravels had an adverse impact on the steelhead resource. According to DFG, the downstream 4.3- mile concrete flood control channel likely was a barrier to steelhead passage as a result of high water velocity and absence of resting pools (Curtis and Scoppettone 1975b). The report observed that a program involving installation and maintenance of baffle plates in the low-flow channel to facilitate steelhead passage was terminated in 1963 with the construction of Don Castro Dam, which blocked access to principal spawning and nursery areas (Curtis and Scoppettone 1975b). The report concluded that San Lorenzo Creek did not appear to support a viable steelhead population and that the area below the reservoir should not be managed for trout (Curtis and Scoppettone 1975b).

A DFG memo from 1975 stated that rainbow trout lived in Don Castro Reservoir and main stem San Lorenzo Creek upstream from the reservoir (Anderson 1975a). The memo further noted that trout migrated upstream from Don Castro Reservoir into tributary streams to spawn during the spring months (Anderson 1975a).

As part of a fish distribution study, 11 sites along the entire length of San Lorenzo Creek were sampled during July 1981. *Oncorhynchus mykiss* was not found (Leidy 1984).

Spring migrant trapping, visual surveys for parr, and some electroshocking were performed on San Lorenzo Creek beginning in the Spring 1997 through the Spring 1998 as part of a masters thesis research project. No *O. mykiss* were observed or collected during the study (Kobernus 1998). The thesis concluded that the 4.6-mile concrete channel in lower San Lorenzo Creek was an impassable barrier to migratory fish. The thesis also identified four limitations in steelhead spawning and rearing habitat in San Lorenzo Creek, including few pools, lack of large woody debris, sedimentation of riffle habitats, and low abundance of benthic macroinvertebrates (Kobernus 1998).

As part of fisheries assessment, a July 1998 fisheries electrofishing survey of 16 sites within the San Lorenzo Creek watershed was conducted. A 305 mm TL fish was collected in San Lorenzo Creek downstream from Don Castro Dam and upstream from the confluence of Crow Creek (Hagar 1998). The survey report suggested that this fish might have come from Don Castro Reservoir because of its relatively large size. The second fish measuring 584 mm TL was collected from a large pool in San Lorenzo Creek downstream from the confluence of Crow Creek (Hagar 1998). The origin of this trout was not known, but the report considered that it was possibly anadromous. The report concluded that "the presence of trout in San Lorenzo Creek in July is an indication that the habitat may at least be capable of sustaining trout through the critical summer months" (Hagar 1998, p. 5). The report recommended further monitoring and analysis to determine whether water temperatures in the watershed were suitable for *O. mykiss*, and whether the 5.8 miles of channelized stream below the MacArthur Freeway was a barrier to adult steelhead.

ACFCWCD conducted a fisheries assessment, including fish sampling, of streams in the San Lorenzo Creek watershed during 2001-2002. Six San Lorenzo Creek sites were sampled, revealing four *O. mykiss* within a 75-meter reach upstream of the Castro Valley Creek confluence (ACFCWCD and HES 2002). In May 2002, staff of the ACFCWCD observed two *O. mykiss* in San

Lorenzo Creek between Foothill Boulevard and 2nd Street in the city of Hayward. The fish were estimated to be between 380-510 mm in length (M. da Costa pers. comm.). It was not determined whether the trout had been "washed out" of Don Castro Reservoir or had migrated into the creek from San Francisco Bay.

Castro Valley Creek

Castro Valley Creek is largely underground in its lower reaches in the city of Castro Valley but has more natural reaches toward the headwaters. It flows generally south to join San Lorenzo Creek in the vicinity of Baywood School, east of Highway 238.

In January 1997, a large adult female *O. mykiss* was noted in the lower part of Castro Valley Creek (L. P. Kobernus pers. comm.). The fish appeared to be of hatchery origin. Three Castro Valley Creek sites were surveyed in 2001 as part of a fish study for the San Lorenzo Creek watershed. No *O. mykiss* were found (ACFCWCD and HES 2002).

Crow Creek

Crow Creek is a perennial stream draining an area of approximately ten square miles and is the largest tributary to San Lorenzo Creek. A 1,600-foot-long concrete box culvert was constructed in 1972 upstream of the Cull Creek confluence with San Lorenzo Creek that is a fish passage barrier.

DFG rescued four fingerling steelhead from drying portions of Crow Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

In June 1960, DFG surveyed Crow Creek from the mouth to the headwaters, a distance of 5.5 miles. No salmonids were observed (Allen and Moore 1960a). However, the survey report noted that small, periodic steelhead runs were known to occur in the drainage (Allen and Moore 1960a). The report further concluded that Crow Creek likely represented one of the better spawning and nursery tributaries of the San Lorenzo Creek watershed. In years of normal runoff, parts of the creek were believed capable of supporting a small juvenile steelhead population throughout the summer period (Allen and Moore 1960a). This DFG report cited local residents who had observed *O. mykiss* between 150-200 mm TL being caught early in the trout season in the stream's lower reaches (Allen and Moore 1960a).

A 1961 DFG memo assessing the probable effects of proposed Corps' flood control projects in the watershed stated that Crow Creek contained the best steelhead spawning and nursery areas in the San Lorenzo Creek watershed (Elwell 1961). The Department of Fish and Game estimated that three to four miles of spawning habitat and two miles of rearing habitat were available in Crow Creek (Elwell 1961). However, DFG did not propose actions to conserve steelhead and their habitat as part of mitigation for water development in the drainage watershed.

In a 1962 report, Skinner indicated that Crow Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In July 1975, a pollution-induced fish kill in the vicinity of Crow Canyon Road included a 430 mm TL *O. mykiss* (DeSilva 1975). In August 1975, DFG visually surveyed the lower 8.2 miles of Crow Creek, essentially the entire stream length (Anderson and Scoppettone 1975). Above the confluence with Bolinas Creek, six *O. mykiss* were observed. One fish was netted and measured 230 mm FL, with the others of similar size (Anderson and Scoppettone 1975). The survey report noted that Crow Creek supported a minimal number of rainbow trout in its upper reach and offered poor spawning habitat but sufficient food (Anderson and Scoppettone 1975).

As part of a fish distribution study, two sites on Crow Creek were sampled in July 1981. No *O. mykiss* were collected (Leidy 1984).

ACFCWCD conducted a fisheries habitat assessment of streams in the San Lorenzo Creek watershed during 2001-2002, including fish sampling at six Crow Creek sites. *Oncorhynchus mykiss* were collected at two locations, one near the Cull Creek confluence and a second about one mile upstream. The former site yielded eight *O. mykiss* in a 115-meter reach, while the latter contained two individuals in a 138-meter reach (ACFCWCD and HES 2002). The report cites the sampling results as evidence of successful reproduction of rainbow trout in Crow Creek (ACFCWCD and HES 2002).

Cull Creek

Cull Creek is characterized by about seven miles of intermittent stream between the confluence with Crow Creek and the headwaters. It flows generally south to enter Crow Creek just downstream of the Cull Creek Dam. This dam, built in 1962, is a complete barrier to fish passage (ACFCWCD and HES 2002).

In July 1960, DFG visually surveyed the length of Cull Creek primarily by automobile with occasional stops to check the stream. No fish were observed, but the survey report noted that in 1957 or 1958, 50-100 mm *O. mykiss* were reported below a ranch pond spillway about midway along Cull Canyon Road (Rafra 1960). The Department of Fish and Game estimated that there was little or no steelhead use in years of normal rainfall (Rafra 1960). Another report from the same survey stated that the stream probably received some use as a spawning area in some years (Allen 1960a). A farm pond dam located at about RM 4 was identified as a complete barrier to fish migration. The Department of Fish and Game recommended that Cull Creek be managed as a steelhead spawning stream (Allen 1960a).

In a 1962 report, Skinner indicated that Cull Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be “lightly used” as steelhead habitat (Skinner 1962).

As part of a fish distribution study, one Cull Creek site was sampled in July 1981. No *O. mykiss* were collected (Leidy 1984).

ACFCWCD sampled three Cull Creek sites in April 2001 as part of a fisheries habitat assessment. No *O. mykiss* were collected (ACFCWCD and HES 2002).

Palomares Creek

Palomares Creek and its tributaries drain the hills east of the city of Castro Valley. This stream is an intermittent tributary to San Lorenzo Creek estimated to consist of about five miles of channel that joins San Lorenzo Creek near Don Castro Regional Recreation Area.

In June 1960, DFG surveyed the length of Palomares Creek by automobile with occasional stops to check the stream. In pools in the lower section, *O. mykiss* 38-89 mm TL were observed at an estimated density of 10-20 fish per 30 meters of stream (Allen 1960b). The survey report stated that historically Palomares Creek was probably utilized by steelhead as a spawning area, and that juveniles probably migrated to the lower part of the drainage, remaining in nursery areas in San Lorenzo Creek until they migrated to the Bay (Allen 1960b). The report also estimated that there was approximately three to four miles of "mediocre" to "fair" steelhead spawning areas, and recommended continued management of Palomares Creek for steelhead spawning (Allen 1960b).

As part of a fish distribution study, two Palomares Creek sites were sampled below Don Castro Dam in July 1981 (Leidy 1984). No *O.* mykiss were collected. The Department of Fish and Game reported seeing rainbow trout in Palomares Creek in September 1987 (Gray 1987c).

In July 1996, Leidy electrofished Palomares Creek at the confluence with Eden Canyon Creek, opposite Palomares School**.** No *O. mykiss* were collected (Leidy 2002). Four Palomares Creek sites were sampled in April 2001 as part of a fisheries habitat assessment by ACFCWCD. No *O. mykiss* were collected (ACFCWCD and HES 2002).

Eden Canyon Creek (Eden Creek)

This creek is tributary to Palomares Creek and consists of about three miles of channel between the mouth and the headwaters. A drop structure under Palomares Road and Interstate 580 on Eden Creek is a barrier to fish passage into Eden Canyon Creek (ACFCWCD and HES 2002).

In June 1960, DFG surveyed the length of Eden Canyon Creek primarily by automobile with occasional stops to assess the stream. No fish were observed. The study report concluded that Eden Canyon Creek had little value as a sport fishery (Allen and Moore 1960b).

As part of a fish distribution study, one Eden Canyon Creek site was sampled in July 1981. No *O. mykiss* were collected (Leidy 1984).

ACFCWCD sampled two Eden Creek sites in April 2001 as part of a fisheries habitat assessment. No *O. mykiss* were collected (ACFCWCD and HES 2002).

Assessment: Steelhead probably used much of the San Lorenzo Creek watershed historically, until channelization and other effects of urbanization led to degraded habitat and decreased population size. Steelhead were relatively abundant in this system into the 1950s (ACFCWCD and HES 2002). Construction of Don Castro Dam and Cull Creek Dam completely blocked anadromous fish migration into large portions of the upper watershed in the early 1960s.

According to a fisheries assessment for the drainage, *O. mykiss* persists at extremely low frequency in the watershed, probably as a result of stocking in Don Castro Reservoir (ACFCWCD and HES 2002). The assessment report summarizes conditions in San Lorenzo Creek as follows: "Although suitable habitat for rainbow trout and steelhead exists in the watershed, passage barriers, excess fine sediment, and periodic poor water quality limit the numbers and distribution of these fish" (ACFCWCD and HES 2002, p. 1).

Alameda Creek Watershed

At about 700 square miles, the Alameda Creek watershed is the largest of the San Francisco Estuary. Alameda Creek was channelized from the San Francisco Bay upstream about 12 miles to the vicinity of Niles Canyon between 1965 and the mid-1970s for flood control and water supply purposes. Geographic features referenced in the following discussion include Niles Canyon, Sunol Valley, and upper Alameda Creek. Important tributaries include Arroyo de la Laguna, San Antonio Creek and Calaveras Creek, each of which contains a major reservoir (*i.e.,* Lake del Valle, San Antonio and Calaveras Reservoirs, respectively).

Alameda Creek

A series of DFG memoranda written by Mr. Leo Shapovalov during 1938 discuss several observations of *O. mykiss* in Alameda Creek. One memo reported on Shapovalov's interview with construction workers for the San Francisco Water Department at the Calaveras Diversion Dam, who described seeing steelhead jumping at the Sunol Dam in Niles Canyon because they were unable to use the fishway (Shapovalov 1938a). The memo noted that steelhead were impeded by an 18-20 foot dam at the second railroad bridge downstream from Sunol, in Niles Canyon, the location of the Hetch Hetchy pipelines.

In another entry on the same date, Shapovalov noted an interview with a local rancher, who reported that in May 1938 a fisherman caught 20 steelhead (~300 mm) at Rooney Ranch near the Pirate Creek confluence (Shapovalov 1938a). In May 1938, DFG staff observed abundant trout (to 40-50 mm TL) that had recently emerged from gravel near the Calaveras Creek confluence and in Calaveras Creek (Shapovalov 1938a). The memo also noted that 4,000 rainbow trout were planted in this reach of Alameda Creek in 1937; however the hatchery source of these fish is not stated.

DFG formerly stocked *O. mykiss* in Alameda Creek for a "put-and-take" fishery during the summer months. This practice dates back to at least 1937 according to DFG records (Shapovalov 1938a). Also, field notes from EBRPD staff report that property owners have planted trout below the Ohlone section of upper Alameda Creek intermittently over the 50 years before 1995 (Alexander 1995-1999).

DFG rescued 200 fingerling steelhead from drying portions of Alameda Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

DFG staff observed 40 miles of Alameda Creek from the mouth to Mt. Hamilton and vicinity, as well as 22 miles of major tributaries, in a one-day survey on foot and by car in May 1957. The report concluded that upper Alameda Creek and its tributaries provided "excellent" habitat both for survival and for reproduction of trout (Pintler 1957).

An ichthyology class's sampling data sheets noted capture by seining of one adult *O. mykiss* in April 1967 (Barlow 1967). The fish was collected at the Stanley Bridge, Old Canyon Road in Niles and, based upon an assessment of condition, was apparently a steelhead.

DFG sampled six Alameda Creek locations in June 1973 by electrofishing: three sites in Lower Alameda Creek, one in Niles Canyon and two in Upper Alameda Creek near the Calaveras Creek confluence. No *O. mykiss* were found during the sampling and the resulting report placed a "?" value in the table indicating presence/absence for rainbow trout in the 1973 collections

(Aceituno et al. 1976). In 1973 and 1974, steelhead were reported attempting to migrate upstream through the Alameda Creek flood control channel. Also, in 1974, "three runs of from 20 to 60 fish" were seen.

In a 1977 paper, Scoppettone and Smith describe results of sampling conducted using seines and electroshockers in three Alameda Creek locations between 1972 and 1977. These locations were a site 0.3 miles upstream from the Calaveras Creek confluence and a site at Mile Post 5, Ohlone Camp Road. The two locations revealed *O. mykiss* at relative abundances of "2" on a 5-point scale with "5" indicating "very abundant" (Scoppettone and Smith 1977).

DFG and EBRPD staff sampled Alameda Creek immediately upstream of the Calaveras Creek confluence in September 1987. Electrofishing results included 15 *O. mykiss* (50-81 mm FL) (Gray 1988b).

Leidy electrofished sites (typically 30 m) on Alameda Creek in 1992, 1993, 1994 and 1996. All *O. mykiss* were found immediately above the Alameda Creek Diversion Dam within or below Camp Ohlone Regional Park, or just below Alameda Creek Diversion Dam. Two exceptions were for two *O. mykiss*, one found in Niles Canyon in 1992 and one found immediately below the Old Spring Valley Water Company diversion dam at the top of Niles Canyon in October 1993 (Leidy 2002).

Leidy's sampling in 1992 and 1993 is reported in Table IV-3. Three sites in Camp Ohlone, two sites near the confluence of Arroyo de la Laguna, and one site just above the confluence with Calaveras Creek did not produce *O. mykiss* in 1992 (Leidy 2002). In 1993, three sites in or near Sunol Regional Park, one site at the confluence with Arroyo de la Laguna, three sites near the Old Spring Valley Water Co. diversion dam at the top of Niles Canyon, three sites within Niles Canyon, and three sites within the flood control channel produced no *O. mykiss* (Leidy 2002).

Table IV-3. Alameda Creek sampling results for *O. mykiss*, 1992

Date	Location	Number	Size (mm FL)
1992			
April	Camp Ohlone	2	140, 168
		3	unmeasured
May	0.2 mi. upstream SFWD Niles Canyon Rd.	2	268, 275
June	0.75 m. downstream ACDD	1	270
		3	~200-255
June	0.5 mi. downstream Camp Ohlone	19	51-215
June	Immediately downstream Little Yosemite	23	50-250
July	0.5 mi. downstream Camp Ohlone	12	70-220
Sept.	Falls 0.5 mi. downstream Camp Ohlone	16	158-265
		~500	~25-100
Sept.	Little Yosemite, downstream from grate on dirt rd.	11	154-230
		many YOY	~100
1993			
May	Falls 0.5 miles downstream Camp Ohlone	10	35-195
May	Immediately upstream above site	22	50-233
Aug.	0.25 miles downstream ACDD	4	79-106
		1	245
Aug.	0.2 miles below ACDD	14	75-240
Aug.	Immediately downstream ACDD	7	78-192
Oct.	Immediately downstream Old Spring Valley Water Co. diversion dam	1	158
Nov.	Opposite Ranch House, Camp Ohlone	2	128, 134

(Source: Leidy 2002)

Leidy observed three *O. mykiss* (25-50 mm TL) near the Calaveras Creek confluence in March 1994. In April 1994, two sites downstream from Interstate 680 and one site downstream from the Old Spring Valley Water Company diversion dam produced no *O. mykiss* (Leidy 2002). Leidy sampled two sites downstream from the Old Spring Valley Water Company diversion dam again in August 1996 and found no *O. mykiss* (Leidy 2002). Department of Fish and Game staff sampled eight upper Alameda Creek locations in July 1995. Four *O. mykiss* were collected (68-79 mm) by electrofishing (Murphy and Sidhom 1995).

EBRPD periodically samples fish populations in portions of Alameda Creek as part of their resources management program. Staff sampled pools at the downstream end of the Little Yosemite area and recorded four *O. mykiss* (113-188 mm FL) in October 1995. Below the Alameda Creek Diversion Dam, a 40-meter pool was electrofished during the same sampling effort and produced 24 *O. mykiss* (84-189 mm). Also in October 1995, staff sampled Alameda Creek near Camp Ohlone and found ten *O. mykiss* (88-207 mm). Electroshocking in another pool near Camp Ohlone produced 20 *O. mykiss* (103-212 mm) (Alexander 1995-1999).

In October 1996, EBRPD staff sampled immediately above and below the Alameda Creek Diversion Dam. The downstream 86-meter reach produced 12 *O. mykiss* (75-282 mm FL) and six “missed” individuals. Field notes indicated that some of the fish showed steelhead characteristics. The upstream site, consisting of a 43-meter pool, contained 19 *O. mykiss* (66-217 mm) and five “missed” individuals (Alexander 1995-1999). EBRPD staff sampled the Camp Ohlone area extensively in October 1996 by electroshocking. Data for nine sites in this area are summarized in the Table IV-4.

Table IV-4. EBRPD electroshocking on Alameda Creek at Camp Ohlone, October 1996

Reach Length	**Number Collected**	**Size Range (mm)**	**Number Observed***
“Pool”	1	200	1 (~200)
70 m	43	50-240	
“Pool”	15	70-230	
18 m	8	62-87	2
33 m	22	59-222	
100 m	20	61-254	
161 m	46	60-214	20
19 m	8	62-85	
“Pools”	44	57-182	9

(Source: Alexander 1995-1999)
*not collected

In June 1997, EBRPD staff electroshocked a 52-meter reach in Sunol Regional Park and found one *O. mykiss* (196 mm). EBRPD staff electrofished a 30 meter reach below Little Yosemite in July 1997 and recorded four *O. mykiss* (54-102 mm) as well as two “missed” individuals of similar size (Alexander 1995-1999). Also in July 1997, staff sampled a one mile reach upstream of Camp Ohlone by dip net and seining at “random intervals” and found 13 juvenile *O. mykiss* (51-60 mm) and one resident adult (200 mm).

Adult steelhead have also been reported in lower Alameda Creek in 1997 and the years up to the present (J. Miller pers. comm.). These fish are unable to pass the ten-foot drop structure between the Union Pacific Railroad and BART tracks. Limited numbers of *O. mykiss* have been collected in the flood control channel section of Alameda Creek. Sightings and collections involve between one and 15 individuals, and adult in-migrants measure up to 850 mm and larger. Genetic analyses of fin clips from *O. mykiss* in Alameda Creek and tributaries indicate a very strong relationship between these fish and Central Coast ESU steelhead (Nielsen 2003).

SFPUC has contracted for aquatic resource monitoring, including fish sampling, as part of its facilities planning. In August 1998, a snorkel survey of seven pools in upper Alameda Creek found 20 *O. mykiss* in four pools (Trihey & Associates Inc. 1999). Sampling also included electrofishing in seven reaches, two of which produced *O. mykiss*. Population estimates were reported as Site 1: 12 0+, 2 1+, 11 2+ and Site 3: 12 0+ (Trihey & Associates Inc. 1999).

As part of the SFPUC monitoring program, consultants re-surveyed seven pools by snorkeling in September 1999, and electrofished seven sites in October of that year. Sampling locations were in the approximately four-mile area beginning near the Sunol Valley Water Treatment Plant to approximately 1,500 feet upstream of the Calaveras Creek confluence. Snorkel surveys found YOY *O. mykiss* only upstream of the confluence. The 1999 electrofishing effort produced an abundance estimate of four individuals at one site.

Surveys of Alameda Creek were performed in September and October 1999 as part of an assessment of the feasibility of restoring steelhead to the watershed (Gunther et al. 2000). *Oncorhynchus mykiss* were observed in most pools from the Little Yosemite area upstream to the Alameda Creek Diversion Dam (ACDD), including YOY and adult *O. mykiss* to 305 mm. From ACDD upstream to the Camp Ohlone area, YOY and adults to 250 mm in length were found to be "abundant" in most pools. In the reach above the Camp Ohlone area, *O. mykiss* was again observed in most pools and included YOY and adults to 200 mm. The survey report noted that upstream migration was not possible past ACDD, indicating that trout above the dam are resident (Gunther et al. 2000). Also in October 1999, EBRPD staff found one *O. mykiss* (198 mm) in a 27 meter reach near the Sunol Lower Swim Dam while electroshock sampling (Alexander 1995-1999).

Sampling was conducted in Alameda Creek in May 2001 to collect *O. mykiss* for genetic analysis. Upstream of ACDD, five *O. mykiss* were collected ranging in size from 120-160 mm FL, while the site downstream of the dam produced nine *O. mykiss* (105-218 mm FL). A third site at the Little Yosemite area yielded 16 *O. mykiss* (99-191 mm FL). Tissue samples were taken from each sampled group of fish for analysis. Upper Alameda Creek trout were shown to be closely related to previously sampled fish and to native, wild *O. mykiss* collected in other portions of the watershed (Nielsen 2003).

Dry Creek

Based on the size and location of the Dry Creek drainage, as well as the known fish assemblage, it is probable that the creek historically supported use by *O. mykiss*, at least in wet years. Under current conditions, use by steelhead or resident *O. mykiss* is highly unlikely (S. McGinnis pers. comm.).

Stonybrook Creek

Stonybrook Creek flows south out of Stonybrook Canyon, joining Alameda Creek in Niles Canyon. In October 1955, staff from the California Academy of Sciences seined approximately 20 *O. mykiss* (75-175 mm TL) at a point about 1.5 miles above the Alameda Creek confluence (Follett 1974). Also in October, five *O. mykiss* (~50 mm TL) were collected in a pool 1.2 miles upstream of the Alameda Creek confluence (Follett 1974).

DFG rescued 645 fingerling steelhead from drying portions of Stonybrook Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season. A 1959 DFG letter indicated that steelhead were known to spawn in Stonybrook Creek (Fisher 1959).

In April 1976, DFG electroshocked a 30-meter reach of Stonybrook Creek 150 yards upstream from the Alameda Creek confluence. One 250 mm *O. mykiss* was found, but the associated DFG report concluded that Stonybrook Creek did not support a viable population of rainbow trout due to the "seasonal" nature of the stream (Scoppettone 1976d).

In September 1987, DFG electrofished a small pool on Stonybrook Creek approximately 1.5 miles from the Alameda Creek confluence. Four *O. mykiss* were caught ranging in length from 162-219 mm FL (Gray 1987b).

EBRPD staff electroshocked a 27-meter reach of Stonybrook Creek immediately downstream of the first road crossing, which constitutes a migration barrier, in April 1999. Eight *O. mykiss* were found (189-335 mm) (Alexander 1995-1999).

Two in-migrating steelhead were captured by EBRPD in main stem Alameda Creek at the BART weir in February, 1999. These fish were radio-tagged and released near the bottom of Niles Canyon. Subsequent tracking found that the female steelhead had passed a culvert into Stonybrook Creek (Miller 1999). Becker noted YOY *O. mykiss* in the following year (2000) at the downstream end of the first impassable road crossing on Stonybrook Creek, suggesting that the steelhead had successfully reproduced with a resident *O. mykiss* (Becker 2002).

Sinbad Creek

Sinbad Creek drains the valley formed by Sunol Ridge and Pleasanton Ridge. It runs roughly from north to south, feeding Alameda Creek in the town of Sunol. A local resident fished in Sinbad Creek during his childhood and donated photographs to EBRPD. The photographs indicate *O. mykiss* caught in the creek during the 1940s and 1950s. Fish depicted in the photos are believed to be anadromous from their size and appearance (Mills *n.d.*).

EBRPD records indicate electofishing of Sinbad Creek downstream of 589 Kilkare Road to the first bridge in September 1999. No *O. mykiss* were collected in the sample (Alexander 1995-1999).

Arroyo de la Laguna

Historically, Arroyo de la Laguna drained Tulare Lake, a marsh situated between the present-day towns of Dublin and Pleasanton. Tulare Lake was fed by numerous tributaries, including the Arroyos Valle and Mocho, as well as Tassajara and Alamo Creeks. The marsh was drained and the stream channels realigned, altering the historic relationship of these streams. Arroyo de la Laguna is currently formed by the confluence of Arroyo Valle and a channel that transports the merged drainages of Arroyo Mocho, Tassajara, South San Ramon and several other creeks (Sowers 1995).

In a 1962 report, Skinner indicated that Arroyo de la Laguna was an historical migration route for steelhead (Skinner 1962). DFG and USFWS sampled Arroyo de la Laguna by electrofishing in October and November 1975, February 1976 (four stations), and May 1976 (two stations). No *O. mykiss* were reported in these three surveys (Michny and Ging 1975; Scoppettone 1976a, 1976b).

A fish kill occurred in January 1985 in an unnamed tributary to Arroyo de la Laguna. An investigation noted several species of fish killed, but no salmonids were among them. The Department of Fish and Game again surveyed the creek in May 1985 in relation to flow releases from del Valle Reservoir. The report stated that adequate streamflows were needed to allow the reestablishment of steelhead runs in the Alameda Creek system and were required under Fish and Game Code Section 5937 (Gray 1986a). No *O. mykiss* were found during the sampling (Gray 1986a).

Leidy electrofished Arroyo de la Laguna at ten locations between March and December 1993, one location in May 1994 and one location in July 1996. No *O. mykiss* were found at any of the sampling locations (Leidy 2002).

According to an unpublished study of steelhead use of the Arroyo de la Laguna system, anadromous *O. mykiss* appear to have used Arroyo de la Laguna for migration into spawning tributaries in wet years. We found no records that the arroyo itself provided steelhead habitat historically.

Vallecitos Creek

Vallecitos Creek is tributary to Arroyo de la Laguna. Leidy electrofished this creek at the San Antonio Road Crossing in October 1993, but found no *O. mykiss*. EBRPD records indicate electrofishing in June 1999 at a site upstream from the Sunol-Pleasanton pipeline crossing that did not produce *O. mykiss* (P. Alexander pers. comm.).

Arroyo Valle (Arroyo del Valle)

Arroyo Valle is tributary to Arroyo de la Laguna. In April 1910, the Livermore *Herald* reported game warden and fishermen's statements that the headwaters of Arroyo Valle were "full of fish." One trout (presumably *O. mykiss*) was collected measuring about 750 mm, and numerous smaller fish were noted (Livermore Herald 1910). In June 1953, an angler took a steelhead measuring over 550 mm from Arroyo Valle near Livermore (Livermore Herald 1953).

In a 1962 report, Skinner indicated that Arroyo Valle was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead (Skinner 1962).

Survey work, including electroshocking, in September 1983 and May 1985 was performed at Arroyo Valle below Lake del Valle to document the potential for steelhead habitat. The survey report indicated that there was potential for establishing populations of *O. mykiss* in the creek downstream of Del Valle dam (Gray 1986b). Unpublished studies by Hanson Environmental in 2002-2003 also documented areas of suitable habitat downstream of the dam.

Leidy electrofished Arroyo Valle at three locations between 1993 and 1996. *Oncorhynchus mykiss* was not found (Leidy 2002). EBRPD records document electrofishing at four Arroyo Valle sites in October-November 1999. *Oncorhynchus mykiss* was not collected at any of the sites, which included locations upstream and downstream of Lake del Valle (Alexander 1995-1999).

Portions of Arroyo Valle were surveyed in September 1999 as part of a steelhead restoration feasibility study. No *O. mykiss* were observed in two reaches downstream from Lake del Valle and the survey report noted: "No habitat offering good potential as spawning or rearing habitat was observed" (Gunther et al. 2000, pp. 73-74).

Unpublished studies by Hanson Environmental of steelhead resources of the Arroyo de la Laguna system indicate that Arroyo Valle likely was most commonly used tributary by spawning steelhead. The relatively large watershed was cited as likely to lead to conditions of hydrologic connectivity with Arroyo de la Laguna in moderate water years.

Trout Creek

This creek is tributary to Arroyo Valle above Lake del Valle and consists of about eight stream miles. *Oncorhynchus mykiss* are noted in Trout Creek in a DFG stream survey believed to date from 1944 that notes perennial stream flow in the upper catchment and "common" spawning grounds, but speculates that natural propagation probably does not occur in the creek (Shapovalov 1944b).

Colorado Creek

Colorado Creek is a headwater tributary of Arroyo Valle. The creek consists of about six miles of channel draining the northeast flank of the Burnt Hills.

Leidy sampled Colorado Creek by dip net about 0.5 miles upstream from the Mines Road crossing in August 1981. He collected *O. mykiss* ranging between 48-282 mm FL (Leidy 1984).

Arroyo Bayo

Arroyo Bayo originates east of Mt. Hamilton and flows generally north to its confluence with San Antonio Creek, when it becomes Arroyo Valle, upstream of Lake del Valle. No records concerning fish in this creek were found. Informal surveys of Arroyo Bayo indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

San Antonio Creek

This creek originates in the area east of Mt. Hamilton and south of the Burnt Hills. It flows north, then east, to its confluence with Arroyo Bayo when it becomes Arroyo Valle. No records concerning fish in this creek were found. Informal surveys of San Antonio Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Beauregard Creek

This creek is tributary to San Antonio Creek. It flows generally west from the area east of San Antonio Valley. No records concerning fish in this creek were found. Informal surveys of Beauregard Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Arroyo Mocho

From its relatively undeveloped headwaters area, the creek runs generally northwest to the city of Livermore where it turns west and flows to its confluence with the drainage channel feeding Arroyo de la Laguna. Potential passage barriers have been identified on Arroyo Mocho, including a drop structure at Stanley Boulevard and an access road at the LLNL.

A newspaper report from May 1911 notes anglers' reports of catching trout over 280 mm in Arroyo Mocho within six miles of Livermore. Fish also were noted in the creek's headwaters, resulting from plantings in the previous two seasons (Livermore Herald

1911). A 1944 DFG stream survey reported *O. mykiss* present in Arroyo Mocho, but cited past stocking as the likely source of the fish, due to a low probability of natural propagation in the creek (Shapovalov 1944a).

In a 1962 report, Skinner indicated that Arroyo Mocho was an historical migration route and habitat for steelhead (Skinner 1962). A report on fish sampling between 1972 and 1977 produced a relative abundance estimate for *O. mykiss* of "4" on a 5-point scale (Scoppettone and Smith 1977). Sampling was performed by seining and electrofishing at a site near the LLNL pumping station. A site 0.6 miles above del Valle Road received an *O. mykiss* relative abundance rating of "2" (Scoppettone and Smith 1977).

An ichthyofaunal survey was conducted in February 1976 at three Arroyo Mocho stations: (1) LLNL pumping station; (2) Cedar Brook Ranch; and (3) near Mines Road. All three stations were electroshocked and produced *O. mykiss*. Combined results indicated 44 individuals with the following size distribution: 21 fish: 67-139 mm FL; 15 fish: 153-195 mm; and 8 fish: 211-318 mm (Scoppettone 1976c).

In December 1993, Leidy electrofished Arroyo Mocho at Wente Road and Marina Avenue. No *O. mykiss* were found (Leidy 2002). Portions of the creek were surveyed in September 1999 as part of a steelhead restoration feasibility study. One *O. mykiss* (150-200 mm) was observed upstream from the LLNL road crossing and the survey report noted pools with potential to hold trout during rearing (Gunther et al. 2000).

Sampling was conducted in Arroyo Mocho in April 2001 to collect *O. mykiss* for genetic analysis. At the property of J. Norton, 31 *O. mykiss* were collected (89-189 mm FL) and tissue samples taken for analysis. Arroyo Mocho trout were shown to be more closely related to Central Valley hatchery strains than to other Alameda Creek watershed populations (Nielsen 2003).

Tassajara Creek

This creek is tributary to the drainage channel feeding Arroyo de la Laguna. In May 1994, Leidy electrofished a 50 meter reach on Tassajara Creek at the Tassajara Regional Land Bank and found no *O. mykiss* (Leidy 2002). Informal surveys of Tassajara Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

Arroyo las Positas

Arroyo las Positas is tributary to Arroyo Mocho. In a 1962 report, Skinner indicated that Arroyo las Positas was an historical migration route for steelhead (Skinner 1962).

The creek was surveyed from the mouth in September 1999 as part of a study of the feasibility of restoring steelhead to the Alameda Creek system. No *O. mykiss* were found and the survey report noted that the creek and its tributaries had no spawning/rearing potential (Gunther et al. 2000).

Cayetano Creek

This creek is tributary to Arroyo las Positas. The creek was surveyed from the mouth in September 1999 as part of a study of the feasibility of restoring steelhead to the Alameda Creek system. No *O. mykiss* were found and the survey report noted that the creek had no spawning/rearing potential (Gunther et al. 2000).

South San Ramon Creek

This creek appears to have been re-constructed as a flood control channel parallel to Interstate 680 on the freeway's east side. It is tributary to the drainage channel feeding Arroyo de la Laguna. No records regarding fish in this creek were found. Informal surveys of South San Ramon Creek indicate that the watershed does not presently support an *O. mykiss* population (J. Hale pers. comm.).

San Antonio Creek

San Antonio Creek originates in the hills near the Ohlone Regional Wilderness and flows generally west to its confluence with Alameda Creek. The majority of the San Antonio Creek catchment was impounded by construction of San Antonio Reservoir in the mid-1960s. The dam forming San Antonio Reservoir is a complete barrier to upstream migration.

According to a 1954 DFG field note, San Antonio Creek formerly supported a small steelhead run each year (Evans 1954). The Department of Fish and Game rescued eight fingerling steelhead from drying portions of San Antonio Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

Leidy sampled two locations on San Antonio Creek above San Antonio Reservoir in 1997. At the first road crossing above the reservoir, a 35-meter reach yielded ten *O. mykiss* (68-148 mm FL) (Leidy 2002). These fish were assumed to be migrating from the reservoir. A 30-meter reach immediately above the confluence with La Costa Creek yielded 13 *O. mykiss* (58-90 mm) (Leidy 2002).

In order to develop information regarding life history characteristics of *O. mykiss* in San Antonio Reservoir, a fish trapping program has been developed for the SFPUC. In February-March 2002, a total of 149 smolts and 44 adults were collected by fish traps operating over the course of 25 days in San Antonio Creek upstream of the reservoir (Entrix 2002). Juvenile *O. mykiss* were found from 111-140 mm FL, while adults ranged from 347-525 mm FL (Entrix 2002).

Trout samples were taken from San Antonio Reservoir in 2002 for genetic analysis. *Oncorhynchus mykiss* using the reservoir and its tributaries were shown to be closely related to previously sampled fish and to native, wild *O. mykiss* collected in other portions of the watershed (Nielsen 2003).

Indian Creek

This creek was formerly tributary to San Antonio Creek. Its mouth was drowned by creation of San Antonio Reservoir, to which the creek is now tributary. San Antonio Creek flows generally north from its headwaters in the Ohlone Regional Wilderness.

In July 1953, DFG inspected Indian Creek and found large numbers of stranded steelhead, ranging in size from 75-150 mm (Johnson 1953b). A rescue was performed in August of that year, with *O. mykiss* moved to Alameda Creek (Johnson 1953a). The DFG field notes from the rescue indicated that about one-quarter of the rainbow trout observed in Indian Creek pools in early August were remaining by the third week, and that these fish ranged in size from 100-300 mm.

DFG rescued 75 fingerling steelhead from drying portions of Indian Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

Leidy sampled a 30-meter reach of Indian Creek in February 1997 at a site approximately 0.2 miles upstream from the road crossing along San Antonio Reservoir. Four *O. mykiss* (75-150 mm FL) were found, primarily in a single pool (Leidy 2002). He noted that this reach of the creek dries completely in summer, although perennial flow occurs in the creek's headwaters.

La Costa Creek

La Costa Creek flows generally north from its headwaters in the Ohlone Regional Wilderness to the San Antonio Creek confluence. Construction of San Antonio Reservoir isolated *O. mykiss* in this system from anadromous steelhead.

A May 1938 DFG survey noted trout to 75 mm as "common" in La Costa Creek (Shapovalov 1938c). The Department of Fish and Game rescued 250 fingerling steelhead from drying portions of Alameda Creek in 1955 (Allen 1957). These fish apparently were moved to other watershed areas with wetted channel persisting longer into the dry season.

Leidy found *O. mykiss* at all of three locations electrofished on La Costa Creek in October 1993 (Leidy 2002). At a site 0.25 miles upstream from the confluence with San Antonio Creek he caught 15 *O. mykiss* (52-115mm FL). Immediately upstream from this site, Leidy collected seven *O. mykiss* (70-165mm), and in a reach downstream from the SFPUC property boundary, he caught 18 *O. mykiss* (53-115mm) (Leidy 2002).

Indian Joe Creek

Indian Joe Creek is primarily contained within the Sunol Regional Wilderness. According to the personal account of a descendant of ranch owners in the area of present-day Sunol Regional Park, anadromous fish were observed to spawn in Indian Joe Creek in the early 1900s (Larson 2000). Mr. Larson told Sunol Park staff that his relatives were able to scoop the fish up for food.

Staff from EBRPD staff sampled this creek at the Alameda Creek confluence by dip net and electroshocking in June 1997. Nine *O. mykiss* were recorded (44-154 mm FL). Parks district staff again sampled this creek by electrofishing in June 1999. A 56-meter reach located just upstream from the Alameda Creek confluence yielded 26 *O. mykiss* (38-67 mm FL) as well as 37 YOY (Alexander 1995-1999). Field notes stated that no larger trout were found at this location or farther upstream.

Calaveras Creek

Calaveras Creek drains the hills area east of the town of Milpitas. It flows generally north to the Alameda Creek confluence. Most of the runoff from this catchment is impounded in Calaveras Reservoir, constructed in the 1920s. The Department of Fish and

Game visually surveyed the 1.5-mile reach between the Alameda Creek confluence and Calaveras Dam in May 1938. The survey report noted abundant trout (40-50 mm) emerging from gravel in Calaveras Creek (Shapovalov 1938b).

In April 1988, DFG staff electrofished "selected" pools and riffles between the Alameda Creek confluence and about 0.5 miles downstream of Calaveras Dam. The survey report noted that habitat appeared to be suitable for rainbow trout, but *O. mykiss* was not caught or seen (Gray 1988a).

A lake survey by DFG from June 1940 indicated the presence of *O. mykiss* in Calaveras Reservoir (Shapovalov 1943). The Department of Fish and Game sampled the reservoir by electroshocking and gill net in at least five sampling events between April and September of 1973. Twenty-six *O. mykiss* were collected ranging from 244 to 546 mm FL (Anderson 1973; CDFG 1973; Meints and Anderson 1973; Strohschein 1973a, 1973b).

Arroyo Hondo

Arroyo Hondo flows generally north from its headwaters on Mt. Hamilton. Formerly a tributary to Calaveras Creek, it now feeds Calaveras Reservoir. A 1905 report noted *O. mykiss* in this stream (Snyder 1905). Construction of Calaveras Dam isolated this population from anadromous *O. mykiss*.

DFG reported that analysis of scales of *O. mykiss* indicated that two adults sampled in 1937 were found to be five years old. These fish probably migrated from Calaveras Reservoir two separate times to spawn in Arroyo Hondo (Shapovalov 1937). A September 1953 field note stated that trout of various sizes were seen in Arroyo Hondo at the bridge on Hondo Road (Evans 1953).

Sampling was performed by seining and electrofishing at a site near Arroyo Hondo Road between 1972 and 1977. The survey produced a relative abundance estimate for *O. mykiss* of "5" on a 5 point scale with "5" being "very abundant" (Scoppettone and Smith 1977).

In September 1993, Leidy electrofished five locations on Arroyo Hondo 0.15 miles, 0.2 miles, 0.6 miles, 0.8 miles, and 1.3 miles upstream from Marsh Road. The first site yielded three *O. mykiss* (72, 78, 82 mm); the second had six *O. mykiss* (70-200 mm); and the third contained three *O. mykiss* (50, 71, 79 mm) and ten fish seen but not collected (Leidy 2002). The fourth site produced four *O. mykiss* (64-100 mm) with three observed but not collected (>175 mm). The fifth and final site had three *O. mykiss* (60, 89, 105 mm) (Leidy 2002).

In order to develop information regarding life history characteristics of *O. mykiss* in Calaveras Reservoir, a fish trapping program has been developed for the SFPUC. In February-March 2002, a total of eight smolts and 23 adults were collected by fish traps operating over the course of ten days in Arroyo Hondo upstream of the reservoir (Entrix 2002). Juvenile *O. mykiss* were found from 98-142 mm FL, while adults ranged from 395-508 mm FL (Entrix 2002).

Trout samples were taken from Arroyo Hondo in 2002 for genetic analysis. *Oncorhynchus mykiss* using the creek were shown to be closely related to previously sampled fish and to native, wild *O. mykiss* collected in other portions of the watershed (Nielsen 2003).

Smith Creek

This creek is tributary to Arroyo Hondo and is about eight miles in length. Smith Creek flows generally north past Mt. Hamilton to its confluence with Isabel Creek, when it becomes Arroyo Hondo. A 1905 report notes *O. mykiss* in Arroyo Hondo (Snyder 1905). This population was isolated from anadromous *O. mykiss* by construction of Calaveras Dam.

A 1940 DFG survey report for the creek noted only that "very good" natural production occurs in one section of Smith Creek (Shapovalov 1940a). A DFG field note from July 1953 indicated the presence of *O. mykiss* fry to 150 mm in length, and called the creek "excellent" for trout (CDFG 1953b). These notes also referred to planting of *O. mykiss* fingerlings in 1952.

A 1957 DFG report noted that rescued juvenile steelhead from Uvas Creek had been planted in the Smith Creek headwaters (Pintler 1957). Sampling was performed by seining and electrofishing at a site near Mt. Hamilton Road between 1972 and 1977. The survey produced a relative abundance estimate for *O. mykiss* of "2" on a 5-point scale (Scoppettone and Smith 1977).

DFG visually surveyed five miles of Smith Creek from its mouth upstream to the Highway 130 Bridge. The survey report referred to 1993 population surveys that discovered *O. mykiss* averaging 82 mm in length, with individuals up to 282 mm in length present (Boydstun 1994). These surveys yielded a population density estimate of approximately 4,400 individuals per mile. The 1994 survey found "numerous" YOY, 1+ and 2+ *O. mykiss*, with the largest up to 250 mm in length. According to the report, the stream appeared to be producing a large and healthy *O. mykiss* population (Boydstun 1994). Spawning areas for *O. mykiss* were noted as "small" and "quite good," while pool habitats were "very good" (Boydstun 1994).

Leidy electrofished a 30 meter reach on Smith Creek about 220 yards upstream from Mt. Hamilton Road in March 1996 and caught two *O. mykiss* (89, 145mm FL) (Leidy 2002). He also electrofished a 60 meter reach immediately above the road crossing in June 1997, catching ten *O. mykiss* (42-52mm) and observing about 50 more *O. mykiss* in the same size range (Leidy 2002).

Sulphur Creek

Sulphur Creek is tributary to Smith Creek. A 1940 DFG survey cited a report by Warden C.H. Holladay that excellent natural reproduction of *O. mykiss* occurred in this stream (Shapovalov 1940b).

In May 2002, Leidy surveyed Sulphur Creek from the Smith Creek confluence upstream about 1.5 miles to a natural falls. He observed juvenile *O. mykiss* (25-125 mm TL) to be "common" (10-15 per 30 meters), and noted adults between 200 and 300 mm TL (Leidy 2002).

Isabel Creek

Isabel Creek joins Smith Creek to become Arroyo Hondo, which is tributary to Calaveras Reservoir. A 1905 report noted *O. mykiss* in this stream (Snyder 1905). Lake Isabel, constructed in the mid-1940s impounds the creek in the headwaters portion of the catchment. The Lake Isabel Dam and the Calaveras Dam isolated *O. mykiss* populations in upstream and downstream reaches.

According to a July 1948 DFG memorandum, the reach seven miles below the Lake Isabel is intermittent in character but several miles of "good" trout habitat exist downstream of the lake (Shapovalov 1948). Department of Fish and Game notes from 1953 referred to the presence of *O. mykiss* and called the creek "excellent" for rainbow trout (CDFG 1953a). The notes also referred to the planting of *O. mykiss* fingerlings, but did not provide a date of occurrence. A 1957 DFG report noted that rescued juvenile steelhead from Uvas Creek had been planted in the Isabel Creek headwaters (Pintler 1957).

Sampling was performed by seining and electrofishing at a site near Kincaid Road between 1972 and 1977. The survey produced a relative abundance estimate for *O. mykiss* of "4" on a 5-point scale (Scoppettone and Smith 1977). A separate DFG visit was performed in June 1975 at this location. Fingerling *O. mykiss* were observed, and interviews with anglers noted individuals 150-215 mm taken (Anderson 1975b). The visit report indicated that Isabel Creek rainbow trout were considered a resident population as a natural falls downstream (in Arroyo Hondo) prevented passage by fish from Calaveras Reservoir.

A 1998 report concerning steelhead resources notes that a "healthy" *O. mykiss* population occurs in Isabel Creek (Smith 1998). These fish are assumed to be native.

W Tree Creek

W Tree Creek enters Alameda Creek from the north near Camp Ohlone Regional Park. EBRPD staff sampled a 55-meter reach of this creek by electrofishing in June 1999. Staff recorded ten *O. mykiss* (53-60 mm) as well as two "missed" YOY (Alexander 1995-1999).

Bear Creek (Bear Gulch)

Bear Creek enters Alameda Creek from the north upstream of Camp Ohlone Regional Park. A 1942 DFG stream survey report noted that a local landowner had observed trout in this three-mile long creek with perennial flows (Curtis 1942).

Assessment: The Alameda Creek watershed, including numerous tributary catchments, formerly supported *O. mykiss* populations of unknown size. Based on the size of the watershed and the presence of perennial streams in the headwaters, it is likely that this catchment supported one of the largest historical steelhead runs in the San Francisco Estuary.

Construction of the Calaveras Dam in the 1920s blocked access to many of the tributaries known to have contained *O. mykiss*. Similarly, San Antonio Dam was constructed without provision for fish passage and this construction led to further restriction of habitat in the Alameda Creek watershed. Habitat restriction and degradation from water projects and other development related to urbanization caused substantial decline in the population of steelhead entering the watershed to spawn. In the 1970s, flood control and water diversion projects in the lower portion main stem Alameda Creek were approved and constructed without regard for anadromous fish passage. These structures completely blocked access to suitable spawning and rearing habitat in the system.

Nonetheless, small numbers of steelhead continue to enter Alameda Creek regularly, and plans to remove or otherwise mitigate migration barriers have been developed. Addressing seven or more barriers in main stem Alameda Creek is likely to allow access to spawning and rearing habitat, and may lead to successful re-establishment of a steelhead run in the creek. Non-hybridized descendants of Central Coast *O. mykiss* in San Antonio and Calaveras Reservoirs may be used to jump-start a run in the future.

Laguna Creek (Arroyo de la Laguna) Watershed

The Laguna Creek basin covers 25 square miles and has been substantially altered for the purposes of flood control. A map from 1870 indicates that Laguna Creek originally flowed from a lagoon that was also the terminus of Mission Creek (Jones & Stokes Associates Inc. 2000). Most of Laguna Creek and its tributaries are maintained as flood control channels (Jones & Stokes Associates Inc. 2000).

Laguna Creek

Laguna Creek begins at Lake Elizabeth and flows south through Fremont, then west to enter the San Francisco Estuary near Don Edwards National Wildlife Refuge. No records related to observations of salmonids were found for Laguna Creek.

Mission Creek

Mission Creek originates in the hills east of Mission San Jose and feeds the current Lake Elizabeth, formerly called Stivers Lagoon. Mission Creek was sampled by dipnet near Mission San Jose High School in August 1981 as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984).

Assessment: Insufficient information exists to determine if Mission Creek historically supported populations of *Oncorhynchus* spp. Under present conditions, riparian corridors along Laguna Creek and its tributaries are narrow and discontinuous due to portions of the creeks being placed underground, and to the effects of development and flood control practices (Jones & Stokes Associates Inc. 2000). The potential for migration of anadromous salmonids through the lower Laguna Creek area appears to be very limited.

Table IV-5. Distribution status of O. mykiss in San Francisco Estuary streams of Alameda County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
Codornices Creek	Codornices	9/1	1995-2003	0, 1, 2	J/8; R/8	Y	DF	DF	-	1, 2, 3	67, 76 (7)
Strawberry Creek	Strawberry	0	0	-	-	N	DF	NP	Y	0	31, 86
Temescal Creek	Temescal	1/0	1856	3	-	N	DF	NP	Y	0	36
Glen Echo Creek	Glen Echo	1/0	0 **1998**	2	-	N	UNK	NP	-	0	60
Sausal Creek	Sausal	6/0	1998-2002	1,2	J/4; R/3	UNK	DF	DF	Y	1	31, 47, 60, 76, 80, 94
	Shepherd	1/1	1998	2	R/1	UNK	DF	DF	Y	1	60, 80
	Palo Seco	4/1	1997-2001	0,1,2	J/3; R/1	UNK	DF	DF	Y	1	60, 80 (1)
Peralta Creek	Peralta	2/0	0 **1998**	1, 3	-	N	UNK	NP	-	0	60, 76
Lion Creek	Lion	2/0	1997	0, 2	J/1; R/1	UNK	DF	DF	Y	1	60, 122
	Horseshoe	1/1	**1998**	2	R/1	UNK	DF	DF	Y	1	60
	Chimes	1/0	0 **1998**	1	-	N	UNK	NP	-	0	60
Arroyo Viejo Creek	Arroyo Viejo	2/0	0 1998	0, 2, 3	-	N	PS	NP	-	0	60, 76

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
San Leandro Creek	San Leandro	20/14	1855-2001	1, 2, 3	J/14; M/1; R/16	Y	DF	DF	Y	1, 2, 3	4-6, 18, 19, 23, 31-33, 37, 44, 57, 63, 64, 66, 68, 75-77, 86, 100, 103
	Miller	1/0	0 **1993**	2	-	N	UNK	UNK	-	0	64
	Kaiser	8/7	1983-2000	2, 3	J/7; R/7	N	DF	DF	-	1, 2, 3	4, 5, 7, 22, 37, 48, 57, 68, 101
	Buckhorn	4/0	2001-2002	1, 2, 3	R/2	N	DF	DF	Y	1	4, 7, 37, 57, 68 (8)
	Redwood	17/15	1972-2002	1, 2, 3	J/16; R/14	N	DF	DF	Y	1, 2, 3	3-6, 18, 22, 26, 36-38, 48, 56, 58, 61, 62, 64, 68, 71, 77, 88-91, 102
	Moraga	7/5	1987-2000	2, 3	J/4; R/3	N	DF	DF	Y	1, 2	37, 40, 51, 65, 68, 76, 121,
	Indian	8/6	1981-97	2, 3	J/5; R/5	N	DF	DF	Y	1	4-6, 48, 57, 68, 76, 77
San Lorenzo Creek	San Lorenzo	9/1	1942-2002	0, 1, 3	J/1; R/3; M/4	N	DF	DF	Y	1	2, 10, 12, 15, 34, 39, 59, 73, 76, 113, 115 (2)
	Castro Valley	2/0	1998 **2001**	1	R/1	N	DF	NP	-	0	2, (4)
	Crow	4/2	1960-2002	0, 1, 3	R/2	N	DF	DF	Y	1	2, 10, 12, 17, 35, 39, 76, 115
	Cull	4/0	1958 **2001**	0, 1,3	J/1	N	DF	NP	Y	0	2, 9, 76, 93, 115

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	*O. mykiss*		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Palomares	5/1	1960-87 **2001**	0, 1, 2	J/1	N	DF	NP	Y	0	2, 11, 53, 76, 77
	Eden Canyon	2/0	0 **2001**	1,3	-	N	PS	NP	Y	0	2, 13, 76
Alameda Creek	Alameda	18/9	1938-2002	0, 1, 2, 3	J/10; R/9; M/11	N	DF	DF	Y	1, 2, 3	1, 8, 10, 20, 52, 56, 77, 85, 87, 92, 99, 105, 123 (6)
	Dry	0/0	0	-	-	N	PB	NP	-	0	(5)
	Stonybrook	5/4	1955-2000	0, 2, 3	J/3; R/4; M/1	N	DF	DF	Y	1, 2	8, 10, 21, 45, 46, 52, 83, 98
	Sinbad	2/0	1940s-1950s **1999**	2, 3	M/1	N	DF	NP	Y	0	8, 84
	Arroyo de la Laguna	6/0	0 **1996**	2	-	N	DF	NP	Y	0	49, 77, 82, 95, 96, 115, 118
	Vallecitos	1/0	0 **1993**	2	-	N	UNK	NP	-	0	(1)
	Arroyo Valle	7/2	1910-1953 **1999**	0, 1, 2, 3	M/2	N	DF	NP	Y	0	8, 27, 50, 56, 77, 115
	Trout	1/0	1944	1	-	N	DF	UNK	-	0	112
	Colorado	1/1	1981	1	-	N	DF	UNK	-	0	76

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Arroyo Bayo	0	0	-	-	N	UNK	NP	-	0	(3)
	San Antonio	0	0	-	-	N	UNK	NP	-	0	(3)
	Beau-regard	0	0	-	-	N	UNK	NP	-	0	(3)
	Arroyo Mocho	11/2	1911-2001	1, 2, 3	J/2; R/4	N	DF	DF	Y	1, 2, 3	56, 77, 79, 87, 97, 99, 111, 115
	Tassajara	1/0	0 **1994**	2	-	N	UNK	NP	-	0	77 (3)
	Arroyo Las Positas	1/0	0 **1999**	1	-	N	PB	NP	-	0	56, 115
	Cayetano	1/0	0 **1999**	-	-	N	UNK	NP	-	0	56
	South San Ramon	0	0	-	-	N	UNK	NP	-	0	(3)
	San Antonio	2/2	1954-97	0, 2, 3	J/2; S/1; R/1	N	DF	DF	Y	1, 2, 3	10, 41, 43, 77, 87
	Indian	2/1	1953-97	1, 2, 3	J/2; R/1	N	DF	DF	Y	1, 2, 3	10, 69, 70, 77
	La Costa	2/1	1938-93	1, 2	J/2	N	DF	DF	Y	1, 2, 3	10, 77, 107
	Indian Joe	2/2	1997-99	0, 2, 3	J/2;	N	DF	DF	Y	1, 2, 3	8, 74

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	*O. mykiss*		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Calaveras	4/1	1938-2002	1, 2, 3	J/1; R/1	N	DF	DF	Y	1	14, 30, 54, 81, 106, 110, 119, 120
	Arroyo Hondo	6/3	1905-2002	1, 2, 3	J/2; R/2; S/1	N	DF	DF	Y	1, 2, 3	41, 42, 77, 87, 99, 104, 117,
	Smith	8/5	1905-97	1, 2, 3	J/6; R/3	N	DF	DF	-	1, 2, 3	24, 29, 77, 92, 99, 108, 117
	Sulphur	2/1	1940-2002	1	J/1; R/1	N	DF	DF	-	1, 2, 3	77, 109
	Isabel	6/2	1905-2002	0, 1, 2, 3	J/1; R/1	N	DF	DF	-	1, 2, 3	16, 28, 92, 99, 114, 116, 117
	W Tree	1/1	1999	2	J/1	N	DF	DF	-	1	8
	Bear Gulch	1/0	1942	0	-	N	DF	PS	-	1	32
Laguna Creek	Mission	1/0	0 **1981**	3	-	N	UNK	NP	-	0	76

[a] Table headings and codes are defined in the Methods section of this report.

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ALAMEDA COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Alameda County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Alameda County, Caliornia.

SANTA CLARA COUNTY

Coyote Creek Watershed

Coyote Creek originates on the slopes of Mount Sizer near Henry Coe State Park and flows generally south and west to the Santa Clara Valley. Near the site of Coyote Reservoir, the creek turns to flow north to enter the southern San Francisco Estuary near Dixon Landing Road. The main stem consists of approximately 42 miles of stream channel, and the creek has approximately ten primary tributaries. The watershed area is about 354 square miles.

Coyote Creek

Snyder documented the occurrence of *Salmo irideus* (*O. mykiss*) from collections likely made in 1898 from two locations in lower Coyote Creek (Snyder 1905). He described *O. mykiss* near the mouth and near the city of San Jose, indicating that the lower creek historically contained suitable habitat. A museum *O. mykiss* specimen from an unknown Coyote Creek location was collected by Synder in 1898, and is designated “Santa Clara Co., Cal.” (Snyder 1898).

Oncorhynchus mykiss was collected from upper Coyote Creek in the canyon east of the Town of Madrone (located within present day Morgan Hill) in 1936 (Fry 1936). In 1936, drawdown of Coyote Reservoir caused fill kills (including *O. mykiss*) both upstream and downstream of the dam (Shapovalov 1937). Fish downstream of the dam are likely to have been of wild origin, while upstream fish may have been stocked brown trout or landlocked wild *O. mykiss*.

A DFG stocking record from June 1938 documents the planting of more than 1,000 steelhead rescued from Uvas Creek in the adjacent Pajaro River watershed into Coyote Reservoir (CDFG 1938b). Brown trout also were planted in the reservoir during June-July 1938. Sixteen steelhead ranging in size from 343-445 mm FL were found dead at the outlet of Coyote Reservoir when it was drained in January 1939 (Shapovalov 1938-1942). The following summer (July 1940) trout as large as 330 mm were caught in the reservoir. These fish presumably originated from the upper Coyote Creek watershed and migrated downstream to the reservoir during winter flows (Shapovalov 1938-1942). Scale analysis of four *O. mykiss* (200-345 mm) taken in Coyote Reservoir in May 1941 indicated that researchers were not able to distinguish between wild and hatchery fish (Shapovalov 1938-1942).

An additional 1,500 rescued *O. mykiss* were planted in Coyote Reservoir in the summer of 1942 (Shapovalov 1938-1942). An August 1945 seine survey produced *O. mykiss* off Highway 101, 1.5 miles north of the town of Coyote at a concrete dam (1: “one-third grown”) and also at the junction of Malaguira Road and Cochran Road, between Madrone and Morgan Hill (1: “half grown”) (Simpson and Simpson 1945). In 1946, DFG stated that a run of steelhead entered Coyote Creek and that the natural propagation in the system was adequate to fill the reduced carrying capacity of the stream due to water diversions and pollution (Shapovalov 1946a).

A 1953 DFG field note reported a healthy trout fishery in upper Coyote Creek upstream of Anderson and Coyote Reservoirs (Pintler 1953). Seven stations along Coyote Creek were sampled by DFG in July 1953. Two fingerling *O. mykiss* were collected downstream of the junction of Gilroy Hot Springs and Canada roads (Merkel 1953).

In January 1962, DFG searched Coyote Creek for dead fish between Coyote and Anderson Reservoir after rotenone use in Coyote Reservoir. No fish of any kind were found (Hinton 1962c). A March 1965 DFG survey of the 8.2-mile reach upstream from Coyote Reservoir noted two *O. mykiss* (125-150 mm). The resulting survey report stated that the stream section had little or no fisheries importance (Brackett 1965). The report also noted on-going stocking in Coyote Reservoir.

In a 1962 report, Skinner indicated that Coyote Creek, from its mouth to the headwaters in Henry Coe State Park, was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

Sampling by seine and electrofishing was performed between 1972 and 1977 at 14 Coyote Creek sites, with *O. mykiss* collected at one location on the middle fork in Coe State Park (Scoppettone and Smith 1977). The resulting report ranked relative abundance at "2" on a 1-5 scale (Scoppettone and Smith 1977).

The Department of Fish and Game electrofished four Coyote Creek stations between the seasonal diversion dam near the mouth and Anderson Reservoir in June 1973. *Oncorhynchus mykiss* (1: 201 mm FL) was found only at the station immediately downstream from Anderson Reservoir (Aceituno et al. 1976).

One *O. mykiss* was recorded in a creel census in Anderson Reservoir in March 1974 (Anderson 1974). The Department of Fish and Game speculated that Anderson Reservoir *O. mykiss* were probably emigrants from upstream Coyote Reservoir where DFG had conducted trout-stocking (Anderson 1976).

A study of Upper Coyote Creek and numerous headwater tributaries within Henry Coe State Park identified *O. mykiss* in June and July 1974. A total of seven individuals were sampled between 185 and 275 mm FL, with four trout found dead (Guzzetta 1974).

In September 1975, DFG electrofished seven Coyote Creek stations between Highway 237 and Hellyer Park at the Highway 101 bridge. No *O. mykiss* were collected in the sampling (Curtis and Scoppettone 1977). A subsequent stream survey report noted that Coyote Creek historically was a steelhead stream but apparently no longer supported a viable steelhead resource due to flow regulation, habitat alteration, and pollution (Curtis and Scoppettone 1977). However, the report noted that the upper reaches of Coyote Creek were known to support populations of rainbow trout. A May 1976 DFG memorandum included *O. mykiss* in an ichthyofaunal list for Anderson Reservoir, but noted the species' likely source as emigrants from upstream Coyote Reservoir where DFG conducted a trout stocking (Anderson 1976).

In March 1978, *O. mykiss* were found dead downstream from the Coyote Canal Diversion Dam when all flow was shunted into the associated canal (Meltzer 1978). The Department of Fish and Game reported that releases from Anderson Reservoir (1.2 miles upstream from the diversion dam) into the natural stream channel normally provided approximately five miles of live stream in which some trout were present (Anderson 1978).

Oncorhynchus mykiss were found in a creel census of Coyote Reservoir in July 1980 (Eimoto and Berthelsen 1983). These fish were likely from DFG stocking activities.

The Santa Clara Valley Water District sponsored a study to sample numerous Coyote Creek locations in 1987 and the results are summarized in Table V-1. The report describing this sampling effort noted that lower Coyote Creek is the only portion of the watershed with sufficient flows for steelhead and salmon access and spawning (HSA 1988). The report stated that a small steelhead run apparently still existed in Coyote Creek, but cited regulated stream flows and barriers as restricting salmon and steelhead utilization upstream of Senter Road (HSA 1988).

Table V-1. Santa Clara Valley Water District *O. mykiss* collections in Coyote Creek, 1987

	Method	**Number**	**Size (mm SL)**
May			
Upstream of Dixon Landing Rd.	Gill net	3 "smolts"	153, 191, 207
Tidal area u/s of flashboard dam	Gill net	1 "partial smolt"	134
August			
U/s of Dixon Landing Rd.	Gill net	1	193
Tidal area u/s of flashboard dam	Gill net	3	175, 200, 245
October			
Tidal area u/s of flashboard dam	Gill net	1	395
300 m reach u/s of Old Oakland Rd.	Electrofish	1	178
		1 Age 2-3+	286
		YOY	unmeasured

(Source: HSA 1988)

The Metcalf Percolation Pond and percolation ponds upstream from Ford Road on Coyote Creek were sampled in August 1990. Four *O. mykiss* were collected at each location (Elsey 1990). The Santa Clara Valley Water District sponsored a study to sample Coyote Creek between November 1990 and September 1991 to study the impact on *O. tshawytscha* and *O. mykiss* of summer spreader dams used for groundwater percolation. No adult salmonids were found during the surveys, although one steelhead redd was found in Coyote Creek near the Upper Penitencia Creek confluence (HRG 1992). Electrofishing in the vicinity of the redd in April and May 1991 did not find juvenile *O. mykiss*.

Leidy electrofished six locations on lower Coyote Creek in August and September 1993, from Kelly Park, upstream from the Interstate 280 crossing, to Anderson Dam. Immediately downstream from Anderson Dam he found a single *O. mykiss* (275 mm FL) (Leidy 2002). Leidy also electrofished a location on upper Coyote Creek just upstream from the entrance to Henry Coe State Park, but found no *O. mykiss* (Leidy 2002).

Additional monitoring conducted as part of the SCVWD spreader dam studies was summarized in 1994. No *O. mykiss* were directly observed during the winter migration season of 1992-1993 (HRG 1994). Gillnetting in Metcalf Pond in Coyote Creek captured a few *O. mykiss* (two to five individuals) (HRG 1994). The report identified three fish ladders at Ford Road Dam as seasonal passage barriers and Metcalf Radial Dam as impassable under all flow conditions. In a summary of five years of sampling, SCVWD noted that electrofishing, gill net and seine sampling associated with the monitoring found a few (2-5) *O. mykiss* of suspected hatchery origin in Metcalf Pond in 1993 as well as a few *O. mykiss* in two ponds upstream of Ford Road in 1990 (HRG 1995).

In March 1994, Leidy electrofished two locations on lower Coyote Creek, one upstream of South Coyote and one downstream of Coyote, and found no *O. mykiss* (Leidy 2002). He electrofished four sites on lower Coyote Creek between the Montague Expressway and South Coyote in July 1995, finding no *O. mykiss* (Leidy 2002). Leidy also found no *O. mykiss* when he electrofished three sites on mainstem upper Coyote Creek in August 1995 between the Gilroy Hot Springs Road crossing and the point where the park road leaves the creek towards Coit Camp (approximately 2.5 miles upstream) (Leidy 2002).

The Santa Clara Valley Water District sponsored a study to sample lower Coyote Creek in October 1995 in association with operation of Standish Dam (that includes a fish ladder). No salmonids were captured during the sampling (Jones & Stokes Associates Inc. 1996). The Santa Clara Valley Water District conducted fyke-net surveys in lower Coyote Creek between April 1997 and June 1998. In May 1997, 14 juvenile and 51 YOY *O. mykiss* were found.

Fyke net sampling of lower Coyote Creek was conducted in May 1998 as part of a stormwater environmental indicators demonstration project. Five juvenile *O. mykiss* were collected (Eisenberg 1999).

A 1998 paper by Smith described the use of western Mt. Hamilton streams, including Coyote Creek. He found that steelhead were extremely rare in this system, with habitat on mainstem Coyote Creek largely restricted to the area from Anderson Reservoir downstream to a series of instream percolation ponds (Smith 1998). According to Smith, operation of these ponds can “restrict or block out migration downstream . . . during April and May of all but the wettest years” (Smith 1998, p. 8).

From 1998 to 2000, SCVWD monitored both upstream and downstream migrating salmonids to determine if Standish Dam was either an impediment to passage, or detrimental to spawning and rearing habitat. Downstream traps were set during the 2-2.5 month period spanning dam installation (in May) and upstream traps were set during the 2-2.5 month period spanning dam removal (in October). A total of 15, 159, and 253 out-migrating steelhead smolts were captured in 1998, 1999 and 2000, respectively, along with two steelhead kelts (out-migrating adults) in 1999 (Roessler et al. 2001). In 1999 and 2000, zero and two steelhead adults were captured, respectively (Roessler et al. 2001).

The SCVWD migration study determined that Standish Dam posed a seasonal barrier for migrating fish and may harm smolts adapting to salt water by impounding fresh water (Roessler et al. 2001). Based on these results, Standish Dam has not been installed since 2000 (Roessler et al. 2001).

As part of an environmental indicators testing project, the Santa Clara Valley Urban Runoff Pollution Prevent Program sampled 14 Coyote Creek stations in May-June, late June, and September-October 1999. According to the summary report, *O. mykiss* were collected throughout the length the creek (Demgen and Dorsey 1999). Five locations downstream from Metcalf Dam produced a total of 11 *O. mykiss* in approximately 1,500 meters of area sampled in the three events, while a single site between Metcalf and Anderson Reservoir produced four individuals in approximately 300 meters of collectively sampled stream length. Upstream of Anderson Reservoir, 31 *O. mykiss* were collected in three sampling events at three sites representing approximately 900 meters of reach sampled (Demgen and Dorsey 1999). Sampling in late June and September-October recorded 19 *O. mykiss* (47-250 mm FL) and four *O. mykiss* (175-253 mm FL), respectively (Demgen and Dorsey 1999).

In 1999, a fish ladder was installed on Metcalf Dam. No monitoring of passage has occurred since construction, but in 2000, *O. mykiss* were observed between Metcalf Dam and Anderson Dam (J. Abel pers. comm.). Leidy electrofished a single site immediately upstream of Enterprise-Concourse Drive in July 2000. No *O. mykiss* were found (Leidy 2002).

Lower Penitencia Creek

Lower Penitencia Creek consists of approximately four miles of channel draining approximately 27 square miles. It has one direct tributary, Berryessa Creek.

A June 1975 DFG stream survey reported that the headwaters of Lower Penitencia Creek had been filled for urban and agricultural use, and that the remaining channel had been altered and re-aligned for its entire length to serve as a storm runoff channel (Curtis and Scoppettone 1975a). No salmonids were noted during the survey and the summary report stated that the reach upstream from tidal influence had no fishery value (Curtis and Scoppettone 1975a).

Berryessa Creek

Berryessa Creek consists of approximately ten miles of channel tributary to Lower Penitencia Creek. It drains an area of approximately 22 square miles. Tributaries include Calera Creek and Arroyo de los Coches.

In June 1975, DFG visually surveyed 7.8 miles of Berryessa Creek from near its headwaters to its mouth. The survey report stated that the portion of the creek serving the trout fishery was limited to the lower-most, tidal 200-300 feet (Curtis and Scoppettone 1975c). The Department of Fish and Game noted that on the valley floor, Berryessa Creek is almost entirely channelized including several drop structures (Curtis and Scoppettone 1975c).

Dipnet sampling was conducted in August 1981 at North Main Street as part of a fish distribution study. No *O. mykiss* were collected (Leidy 1981-1984, 1984).

Calera Creek

Calera Creek is tributary to Berryessa Creek and drains an area of approximately three square miles. The creek contains approximately three miles of channel (SCBWMI 2001).

The Department of Fish and Game sampled two Arroyo Colero (Calera Creek) sites in July 1953 and did not encounter salmonids (Merkel 1953). In July 1975, DFG visually surveyed 2.7 miles of Calera Creek from near its headwaters to its mouth. The survey report found that the creek had no “direct” fishery functions and noted channelization of the valley floor reach (Scoppettone and Curtis 1975a).

Calera Creek was sampled as part of a fish distribution study at Jose Hueguera Park in August 1981. No salmonids were encountered (Leidy 1981-1984, 1984).

Arroyo de los Coches

Arroyo de los Coches is tributary to Berryessa Creek and drains an area of approximately four square miles. The creek consists of approximately 3.4 miles of channel (SCBWMI 2001).

In July 1975, DFG visually surveyed four sites on Arroyo de los Coches Creek between its headwaters and mouth. The survey report noted channelization of the creek for flood protection and land development in the valley floor. No fish were observed during the survey, and DFG concluded that the creek appeared to have no immediate fishery function (Curtis and Scoppettone 1975b).

Arroyo de los Coches was sampled by dipnet for a fish distribution study near the Interstate 680/Calaveras Road on-ramp in August 1981. No *O. mykiss* were collected (Leidy 1981-1984, 1984).

Upper Penitencia Creek (Alum Rock Creek)

Upper Penitencia Creek drains an area of approximately 24 square miles and includes approximately 11 miles of channel. It has one major tributary, Arroyo Aguague, and one major impoundment, Cherry Flat Reservoir (SCBWMI 2001).

In 1946, DFG noted a run of steelhead spawned in Penitencia Creek, and cited the presence of “impassable falls” (approximately 0.3 miles above confluence with Arroyo Aguague) upstream from which stocking was performed every third year (Shapovalov 1946a). The Department of Fish and Game sampled two Penitencia Creek sites in July 1953 and did not encounter salmonids (Merkel 1953). However, a 1954 DFG field note stated that a few wild trout were present in the stream (Evans 1954).

In a 1962 report, Skinner indicated Penitencia Creek as an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be “lightly used” as steelhead habitat (Skinner 1962).

In June 1975, DFG visually surveyed Upper Penitencia Creek between the Coyote Creek confluence and Cherry Flat Reservoir. One *O. mykiss* (178 mm) was noted approximately one mile downstream of the reservoir (Curtis and Scoppettone 1975l). Numerous *O. mykiss* fry were sighted at and downstream from the Arroyo Aguague confluence to the western boundary of Alum Rock Park (Curtis and Scoppettone 1975l). These fish were approximately 40 mm in length and occurred at a density of approximately 50-60 fish per 30 meters in some areas (Curtis and Scoppettone 1975l). Numerous migration barriers in the creek also were noted. The survey report concluded that channel alteration and sedimentation made the valley portion of the channel of little fishery function, but that the upper canyon reach was a unique fishery resource with ample spawning and rearing habitat for *O. mykiss* (Curtis and Scoppettone 1975a).

Two Upper Penitencia Creek sites were sampled by seining and electrofishing between 1972 and 1977. The survey report included a relative abundance estimate for *O. mykiss* of “1” at Alum Rock Park on a scale of 1-5, with “5” indicating highest abundance (Scoppettone and Smith 1977).

The Department of Fish and Game and the Soil Conservation Service conducted an electrofishing survey of Upper Penitencia Creek in June 1984. The study report found age 1+ and 2+ steelhead to be fairly abundant in the upper reach (*i.e.*, Alum Rock Park to Toyon) (Gray 1984).

The Department of Fish and Game summarized anadromous fish utilization of several Santa Clara County creeks in 1988 based on previous collections. Salmonids in Upper Penitencia Creek were reported as shown in Table V-2. In addition, the report identified potential barriers at the steeply sloping culvert under the ford at Quail Hollow in Alum Rock Park and at a four and one-half foot drop structure with a four to five foot deep plunge pool located 150 yards upstream of the Quail Hollow ford (Ulmer 1988).

Table V-2. Summary of sampling, Upper Penitencia Creek, 1986-87

	Location	**Method**	**Collected (size range)**
Feb. 1986	Quail Hollow in Alum Rock Park	Collected dead	Ripe female *O. mykiss* (640 mm TL)
Late 1986	White & Penitencia Rds.	Collected dead	2 "adult salmonids"
Aug. 1987	Downstream of percolation pond outlet	Electrofishing	5 *O. mykiss* (95-105 mm TL)
Nov. 1987	Upstream of Doral Rd. bridge	Captured	5*O. mykiss* (120-215 mm SL)

(Source: Ulmer 1988)

In August 1987, 50 meters of Upper Penitencia Creek adjacent to SCVWD percolation ponds was electrofished, producing two *O. mykiss* (87, 122 mm SL) (HSA 1988). The resulting report stated that a small steelhead run apparently still existed in Upper Penitencia Creek (HSA 1988).

The Santa Clara Valley Water District sponsored a study to sample Upper Penitencia Creek between November 1990 and September 1991 to study the impact of constructing seasonal spreader dams on *O. tshawytscha* and *O. mykiss*. No adult salmonids were found during the surveys, although two steelhead redds were found in Upper Penitencia Creek near the western edge of Alum Rock Park (HRG 1992). Electrofishing in the vicinity of the redds in April and May 1991 did not find juvenile *O. mykiss*.

The Santa Clara Valley Water District sponsored electrofishing at the following sites and years: at Dorel Drive in 1990 and 1991, Noble Avenue in 1990, upstream of White Road in 1991 and 1992, and downstream of the bridge in Alum Rock Park and at Linda Vista Street from 1991-1994. No *O. mykiss* were collected (HRG 1995).

In May 1997, SCVWD electrofished Upper Penitencia Creek between Dorel Drive and Alum Rock Park. Eleven steelhead smolts (115-180 mm SL) and 33 steelhead YOY (50-69 mm SL) were captured (Salsbery and Abel 1998). An Alum Rock Park site and a Dorel Drive site also were sampled by Smith in May 1997. He collected 23 juvenile *O. mykiss* (45-64 mm SL) and 42 larger individuals (100-239 mmSL) at the Alum Rock site; the Dorel Drive site produced 36 juvenile *O. mykiss* (50-69 mm SL) and (Smith 1997).

According to SCVWD staff, Stacy Li found *O. mykiss* in Upper Penitencia Creek in 2000 (J. Abel pers. comm.). A management plan for Alum Rock Park was published in April 2001 and included a review of biological resources. The plan stated, "Steelhead are known to spawn and rear in Upper Penitencia Creek within Alum Rock Park. These steelhead coexist with a resident population of rainbow trout" (BRG 2001).

Arroyo Aguague

Arroyo Aguague Creek is tributary to Upper Penitencia Creek. The creek drains an area of approximately nine square miles and includes approximately 15 miles of channel (SCBWMI 2001). A natural waterfall near the boundary of Alum Rock Park prevents anadromous fish passage.

One site on Arroyo Aguague 0.6 miles upstream from the mouth was seined and electrofished between 1972 and 1977. The study produced a relative abundance estimate for *O. mykiss* of "3" on a scale from 1 to 5 (Scoppettone and Smith 1977).

In September 1975, DFG visually surveyed Arroyo Aguague between the mouth and headwaters. *Oncorhynchus mykiss* was present upstream and downstream from a natural falls where sufficient habitat existed to support populations (Scoppettone and Curtis 1975b). The falls referred to in the survey report have a 15-foot drop and occur 1.2 miles upstream from the confluence with Upper Penitencia Creek. Additional barriers associated with land use activities occurred in the system.

According to the 1975 DFG survey report, electrofishing near the mouth revealed an age structure that suggested possible steelhead utilization of the stream (Scoppettone and Curtis 1975b). In a 30-meter reach, 63 *O. mykiss* were collected (45: 38-64 mm; 8: ~75 mm; 2: ~125 mm; 8: ~180 mm) (Scoppettone and Curtis 1975b). The Department of Fish and Game stated that Arroyo Aguague and Upper Penitencia Creek appeared to support the most significant fishery resource of all the tributary streams to lower Coyote Creek (Scoppettone and Curtis 1975b).

Surveys conducted in 1999 found resident *O. mykiss* upstream from the falls and "abundant" potentially anadromous *O. mykiss* downstream from this barrier (Buchan et al. 1999). The creek was referred to as containing "regionally significant" steelhead spawning and rearing habitat in a 1999 report on western Mt. Hamilton streams (Buchan et al. 1999).

Lower Silver Creek

Lower Silver Creek drains an area of approximately 44 square miles and includes approximately seven miles of channel (SCBWMI 2001). Tributaries include North Babb Creek, South Babb Creek, Flint Creek, and Thompson Creek. In the 1970s, the East Zone Flood Project connected many of these tributaries to Thompson Creek/Lower Silver Creek to provide storm drainage for urban development (Curtis and Scoppettone 1975g).

In a 1962 report, Skinner indicated Lower Silver Creek as an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In July 1975, DFG visually surveyed a 6.3-mile reach of Lower Silver Creek between the mouth and the Thompson Creek confluence. Lower Silver Creek was characterized as an altered channel of little function for fisheries, and no *O. mykiss* were observed (Curtis and Scoppettone 1975g).

Fish sampling was performed in numerous Santa Clara Valley creeks in September and October of 1999. A station coded "U3" on Lower Silver Creek produced two *O. mykiss* (235, 253 mm FL) (Demgen and Dorsey 1999). It appears unlikely that an *O. mykiss* population exists in Lower Silver Creek (D. Salsbery pers. comm.).

North Babb Creek

North Babb Creek is tributary to Lower Silver Creek and drains an area of 2.6 square miles, consisting of 1.3 miles of channel (SCBWMI 2001). The creek provides storm drainage to an almost entirely urbanized area and includes channelized and underground culverted sections.

In June 1975, DFG visually surveyed North Babb Creek between the mouth and headwaters and found no fish. The Department of Fish and Game concluded that channel modifications and low seasonal flow created conditions with no "direct" functions for fisheries (Curtis and Scoppettone 1975h).

South Babb Creek

South Babb Creek is tributary to Lower Silver Creek and drains an area of approximately four square miles, consisting of 3.6 miles of channel (SCBWMI 2001). It originates in foothill ravines and flows across the urbanized valley floor to its confluence with Lower Silver Creek (Curtis and Scoppettone 1975j). The creek is concrete-lined between Clayton Road and the mouth.

In July 1975, DFG visually surveyed South Babb Creek between the mouth and headwaters. No fish were observed and DFG concluded that seasonal dryness and channel modifications led to the stream having no fishery value (Curtis and Scoppettone 1975j).

Flint Creek

Flint Creek is tributary to Lower Silver Creek. It drains an area of approximately two square miles and includes 1.5 miles of channel (SCBWMI 2001).

In July 1975, DFG visually surveyed Flint Creek between its mouth and headwaters, finding no fish. The Department of Fish and Game considered Flint Creek not to provide a sport fishery because of seasonally intermittent flow (Curtis and Scoppettone 1975e).

Thompson Creek (Dry Creek)

Thompson Creek is tributary to Lower Silver Creek. It drains an area of approximately 18 square miles and includes 8.8 miles of channel (SCBWMI 2001). Tributaries include Quimby, Fowler, Yerba Buena, and Dry creeks. Historically, Thompson Creek emptied into a large freshwater marsh in the Evergreen area of the Santa Clara Valley. For land reclamation purposes, Thompson Creek was extended to Lower Silver Creek, which was also realigned and channeled (Curtis and Scoppettone 1975k).

In January 1961, DFG visually surveyed Dry (Thompson) Creek at two locations and did not find fish. The Department of Fish and Game concluded that Thompson Creek had insufficient flow to provide suitable spawning or nursery habitat for steelhead (Hinton 1961a).

In July 1975 DFG visually surveyed Thompson Creek between its mouth and headwaters, finding no fish. The survey report concluded that the creek did not directly support a fishery due largely to its tendency to dry by the fall as well as control of flow by SCVWD (Curtis and Scoppettone 1975k).

Quimby Creek

Quimby Creek drains an area of 2.2 square miles and consists of approximately two miles of channel (SCBWMI 2001). Although it has no defined confluence with a receiving stream, it is considered to be tributary to Thompson Creek (Curtis and Scoppettone 1975i).

In July 1975, DFG visually surveyed Quimby Creek from the Quimby Road Bridge to the termination of the defined channel. No fish were found, and DFG concluded that Quimby Creek was a minor seasonal drainage that did not support a sport fishery (Curtis and Scoppettone 1975i).

Fowler Creek

Fowler Creek drains an area of 2.8 square miles and contains 2.8 miles of channel (SCBWMI 2001). Although it has no defined confluence with a receiving stream, it is considered to be tributary to Thompson Creek (Curtis and Scoppettone 1975f).

In July 1975, DFG visually surveyed Fowler Creek between its discontinuation and headwaters. The creek was described as a minor seasonal drainage issuing from the foothills into the valley, where it gradually lost definition. For this reason, DFG concluded Fowler Creek did not support a sport fishery (Curtis and Scoppettone 1975f).

Yerba Buena Creek

Yerba Buena Creek is tributary to Thompson Creek. It drains an area of 2.6 square miles and includes 1.5 miles of channel (SCBWMI 2001).

In July 1975, DFG visually surveyed Yerba Buena Creek between the mouth and headwaters, finding the channel dry for most of the creek's length. The survey report stated that the stream did not directly contribute to a sport fishery (Curtis and Scoppettone 1975n).

Upper Silver Creek

Historically, Upper Silver Creek and Thompson Creek issued into a large freshwater marsh in the Evergreen area of Santa Clara. This marsh served as the headwaters of Lower Silver Creek but was drained for flood control and urban development. In the 1970s, Upper Silver Creek flows were shunted into a flood control channel discharging directly to Coyote Creek (Curtis and

Scoppettone 1975m). The creek currently drains an area of about six square miles and consists of approximately seven miles of channel (SCBWMI 2001).

In a 1962 report, Skinner shows Upper Silver Creek as an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In July 1975, DFG visually surveyed Upper Silver Creek between the Highway 101 bridge and the headwaters. The survey report noted an impassable culvert in the lower reach that was suspected of precluding use by salmonids. No *O. mykiss* were observed (Curtis and Scoppettone 1975m). An electrofishing survey during the period 1972-1977 included sampling in Upper Silver Creek at Upper Silver Creek Road near the Capitol Expressway. No *O. mykiss* were found (Scoppettone and Smith 1977).

Fisher Creek

Fisher Creek drains an area of 15.8 square miles and contains approximately eight miles of channel (SCBWMI 2001). Fisher Creek is the receiving stream for numerous minor, foothill drainages on the western side of the La Laguna Seca Valley. Historically, it passed through a marsh in the vicinity of the present day Calero Hills Golf Course before entering Coyote Creek. The marsh was drained and the creek channelized during construction of the golf course and development of the surrounding area in the 1970s (Curtis and Scoppettone 1975d).

In June 1975, DFG visually surveyed Fisher Creek from its mouth upstream to Laguna Avenue. No *O. mykiss* were observed. Because of intermittent flow and warm temperatures, DFG concluded that Fisher Creek did not provide suitable habitat for salmonids and did not contribute substantially to a sport fishery (Curtis and Scoppettone 1975d).

San Felipe Creek

San Felipe Creek is tributary to Anderson Reservoir. According to a watershed characteristics report, the creek consists of approximately 29 miles of channel and drains eight square miles (SCBWMI 2001).

In January 1961, DFG visually surveyed the lower areas of San Felipe Creek and interviewed local residents. A resident reported a steelhead run several years prior to 1961 when Anderson Reservoir had overflowed (Hinton 1961b). The Department of Fish and Game interpreted the run as land-locked *O. mykiss* residing in Anderson Reservoir (Hinton 1961b). In a field note from 1961, DFG reported that "Anderson Dam and the dams from the Coyote percolation basin prevent steelhead from using the creek as they formerly did" (Hinton 1961b, p. 1).

Leidy found *O. mykiss* at four locations electrofished on San Felipe Creek in June and July 1997 (Leidy 2002). His downstream-most station, approximately 0.9 miles downstream from the confluence with Cow Creek, yielded 28 *O. mykiss* between 40 and 220 mm FL (Leidy 2002). Here he estimated density at 20 *O. mykiss* per 30 meters of stream. At a location 0.3 miles downstream from Cow Creek, Leidy caught three *O. mykiss* (68, 76, 87 mm) and estimated density at 5 fish per 30 meters (Leidy 2002). Two pools immediately downstream from San Felipe Road contained 11 *O. mykiss* (66-165 mm) at a density of 15 fish per 30 meters. Finally, at his upstream-most location, immediately upstream from where the unpaved road leaves San Felipe Creek, Leidy caught 28 *O. mykiss* between 40 and 220 mm long, and estimated density at 50 fish per 30 meters of stream (Leidy 2002).

Cow Creek

Cow Creek is tributary to San Felipe Creek. It drains a relatively undeveloped area northeast and upstream from Anderson Reservoir.

In June 1997, Leidy electrofished Cow Creek one-half mile upstream from the first road crossing upstream from San Felipe Creek. In a 15-meter reach he caught 17 juvenile *O. mykiss* (42-70mm FL) and one adult (275 mm) (Leidy 2002). He observed ten additional juvenile *O. mykiss* in the same size range.

Packwood Creek

Packwood Creek is tributary to Anderson Reservoir. It drains an area of approximately ten square miles, and includes approximately 11 miles of channel (SCBWMI 2001). Leidy surveyed pools in a Packwood Creek in the canyon downstream from Dairy Flat in July 1997. He observed several juvenile *O. mykiss* (5-10: 35-75 mm TL) (Leidy 2002).

Hoover Creek

Hoover Creek is tributary to Packwood Creek. It drains the hills area immediately west of Henry Coe State Park.

Leidy electrofished a 30-meter reach on Hoover Creek 0.7 miles upstream from Packwood Creek in July 1997. He caught 30 *O. mykiss* (58-96 mm FL) and observed approximately 15 additional individuals in the same size range (Leidy 2002). The estimated *O. mykiss* density was 40 fish per 30-meter reach.

Cañada de los Osos Creek (La Cañada Creek)

Cañada de los Osos Creek is a headwater tributary of Coyote Creek. It drains the hills area east of the city of Gilroy and joins Coyote Creek approximately two miles upstream from Coyote Lake.

In June 1940, 6,000-10,000 *O. mykiss* fingerlings rescued from Uvas Creek were planted in Cañada de los Osos Creek (Holladay 1940). A July 1940 DFG stream survey noted that the channel went dry at its confluence with Coyote Creek. The lower mile of Cañada de los Osos Creek was said to be intermittent, with the upstream area perennial. The surveyor noted that the planted fingerlings from Uvas Creek were healthy (Shapovalov 1940b).

Hunting Hollow Creek

Hunting Hollow Creek joins Coyote Creek immediately upstream from the confluence with Cañada de los Osos Creek. The creek consists of approximately 3.5 miles of channel.

The Department of Fish and Game surveyed the entire length of Hunting Hollow Creek in July 1940. The stream was dry at the time of the survey, and no fish were observed (Shapovalov 1940a).

Big Canyon Creek

Big Canyon Creek is formed by the combined drainages of Rough Gulch and Little Rough Gulch. The creek enters Coyote Creek from the west, and its watershed is the eastern flank of the Palassou Ridge.

Leidy surveyed about 100 meters of Big Canyon Creek upstream from the Coyote Creek confluence in October 1999. He noted juvenile O. mykiss (25-90 mm TL) at a density of about 15-20 fish per 30 meters (Leidy 2002).

Middle Fork Coyote Creek

Immature trout were noted in Middle Fork Coyote Creek when the site was surveyed in June-July 1974 as part of an aquatic habitat survey of Henry Coe State Park (Guzzetta 1974).

Electrofishing on the Middle Fork in September 1995 produced 12 *O. mykiss* (45-195 mm) at Upper Camp, plus another 20 observed in the same size range (Leidy 2002). Leidy estimated *O. mykiss* density at this last site to be 75 per 30 meters of stream. In April 1997, Leidy electrofished the same site at Upper Camp. He caught five *O. mykiss* (45-176 mm FL) and estimated density at 15 per 30 meters of stream.

East Fork Coyote Creek

Leidy electrofished two sites on the East Fork of Coyote Creek downstream of Water Gulch in September 1995. At one site he caught a single *O. mykiss* (225 mm FL) (Leidy 2002).

Kelly Cabin Creek

Kelly Cabin Creek drains the hills south of Henry Coe State Park. It flows generally north and joins East Fork Coyote Creek in the southern portion of the park.

Leidy electrofished an isolated pool on Kelly Cabin Creek approximately 0.2 miles upstream from the confluence with East Fork Coyote Creek in August 1995. No *O. mykiss* were found (Leidy 2002). Informal surveys of Kelly Cabin Creek suggest that the system presently does not support *O. mykiss* populations (J. Smith, San Jose State University pers. comm.).

Assessment: Steelhead historically occurred throughout the Coyote Creek system. Human activities, primarily between the early-to-mid 1900s and the present, have substantially disrupted salmonid migration and degraded spawning and rearing habitats. Coyote and Anderson reservoirs, constructed in 1936 and 1950, respectively, block access to approximately 200 square miles of the upper Coyote Creek watershed, or approximately 56 percent of the total drainage (SCBWMI 2001). Although steelhead were known to use lower Coyote Creek for spawning and rearing, minimum instream flow requirements were never established following construction of Anderson Dam (Anderson 1978). The Coyote Canal bypasses and seasonally dewaters an approximately five-mile reach of Coyote Creek beginning at Coyote Diversion Dam approximately 1.2 miles downstream from Anderson Reservoir.

Extensive gravel mining downstream from Anderson Dam has altered natural streamflow and sediment transport patterns in Coyote Creek. Many of the larger remaining in-channel gravel mining ponds are now used for groundwater percolation, and their operation often creates seasonal barriers to the migration of salmonids (Smith 1998).

Urban development in the Santa Clara Valley and adjacent foothills has changed stream discharge patterns and degraded water quality in Coyote Creek. Urbanization also has fostered flood control projects for many of the smaller tributaries entering lower Coyote Creek, typically leading to a virtual lack of habitat function in post-project configurations.

Steelhead are now relatively rare in the Coyote Creek system (Smith 1998). The most important spawning and rearing habitat resources remaining in the watershed are Upper Penitencia Creek and Arroyo Aguague. Portions of these creeks are protected by their location in Alum Rock Park, where they join to flow into Coyote Creek near San Jose (RM 10) (Smith 1998). A resident *O. mykiss* population is believed to occur in this area, and observation of *O. mykiss* smolts in Upper Penitencia Creek suggests anadromy (Smith 1997). As stocking of both hatchery and wild (from Uvas Creek) *O. mykiss* has occurred sporadically throughout the Coyote Creek system since at least 1938, the Coyote Creek population may reflect particularly complex ancestry.

Guadalupe River Watershed

The Guadalupe River is formed by the confluence of Alamitos Creek and Guadalupe Creek at the location presently inundated by Lake Almaden. In addition to these two streams, direct tributaries to the Guadalupe River include Los Gatos, Canoas, and Ross creeks. These tributaries originate on the eastern side of the Santa Cruz Mountains and enter the Guadalupe River as it flows through the Santa Clara Valley. The Guadalupe River consists of approximately 20 miles of main channel, and its watershed area is about 170 square miles. The river enters the San Francisco Estuary north of Sunnyvale (SCBWMI 2001).

Guadalupe River

According to a stakeholder group's report on the Guadalupe River, "Early written documents record the local presence of migrating salmon in the 'Rio Guadalupe' dating as far back as the 1700s…" (SCBWMI 2001, p. 7-131). A 1905 report notes *O. mykiss* in this stream (named "Guadalupe Creek" in this source)(Snyder 1905). In 1936, Fry surveyed part of the Guadalupe River in the hills approximately two miles north of the town of Almaden. He noted that in approximately May streamflow stopped until the start of winter rains, and that only occasional pools were present in the stream in the dry season (Fry 1936). Salmonids were not found in Fry's survey of the Guadalupe River.

A July 1953 survey identified *O. mykiss* 1.4-1.5 miles by road upstream from the intersection of Hicks and Shannon Roads and "salmonids" 0.3 miles by road upstream from the same intersection (Merkel 1953). A 1959 DFG memorandum stated that no steelhead run had existed for many years. According to a game warden for the region, resident rainbow trout were found in the section of stream from Guadalupe Dam to a point three miles downstream (on Guadalupe Creek) (Schreiber 1959).

In a 1962 report, Skinner indicated the Guadalupe River as an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

The Department of Fish and Game electrofished five Guadalupe River stations between Brokaw Road and Willow Glenn Way in September 1975. No salmonids were found and the survey report noted that poor water quality might have been a major factor depressing fishery resources (Curtis and Anderson 1975).

In August 1981, Leidy sampled the Guadalupe River at the USGS gauging station on Hicks Road. He caught four *O. mykiss* (96-167 mm FL) (Leidy 1981-1984, 1984). A 1987 DFG correspondence stated that in the previous five years, runs of steelhead trout were reported on the Guadalupe River up to the drop structure near Blossom Hill Road (Hunter 1987).

In December 1987, DFG observed two adult salmonids 500 feet downstream of this location (Ulmer 1988). According to a DFG report, salmonids were able to migrate up to the confluence of Canoas Creek, a constructed, concrete-lined drainage channel (Ulmer 1988). The report stated that DFG observed 248 apparent salmonid redds in 1987 in the Guadalupe River.

The Santa Clara Valley Water District routinely constructs seasonal spreader dams in the Guadalupe River channel to increase percolation. As part of a five-year study (1989-1994) of the impact of spreader dams on fisheries, SCVWD monitored habitat and passage conditions in the Guadalupe River from 1990 to 1994. Passage observations by SCVWD during 1993 to 1994 winter low-flow conditions found the weirs at Hillsdale, Foxworthy and St. John Streets passable only during major storm events (>50-200 cfs) (HRG 1995). In addition, the drop structure upstream from Blossom Hill Road was impassable under all flow conditions. Electrofishing, and gillnet and seine sampling upstream and downstream from the spreader dams between Branham Avenue and the confluence of Alamitos Creek revealed no *O. mykiss* during the course of this study (HRG 1995).

The district sponsored additional monitoring as part of the spreader dam studies that was summarized in 1994. Electrofishing was conducted in the winter of 1992-1993 at two sites in the vicinity of percolation ponds near Blossom Hill Road. A few (two to five) *O. mykiss* were found (HRG 1994). The 1994 report also noted the presence of approximately six steelhead redds in lower Guadalupe River in April 1993. No juvenile salmonids were captured in the vicinity of the redds during subsequent electrofishing (HRG 1994).

In comments on a Guadalupe River flood control project, a canoe club submitted photographs of fish caught in the river in October 1993. Materials accompanying the photos indicated that a 305 mm *O. mykiss* was collected between Interstate 880 and the Airport Parkway Bridge. The fish apparently was fin-clipped, and resulting genetic analysis identified it as a "Pacific steelhead" (Johmann 1995).

Leidy found *O. mykiss* at three locations in May and June 1994 (Leidy 2002). In a 30-meter reach at the end of Pam Lane off Coleman Road, he observed approximately 50 *O. mykiss*, 25 of which ranged from 50-210 mm FL (Leidy 2002). Downstream from the Guadalupe Reservoir, at Pheasant Valley and Hicks Roads, he caught 17 *O. mykiss* (38-165 mm) in a 30-meter reach. While upstream from the first Hicks Road crossing upstream from the reservoir, a 30-meter reach yielded 12 *O. mykiss* (32-169 mm).

A few *O. mykiss* juveniles were found near Woz downstream of Interstate 280 during dewatering of the channel in 1998 (J. Abel pers. comm.). A San Jose State University classroom exercise led by Dr. Jerry Smith noted that in 2000, approximately 24 steelhead smolts were gillnetted in Lake Almaden (J. Smith, San Jose State University pers. comm.).

In March 2002, a consulting fisheries biologist reported four *O. mykiss* (2: 250-300 mm; 1: ~300 mm; 1: ~600-700 mm) near the Los Gatos Creek confluence (Kozlowski 2002). The four fish had intact adipose fins but their genetic make-up was undetermined.

Los Gatos Creek

Los Gatos Creek drains an area of approximately 55 square miles and consists of approximately 24 miles of channel (SCBWMI 2001). It has four major impoundments: Vasona Reservoir, Lexington Reservoir, Lake Elsman (built in the late 1940s) and Williams Reservoir (built pre-1938). Major tributaries include Briggs Creek, which enters Lexington Reservoir, and Austrian Gulch, which enters Lake Elsman.

Based on the locations of fish collections made in 1895 by Snyder (Snyder 1905) and historical habitat condition suitable for salmonids, Smith (Smith 1998) concluded that Los Gatos Creek likely supported heavy steelhead use throughout. In November 1948, correspondence regarding responsibility for repair of an inadequate fish ladder at Page Dam (located downstream from Lexington Reservoir) suggested that steelhead attempted passage at the ladder (McCaulay 1948). Department of Fish and Game correspondence from 1950 regarding the pending construction of Lexington Reservoir indicated that large numbers of presumably wild trout were present in Los Gatos Creek upstream from the dam site (CDFG 1950).

A 1952 DFG document stated that substantial steelhead runs had not been seen in Los Gatos Creek since 1937, when agricultural pumps lowered the water table throughout the Santa Clara Valley and dewatered the lower reach (Evans 1952). The document also noted that resident trout populations had remained in the portions of the creek maintaining permanent flow (Evans 1952). In March 1953, DFG determined that no repair of the inadequate fish ladder at Page Dam would be necessary because no steelhead run had occurred in Los Gatos Creek since 1937 (Jones 1953). In April 1953, DFG observed "thousands" of steelhead massing at the base of Ryland Diversion Dam, with many attempting to jump at the overflow (Johnson 1953a). (Ryland Dam replaced Jones diversion dam, which was inundated by Lexington Reservoir).

In a 1962 survey of the probable distribution of steelhead in the San Francisco Bay Area, Skinner noted Los Gatos Creek as serving as historic habitat for this species (Skinner 1962). The survey shows the 1962 distribution of steelhead in this creek as the reaches immediately downstream and upstream from Lexington Reservoir.

In June 1962, DFG visually surveyed the remote reach of Los Gatos Creek upstream from Austrian Reservoir after a forest fire. In 400 meters of stream, eight *O. mykiss* (100-200 mm) were observed (Hinton 1962b). Surviving native *O. mykiss* were deemed adequate for propagation and re-population of reaches affected by the fire (Hinton 1962b). Electrofishing in Lexington Reservoir in June 1970 found two *O. mykiss* (Wood 1970).

In September 1981, seining produced three *O. mykiss* (57, 151, 203 mm FL) immediately upstream of Wrights Station Road (between Lexington Reservoir and Lake Elsman). Approximately 0.15 miles further upstream, two additional *O. mykiss* (56, 58 mm) were found at the confluence with a southwest running tributary (Leidy 1981-1984, 1984).

Prior to 1996, SCVWD routinely constructed seasonal spreader dams in the Los Gatos Creek channel to increase percolation. As part of a five-year study (1989-1994) of the impact of spreader dams on fisheries, SCVWD sponsored a study of habitat and passage conditions in Los Gatos Creek from 1990 to 1994. It was concluded that spreader-dam removal at three sites immediately upstream and downstream from the Hamilton Road crossing resulted in wide, shallow riffles that presented passage problems during the low winter flow conditions of 1993 to 1994 (HRG 1995). Electrofish, gillnet and seine sampling upstream and downstream from spreader dams revealed no *O. mykiss* in Los Gatos Creek during the course of the study (HRG 1995).

In 1998, *O. mykiss* were observed spawning in Los Gatos Creek near Hamilton and Meridian Avenues (J. Abel pers. comm.). In summer 2001, two juvenile *O. mykiss* were collected in Los Gatos Creek at Leigh Avenue.

Both Williams Dam and Austrian Dam represent complete barriers to upstream migration of fish (but still allow out-migration over spillways) (Evans 1952). We found only one report of *O. mykiss* stocked upstream from Williams Reservoir: 10,000 steelhead fingerlings planted in July 1938 (CDFG 1938a). Department of Fish and Game studies have shown that survival of planted hatchery fingerling trout in competition with wild fish that are already present is extremely low (Greenwald 1962).

Briggs Creek

Briggs Creek is tributary to Los Gatos Creek via Lexington Reservoir and contains approximately one mile of channel (SCBWMI 2001). It drains the area immediately west of the reservoir.

In September 1981, a fish survey recorded “great” fish habitat at Bear Creek Road, but found no fish. The surveyor hypothesized that a barrier may limit fish migration in this creek (Leidy 1981-1984, 1984).

Hooker Gulch Creek

Hooker Gulch Creek is tributary to Los Gatos Creek between Lexington Reservoir and Lake Elsman. It drains the west slope of Mt. Thayer.

In September 1981, dip-net sampling was conducted adjacent to Aldercroft Heights Road, immediately upstream from the confluence with Los Gatos Creek. Eleven *O. mykiss* (37-72mm FL) were collected (Leidy 1981-1984, 1984).

Austrian Gulch Creek

Austrian Gulch Creek is tributary to Los Gatos Creek via Lake Elsman and includes approximately 1.4 miles of channel (SCBWMI 2001). It drains the hills of the Sierra Azul east of the lake.

In September 1981, a fish survey including dip netting was conducted immediately upstream from Cathermola Road (and Lake Elsman). The surveyor observed approximately 200 *O. mykiss* and collected 75 that ranged in size from 32-60 mm FL (Leidy 1981-1984, 1984).

Staff from SCVWD sampled Austrian Gulch Creek in March 2005. The presence of multiple year classes of *O. mykiss* observed during the survey indicates that reproduction is occurring (D. Salsbery pers. comm.).

Ross Creek

Ross Creek originates in the lower Santa Cruz mountain foothills near the town of Blossom Hill. It drains a primarily urbanized area of approximately ten square miles between Los Gatos Creek and the Guadalupe River main stem, and includes 6.2 miles of channel (SCBWMI 2001).

In April 2001, an adult steelhead was found stranded in Ross Creek. The fish was moved to more suitable spawning habitat in the Guadalupe River (J. Abel pers. comm.). Ross Creek does not appear to support an *O. mykiss* population currently (D. Salsbery pers. comm.).

Guadalupe Creek

Guadalupe Creek has one major impoundment, Guadalupe Reservoir, and drains an area of approximately 15 square miles. The creek consists of approximately 28 miles of channel (SCBWMI 2001). The confluence of Guadalupe Creek and Alamitos Creek at Lake Almaden forms the Guadalupe River.

In July 1953, DFG sampled several locations on Guadalupe Creek with a one-man braile seine. A 125 mm *O. mykiss* was caught approximately 1.5 miles upstream from the junction of Hicks and Shannon roads, while fingerling salmonids were seen, but not captured, approximately 0.25 miles upstream from the same junction (Merkel 1953).

In July 1956, DFG visually surveyed Guadalupe Creek from the bridge crossing at Hicks Road and Coleman Avenue upstream to the Guadalupe Dam. Many steelhead juveniles (25-125 mm) were observed in pools near riffles (Thassalt 1956). The survey report noted apparently “good” natural propagation in the creek.

In April 1958, a DFG document commenting on a proposed spreader dam on Guadalupe Creek characterized the steelhead resource of the creek as of minor importance due to its apparently intermittent nature (Smedley 1958). In October 1959, DFG correspondence stated that resident rainbow trout were found from the Guadalupe Dam to a point three miles downstream (Schreiber 1959).

In November 1975, USFWS electrofished sites two miles and three miles downstream from Guadalupe Dam. Both sites produce 50-330 mm *O. mykiss* as well as numerous YOY (Michny and Ging 1975).

Prior to 1996, SCVWD routinely constructed seasonal spreader dams in the Guadalupe Creek channel to increase percolation. As part of a five-year study (1989-1994) of the impact of spreader dams on fisheries, SCVWD monitored habitat and passage conditions in Guadalupe Creek in 1993 and 1994. In addition to barriers located downstream in the Guadalupe River, SCVWD identified a potential barrier to migration at the Masson Dam Diversion. Electrofishing, and gillnet and seine sampling upstream and downstream from spreader dams in 1993 revealed a few *O. mykiss* (two to five individuals) upstream of Capitancillos Drive and upstream of the diversion (HRG 1995). Also, one *O. mykiss* was found in an off-channel pond and one in the spreader dam pond upstream of Meridian. Sampling in 1994 found no *O. mykiss* (HRG 1995).

Leidy surveyed about 1,200 meters of Guadalupe Creek between the Hicks Road crossing (upstream from the Guadalupe Reservoir) and an impassable natural falls in October 1999. He observed adult *O. mykiss* to 254 mm TL in pools, and juveniles in a reach upstream from Hicks Road (10-15 per 30 m) and in a reach downstream of the falls (25-30 per 30 m) (Leidy 2002).

In 1999, *O. mykiss* were observed throughout Guadalupe Creek downstream from Guadalupe Reservoir (J. Abel pers. comm.). Ladder construction was completed in 2000. In summer 2001, approximately 30 *O. mykiss* were rescued from a degraded reach of Guadalupe Creek that was dewatered for rehabilitation (J. Abel pers. comm.).

Pheasant Creek

Pheasant Creek drains an area of 1.4 square miles and consists of approximately one mile of channel (SCBWMI 2001). The creek is tributary to Guadalupe Creek downstream from the Guadalupe Reservoir.

In July 1956, DFG visually surveyed a 0.25-mile reach of Pheasant Creek one mile upstream from its confluence with Guadalupe Creek. Large numbers of young steelhead were observed in pools that a landowner said persisted throughout the dry season when the stream became intermittent (Thassalt 1956). A 1958 DFG comment regarding a proposed watershed project indicated that steelhead use Pheasant Creek as a spawning stream (Smedley 1958). Pheasant Creek presently supports a reproducing resident *O. mykiss* population (J. Smith pers. comm.).

Hicks Creek

Hicks Creek consists of approximately two miles of channel and is tributary to Guadalupe Creek downstream from the Guadalupe Reservoir (SCBWMI 2001). In July 1956, DFG visually surveyed a 200-meter reach of Hicks Creek upstream from the mouth. The Department of Fish and Game observed *O. mykiss* between 50 and 75 mm in almost every pool and riffle in the surveyed reach (Thassalt 1956). A 1958 DFG comment regarding a proposed watershed project indicated that steelhead used Hicks Creek as a spawning stream (Smedley 1958).

Rincon Creek

Rincon is tributary to Guadalupe Creek upstream from the Guadalupe Reservoir. The creek drains a portion of the eastern slopes of the Sierra Azul.

In April 1962, DFG did not find *O. mykiss* in a survey at Hicks Road Bridge (Hinton 1962a). As part of a fish distribution study, Rincon Creek was sampled in August 1981. Six *O. mykiss* (60-172 mm FL) were found in a series of isolated pools just upstream from the confluence with Guadalupe River (Leidy 1981-1984, 1984).

Leidy surveyed a 100-meter reach of Rincon Creek upstream from the Hicks Road crossing (upstream from the Guadalupe Reservoir) in October 1999. He observed adult *O. mykiss* to 305 mm TL in pools, and juveniles at a density of about 15-20 per 30 meters (Leidy 2002).

Alamitos Creek

Alamitos Creek has one major impoundment, Almaden Reservoir (different from Lake Almaden), drains an area of approximately 38 square miles, and contains approximately nine miles of channel (SCBWMI 2001). The confluence of Guadalupe Creek and Alamitos Creek at Lake Almaden forms the Guadalupe River.

According to a 1978 DFG letter, Alamitos Creek once supported runs of steelhead. Dam construction, streamflow regulation, channelization, and urban development during the previous 50 years was said to have eliminated self-sustaining *O. mykiss* populations (Yoshioka 1987b).

In July and August 1997, SCVWD electrofished sites on Alamitos Creek from the confluence with Golf Creek to the McKean Road crossing. Five *O. mykiss* were found in the 200-meter reach upstream of the confluence, and 21 *O. mykiss* were found in the 120-meter reach downstream of the crossing (Abel 1997).

Arroyo Calero

Arroyo Calero is tributary to Alamitos Creek, and has one major impoundment, Calero Reservoir. The creek drains an area of approximately 12.4 square miles and includes approximately six miles of channel (SCBWMI 2001).

No historical records were found for this Pheasant Creek. However, the creek presently supports a reproducing resident *O. mykiss* population (J. Smith pers. comm.). Recent modifications to downstream channel areas have opened the system to anadromous fish migration.

Barret Creek

Barret Creek drains Barrett Canyon, which located upstream from, and south of, Almaden Reservoir. Leidy reported speaking with local fishermen who stated that *O. mykiss* are regularly caught in Barrett Creek (Leidy 2002).

Herbert Creek

Herbert Creek drains into Almaden Reservoir from the southwest. Leidy reported speaking with local fishermen who stated that *O. mykiss* are regularly caught in Herbert Creek (Leidy 2002).

Assessment: The Guadalupe River system formerly hosted a steelhead run, although the aridity of the watershed probably limited its size. Substantial alteration of the lower watershed stream channels for flood control as well as construction of dams and other passage barriers has restricted anadromous salmonid habitat in the drainage to a fraction its original extent. "The steelhead population had declined significantly by 1962 following construction of reservoirs on all main tributaries (Los Gatos, Guadalupe, Alamitos creeks and Arroyo Calero creeks) and the construction of a drop structure upstream of Blossom Hill Road" (SCBWMI 2001, p. 7-131).

The Guadalupe system currently supports a reproducing steelhead population (SCBWMI 2001, p. 7-131). Non-migratory *O. mykiss* also persist in upper portions of the watershed. "From the time dams were installed in the river up until 1999, steelhead were confined to the main stem of the Guadalupe River and lower Los Gatos Creek, where limited spawning and rearing habitat occur" (SCBWMI 2001, p. 7-131). The Santa Clara Valley Water District modified the Alamitos drop structure on the Guadalupe River to provide access to upstream habitat areas. Additional "smaller barriers and passage obstructions that occur on Guadalupe and Alamitos creeks" must be modified to open additional habitat areas (SCBWMI 2001, p. 7-132). Further surveys are needed to determine the extent to which steelhead use habitat made available by construction of the fish ladder at Lake Almaden, and to determine *O. mykiss* status in tributaries with little or no previous documentation, including Arroyo Calero, and tributaries upstream from Guadalupe and Almaden Reservoirs. Genetic analysis of *O. mykiss* occurring upstream from Austrian Dam in the headwaters of Los Gatos Creek could be useful in determining whether this population is closely related to wild, coastal stocks.

San Tomas Aquino Creek/Saratoga Creek Watershed

San Tomas Aquino Creek originates in the foothills of the Santa Cruz Mountains and drains a primarily urbanized area of the Santa Clara Valley. The headwaters area drained by the tributary Saratoga Creek is less urbanized. Other direct tributaries are Smith Creek and Wildcat Creek. The overall watershed area is about 39 square miles. A barrier at the confluence of San Tomas Aquino Creek and Saratoga Creek prevents passage into the upstream reaches of both creeks (SCBWMI 2001).

San Tomas Aquino Creek

San Tomas Aquino Creek consists of approximately 16.5 miles of channel and enters the San Francisco Estuary near via Guadalupe Slough (SCBWMI 2001). It flows generally north from its headwaters area upstream of the town of Saratoga.

In August 1981, three locations on upper San Tomas Aquino Creek between Virginia Avenue and the junction of Old Adobe and Quito roads were surveyed as part of a fish distribution study. One location was also sampled on San Tomas Aquino Creek downstream from the confluence of Saratoga Creek. No *O. mykiss* were found (Leidy 1981-1984, 1984).

A 1985 DFG survey of Saratoga Creek noted "a major steelhead and king salmon spawning area" on San Tomas Aquino Creek located approximately 200 yards downstream of the Saratoga and San Tomas Aquino creeks confluence (Bordenave and Ford 1985). Based on informal survey of the creek, it is believed not to support use by *O. mykiss* currently (J. Abel pers. comm.).

Saratoga Creek (Campbell Creek)

Saratoga Creek consists of approximately 15 miles of main channel and drains an area of approximately 16.5 square miles, including tributaries Bonjetti Creek and Booker Creek that originate in the Santa Cruz Mountains (SCBWMI 2001). A 1905 report notes *O. mykiss* in this stream (named "Cambell Creek" in this source) (Snyder 1905).

Stocking records indicate that steelhead from the Brookdale Hatchery were stocked in Saratoga Creek in 1938 and in 1939 (CDFG 1939). A 1953 DFG field note conveyed Santa Clara County workers' reports that steelhead had not ascended Saratoga Creek for the previous 15 years (Johnson 1953b). Saratoga Dam is described as a complete barrier to upstream migration with a non-functioning fish ladder. The Department of Fish and Game reported observing trout upstream and downstream from the dam, and concluded that the fish were resident (Johnson 1953b). Another DFG field note from July 1953 records *O. mykiss* fingerlings in Saratoga Creek, citing the likely source as migration downstream from the water company's property (Shapovalov 1953). The note stated that sizable runs had not occurred for the previous eight to ten years.

Oncorhynchus mykiss were found at three of six locations sampled in August 1981 as part of a fish distribution study (Leidy 1981-1984, 1984). Six *O. mykiss* (46-62 mm FL) were collected by dip net in a 15 meter reach 0.25 miles upstream from the confluence of Booker Creek; 15 *O. mykiss* (61-170 mm) were found in a 20 meter reach at 4th St. in the town of Saratoga (Wildwood Park); and at Crestbrook Drive (off Saratoga Avenue), four *O. mykiss* (56, 64, 151, 226 mm) were collected by pole seine from a 20 meter reach. No *O. mykiss* were found downstream from the town of Saratoga (Leidy 1981-1984, 1984).

In early October 1985, DFG interviewed the owner of land adjacent to the upper perennial headwaters of Saratoga Creek who reportedly caught *O. mykiss* up to 230 mm in length upstream and downstream from the Booker Creek confluence (Gray 1985). In October and November 1985, DFG followed up the interview with a survey of Saratoga Creek between the headwaters and the confluence with San Tomas Aquino Creek. The resulting report stated that Saratoga Creek did not have a steelhead run, citing a large barrier at the first entry point of Saratoga Creek into San Tomas Aquino Creek (Bordenave and Ford 1985). Some *O. mykiss* (to 150 mm) were observed (Bordenave and Ford 1985).

Prior to 1996, SCVWD routinely constructed seasonal spreader dams in the Saratoga Creek channel to increase percolation. As part of a five-year study (1989-1994) of the impact of spreader dams on fisheries, SCVWD sponsored a study of habitat and passage conditions in Saratoga Creek in 1993 and 1994. The Santa Clara Valley Water District identified a drop structure located at the confluence with San Tomas Aquino Creek as a complete barrier to upstream migration, which precluded use of Saratoga Creek by anadromous salmonids (HRG 1995). Electrofishing, gillnet and seine sampling upstream and downstream from spreader dams found *O. mykiss* "abundant" (30+ individuals sampled) in 1993 and "common" (15-29 individuals) in 1994 at Herriman Avenue upstream of the spreader dams. Monitoring of dam removal in August 1993 found *O. mykiss* (85-225 mm SL) both upstream and downstream of the dam, which had been stranded when the percolation pond was drained (HRG 1995). Also, one *O. mykiss* was found in the spreader dam ponds upstream of Cox Avenue and one in the area upstream of Prospect Road in 1994.

In 1996, Saratoga Creek at McLellan Ranch Park was said to contain abundant *O. mykiss* (J. Abel pers. comm.). In summer 2000, a few *O. mykiss* were rescued near Homestead Road by SCVWD when the channel was dewatered. Also, unexplained fish kills during recent years in Saratoga Creek from the Lawrence Expressway to Prospect Road revealed *O. mykiss* (J. Abel pers. comm.).

In April 1996, Leidy electrofished two sites on Saratoga Creek. Immediately downstream of the Fourth Street Bridge in Saratoga he caught 12 *O. mykiss* from 89-160 mm FL, with an estimated density of 20 per 30 meters (Leidy 2002). From Via Monte Drive downstream, Leidy caught 18 *O. mykiss* (110-200 mm), with an estimated density of 30 per 30 meters of stream (Leidy 2002). Recent smolt trapping in Saratoga Creek (reported in 1997) did not collect *O. mykiss* (Smith 1997).

Fish salvage activities were conducted in Saratoga Creek on at least two occasions in 1999, during March and August (J. Abel pers. comm.). Salvaged *O. mykiss* were transferred to DFG staff.

Bonjetti Creek

Bonjetti Creek consists of approximately 0.14 miles of main channel. As part of a fish distribution study, two Bonjetti Creek locations were sampled by dip net in August 1981. At a site approximately 0.2 miles upstream from the confluence with Saratoga

Creek, four *O. mykiss* (37-56 mm FL) were found (Leidy 1981-1984, 1984). A single *O. mykiss* (178 mm) was collected on the southeast branch of Bonjetti Creek under the most upstream Sanborn Road crossing (Leidy 1981-1984, 1984).

In April 1996, Leidy electrofished a 30 meter reach in Sanborn Regional Park, approximately a 0.5 miles upstream from Saratoga Road. Two *O. mykiss* (126, 250 mm FL) were found (Leidy 2002).

McElroy Creek

McElroy Creek is the western-most tributary of Bonjetti Creek. As part of a fish distribution study, a single McElroy Creek site was sampled by dip net in August 1981 approximately 0.2 miles upstream from the confluence of Bonjetti and Saratoga Creeks. Three *O. mykiss* (32, 49, 59 mm FL) were found in a 15-meter reach (Leidy 1981-1984, 1984).

Vasona Creek

Vasona Creek is a primary tributary of San Tomas Aquino Creek. It drains an area of approximately 1.4 square miles, and includes approximately 0.5 miles of channel (SCBWMI 2001). Vasona Creek mainstem and the western fork (Sobey Creek) were each sampled at one location in August 1981 as part of a fish distribution study. *Oncorhynchus mykiss* was not found (Leidy 1981-1984, 1984). Based on informal survey of the creek, it is believed not to support use by *O. mykiss* currently (J. Abel pers. comm.).

Wildcat Creek

Wildcat Creek is tributary to Vasona Creek. Its drainage area is approximately four square miles, and the creek consists of about four miles of channel (SCBWMI 2001). No records regarding fisheries of Wildcat Creek were found. Wildcat Creek does not appear to support an *O. mykiss* population currently (D. Salsbery pers. comm.).

Smith Creek

Smith Creek is the headwater tributary of San Tomas Aquino Creek and drains an area of 2.6 square miles. It consists of 3.4 miles of channel (SCBWMI 2001).

A site on Smith Creek within a new housing development was sampled as part of a fish distribution study in August 1981. No fish of any kind were found (Leidy 1981-1984, 1984). According to SCVWD staff, *O. mykiss* are not found in the creek currently (J. Abel pers. comm.).

Assessment: Saratoga Creek historically hosted a steelhead run, and resident *O. mykiss* exist in the watershed that may have recent anadromous ancestry (K. Anderson, pers. comm. cited in SCBWMI 2001, p. 7-124). However, an impassable barrier at the confluence of San Tomas Aquino Creek and Saratoga Creek currently prevents anadromous fish passage to upstream portions of both creeks (SCBWMI 2001).

Calabazas Creek Watershed

Calabazas Creek drains a 21 square mile area of the Santa Clara Valley that is mostly urbanized in its lower portions. The headwaters are in rural and/or relatively undeveloped areas on the eastern slopes of the Santa Cruz Mountains. The creek consists of approximately 13 miles of channel that enters the San Francisco Estuary via Guadalupe Slough (SCBWMI 2001). According to a 1987 DFG memo, four substantial fish barriers are found downstream of Comer Drive on Calabazas Creek (Ulmer 1987). Drop structures at Bollinger Road and Rainbow Drive are believed to be absolute barriers to upstream fish movement, as is a 12 foot inclined dam downstream of Comer Drive (HSA and Smith 1987).

Calabazas Creek

According to an account by Ian Gilroy, *O. mykiss* were present in Calabazas Creek in the early 1970s (J. Abel pers. comm.). As part of a fish distribution study, four Calabazas Creek sites were sampled between the Bayshore Freeway and Cox Avenue in August 1981. No *O. mykiss* were found (Leidy 1981-1984, 1984). A survey of the creek performed on behalf of SCVWD in May and August 1987 found no native fish (HSA and Smith 1987).

Prospect Creek

Prospect Creek is the uppermost tributary of Calabazas Creek and drains an area of approximately 1.4 square miles. It contains approximately with 1.4 miles of channel (SCBWMI 2001).

Prospect Creek was sampled by dip net upstream from Prospect Road in August 1981 as part of a fish distribution study. No fish of any kind were encountered (Leidy 1981-1984, 1984).

Assessment: The lower portion of Calabazas Creek was extensively altered for flood control purposes between the 1960s and the early 1980s, leaving most of the channel in the form of box culvert or earthen constructed channel. According to a study of fisheries values of Calabazas Creek, the stream is unsuitable for steelhead because of a lack of pools, good hiding cover, and suitable streamflows (HSA and Smith 1987).

Stevens Creek Watershed

Stevens Creek drains an area of about 29 square miles and originates in the Santa Cruz Mountains. The creek drops into the western edge of the Santa Clara Valley where it drains into the South San Francisco Bay. There is one major impoundment, Stevens Creek Reservoir. Several tributaries including Gold, Deer and Indian creeks were surveyed by DFG in 1946 and were found to be too steep to support trout (Shapovalov 1946c). During periods of high runoff, water from Permanente Creek is diverted into Stevens Creek.

Stevens Creek

Stevens Creek consists of approximately 20 miles of channel, and enters the San Francisco Estuary near Long Point, north of Moffett Field Naval Air Station (SCBWMI 2001). A 1905 report notes *O. mykiss* in Stevens Creek (Snyder 1905).

In 1947, no hatchery origin *O. mykiss* were identified in angler catch reports from Stevens Creek Reservoir, although 3,520 were planted the previous summer. The Department of Fish and Game concluded that hatchery *O. mykiss* showed negligible survival in this system (CDFG 1947).

According to a DFG summary report, 6,865 fingerling steelhead were rescued from Stevens Creek in 1954 (Pintler 1956). Rescued fish apparently were moved to other areas within the Stevens Creek watershed that had wetted stream channel throughout the dry season.

Sampling as part of a fish distribution study found *O. mykiss* at four of eight Stevens Creek locations in August 1981. Four *O. mykiss* (65-110 mm FL) were caught in a ten-meter reach downstream from Stevens Creek Road and two *O. mykiss* (60, 192 mm) were caught in a 30.3-meter reach in Stevens Creek County Park downstream from Stevens Creek Reservoir (Leidy 1981-1984, 1984). Upstream from Stevens Creek Reservoir, two *O. mykiss* (48, 58 mm) were caught in a seven-meter reach at the first bridge upstream from Mount Eden Road and 15 *O. mykiss* (58-72 mm) were found in a ten-meter reach approximately 5.9 miles upstream from the reservoir (Leidy 1981-1984, 1984).

The Department of Fish and Game surveyed Stevens Creek for migrating salmonids in December 1985. One steelhead (650 mm) was seen at the base of the fishway 100 yards upstream of the Highway 101 bridge (Bordenave 1986). Scale analysis indicated that the fish was age 6+ and had previously spawned and returned to the ocean.

Prior to 1996, SCVWD routinely constructed seasonal spreader dams in the Stevens Creek channel to increase percolation. As part of a five-year study (1989-1994) of the impact of spreader dams on fisheries, SCVWD sponsored a study of habitat and passage conditions in Stevens Creek from 1990 to 1994. In 1994, SCVWD found fish ladders at the Central Expressway and Highway 101 often had insufficient flow and/or were clogged with debris and sediment (HRG 1995). In addition, the drop structure at L'Avenida Avenue was impassable in all five years of the study. Electrofish, gillnet and seine sampling upstream and downstream from spreader dams and downstream from the Stevens Creek Reservoir is reported in Table V-3.

Table V-3. Number of O. mykiss sampled on Stevens Creek, 1990-1994

Location	1990	1991	1992	1993	1994
Stevens Ck. Country Park	*	6-14	2-5	6-14	1
Downstream Stevens Ck. Blvd.	*	*	2-5	30+	*
Spreader-dam pond downstream I-280	*	*	2-5	*	*
Homestead Rd.	*	*	0	0	6-14
Dam pond upstream Fremont Ave.	*	0	0	2-5	6-14
Downstream Fremont Ave. Dam	0	*	0	0	*
L'Avenida Ave.	0	*	0	0	0

(Source: HRG 1995)

*Not sampled.

Additional monitoring conducted as part of the SCVWD spreader dam studies was summarized in 1994. Of five locations electrofished in 1992-1993 surveys, *O. mykiss* were found to be "abundant" (30 or more individuals) near Stevens Creek Boulevard and "common" (15-30 individuals) at Stevens Creek County Park (HRG 1994). Fish ladders at Central Expressway and Moffett Boulevard were checked as part of the monitoring program and were found to be non-functional due to maintenance and flow issues.

Leidy electrofished Stevens Creek between McClellan Ranch Park and Monte Bello Preserve in September 1994, finding *O. mykiss* at all four locations sampled (Leidy 2002). He caught 23 *O. mykiss* (55-240 mm FL) in a 30-meter reach within McClellan Ranch Park, and seven *O. mykiss* (140-235 mm) in the Chestnut Picnic Area just downstream from the reservoir (Leidy 2002). Just upstream from the reservoir, he caught 12 *O. mykiss* (50-140 mm) in the Cooley Picnic Area. Further upstream, at the end of Stevens Creek Canyon Road, Leidy caught 16 *O. mykiss* (46-170 mm) (Leidy 2002). In April 1996, Leidy electrofished Stevens Creek downstream of East Middlefield Road and found no *O. mykiss* (Leidy 2002).

In 1996, sampling for a genetic study found *O. mykiss* in the lower reach of Stevens Creek (J. Abel pers. comm.). The study found these *O. mykiss* to be primarily of hatchery origin, although some native, Central Coast ESU steelhead were present. In 1997, steelhead smolts and YOY were rescued by SCVWD staff from reaches of the stream where it was drying due to seasonal releases rates and stream flow conditions (J. Abel pers. comm.). In 1998 and 1999, SCVWD electrofishing surveys found *O. mykiss* throughout the entire reach from the Central Expressway to Fremont Road. Staff noted the presence of *O. mykiss* to be atypical since the lower reach was usually dry during the season (when sampling occurred). Also in 1998 and 1999, out-migrant traps caught steelhead smolts in Stevens Creek (J. Abel pers. comm.).

As of 2001, SCVWD had identified multiple potential passage barriers on Stevens Creek of which zero completely precluded passage. Five were rated passable only under a small range of flow conditions and included: the gaging station between Central Avenue and Hwy 85 with its three associated drop structures; the Moffett fish ladder downstream of the gaging station; fish ladders at Evelyn and Fremont Avenues; and a low-flow vehicle crossing at Blackberry Farm (Entrix Inc. 2001).

Swiss Creek

Swiss Creek is tributary to Stevens Creek Reservoir. It consists of approximately 1.7 miles of channel (SCBWMI 2001).

In August 1981, two Swiss Creek locations were sampled as part of a fish distribution study. No *O. mykiss* were found (Leidy 1981-1984, 1984). According to SCWVD staff, the creek rarely maintains sufficient water throughout the dry season to support an *O. mykiss* population (J. Abel pers. comm.).

Assessment: Stevens Creek historically supported a steelhead run, though the population has been reduced by alterations to the watershed, particularly construction of Stevens Creek Reservoir. Stevens Creek currently supports resident *O. mykiss* that appears to produce smolts (SCBWMI 2001; Smith 1997). A 1994 DFG memo stated that Stevens Creek had good potential for sustaining steelhead (Roper 1994).

Permanente Creek Watershed

Permanente Creek drains an area on the northeast-facing slopes of the Santa Cruz Mountains and drops into the western edge of the Santa Clara Valley. It flows through the Cities of Los Altos and Mountain View and enters the South San Francisco Bay via the Mountain View Slough (SCBWMI 2001). The creek consists of approximately 13 miles of channel draining a watershed area of 17 square miles. High flows are diverted into Stevens Creek via the Permanente Creek Diversion, constructed in 1959.

Permanente Creek

A 1905 report notes *O. mykiss* in Permanente Creek (named "San Antonio Creek" in this source) (Snyder 1905). In 1940, a DFG stream survey noted a resident's account of Permanente Creek as formerly a "fine" trout stream from which anglers caught large fish (Shapovalov 1940c).

As part of a fish distribution study, six Permanente Creek sites between Charleston Road and Interstate 280 were sampled in August 1981. No *O. mykiss* were found (Leidy 1981-1984, 1984).

In April 1996, Leidy electrofished Permanente Creek at two sites, a 50-meter reach upstream from Charleston Road (downstream from Highway 101), and a 100-meter reach upstream from Interstate 280. No *O. mykiss* were found (Leidy 2002).

Hale Creek

Hale Creek drains an area of approximately five square miles, and contains approximately with 3.2 miles of channel (SCBWMI 2001). A fish distribution study found no *O. mykiss* at two locations sampled in August 1981 (Leidy 1981-1984, 1984).

Assessment: Permanente Creek appears to have supported *O. mykiss* historically. A cement company operating in the upper part of the watershed has discharged sediment-laden water into Permanente Creek and has undertaken corrective actions as directed by the RWQCB (SCBWMI 2001).

Adobe Creek Watershed

Adobe Creek consists of approximately 14 miles of channel originating southwest of Foothill College, and enters the San Francisco Estuary via the Palo Alto Flood Basin. The watershed area consists of about 11 square miles. Operations of the tidal gates at the mouth of Adobe Creek can preclude the passage of anadromous fish (D. Salsbery pers. comm.). A culverted section of the creek is found in the city of Los Altos approximately three miles from the mouth. Box culverts at the road crossings of El Camino Real and Highway 280 are probably impassable to in-migrating salmonids (HRG 1989).

Adobe Creek (San Antonio Creek)

The Sportsman Gazetteer for 1877 reported rainbow trout in Adobe Creek (Hallock 1877). Snyder documented the occurrence of *Salmo irideus* (*O. mykiss*) from collections likely made in 1898 from Adobe Creek (Snyder 1905). Adobe Creek was sampled as part of a fish distribution study at Highway 101 and at Wilkie Way in August 1981. No *O. mykiss* were found (Leidy 1981-1984, 1984).

Staff from DFG sampled Adobe Creek in February 1988 and did not encounter salmonids (HRG 1989). Consultants to SCVWD surveyed Adobe Creek between El Camino Real and Hidden Villa in October, November and December of 1988. Again, no salmonids were seen. The Department of Fish and Game surveyed Adobe Creek in May 2002 and found the channel to be dry in the vicinity of the city of Los Altos (Cleugh 2002).

Assessment: Based on the species' documented historical presence in proximate watersheds and anecdotal accounts, it is likely that steelhead used the Adobe Creek watershed in the past (HRG 1989). Salmonids have not been seen in the several surveys conducted since 1981, and probably are extirpated from the creek system. Channelization and other flood control projects in the watershed have drastically reduced fish habitat, and present impassable barriers to upstream migration (SCBWMI 2001). Some "excellent" fish habitat was noted in a 1988 assessment, however, in the reaches upstream of Hidden Villa (HRG 1989).

Matadero Creek/Barron Creek Watershed

Matadero Creek consists of approximately eight miles of channel and enters the San Francisco Estuary via the Palo Alto flood basin. Its drainage area is approximately 14 square miles, and is supplemented by flows from the approximately three-square mile watershed of Barron Creek. Operations of the tidal gates at the mouth of Matadero Creek can preclude the passage of anadromous fish (D. Salsbery pers. comm.).

Matadero Creek

A 1905 report notes *O. mykiss* in "Madera Creek," referring to Matadero Creek (Snyder 1905). A DFG field note from 1945 documents a fisherman's sighting of steelhead adults in Matadero Creek two years prior (1942/43 season) (Shapovalov 1945).

As part of a fish distribution study, seven Matadero Creek sites were surveyed in August 1981. No *O. mykiss* were found, although good habitat was observed immediately downstream of the Foothill Expressway and near El Camino Real (Leidy 1981-1984, 1984).

According to DFG, steelhead were caught by local fishermen during 1985, 1986 and 1987 in the slough that comprises the lower portion of Matadero Creek. At least six steelhead were noted passing the tidal gates in April 1987 (Yoshioka 1987a). Department of Fish and Game correspondence identifies Matadero Creek as an anadromous steelhead trout stream with winter spawning runs (Ulmer 1986).

In February 1997, Leidy electrofished Matadero Creek at three sites between Laguna Street and the third downstream bridge crossing on Old Matadero Creek Road. No *O. mykiss* were found (Leidy 2002). Based on informal survey of the creek, it is believed not to support use by *O. mykiss* currently (J. Abel pers. comm.).

Barron Creek

Barron Creek consists of approximately five miles of channel, with high flows diverted into Matadero Creek via a constructed channel (SCBWMI 2001). A fish distribution study found no fish of any kind when surveying a 100-meter reach on Barron Creek at Louie Road in August 1981 (Leidy 1981-1984, 1984).

Deer Creek

This creek is tributary to Purisma Creek, which in turn is tributary to Matadero Creek. Deer Creek drains an area of 1.6 square miles and comprises approximately 2.5 miles of channel.

In 1946, DFG visually surveyed Deer Creek and determined it was too steep and its flows too low in summer to support trout (Shapovalov 1946b) A fish distribution study found no *O. mykiss* at two locations surveyed on Deer Creek in August 1981 (Leidy 1981-1984, 1984).

Assessment: The Matadero Creek watershed probably supported a small steelhead run and anadromous *O. mykiss* continue to enter the system, according to local residents (SCBWMI 2001). Channelization, flood control projects, and barriers such as culverts have drastically reduced fish habitat (SCBWMI 2001).

Table V-4. Distribution status of O. Mykiss in San Francisco Estuary streams of Santa Clara County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
Coyote Creek	Coyote	25/11	1898-2000	0, 1, 2, 3	J/5; S/4; R/7; M/2	Y	DF	DF	Y	1, 2, 3	2, 4, 8, 12, 32-36, 40, 44, 50, 53, 55, 56, 62, 67, 69, 70, 72, 74, 81, 83, 88, 92, 93, 96-98 (1)
	Lower Penitencia	1/0	0 **1975**	1	-	N	DF	NP	Y	0	17
	Berryessa	2/0	0 **1981**	1, 3	-	N	UNK	NP	-	0	20, 65, 66
	Calera	3/0	0 **1981**	1, 3	-	N	UNK	NP	-	0	65, 66, 70, 79
	Arroyo de los Coches	2/0	0 **1981**	1, 3	-	N	UNK	NP	-	0	19, 65, 66
	Upper Penitencia	13/6	1946-2000	0, 1, 2, 3	J/4; S/1; R/5	Y	DF	DF	Y	1, 2, 3	9, 17, 29, 39, 42, 53, 55, 56, 70, 81, 88, 93, 95, 102 (1)
	Arroyo Aguague	2/2	1974-1999	1, 2	J/1; R/1	Y	DF	DF	-	1, 2, 3	10, 80, 81
	Lower Silver	2/1	1999	1	R/1	N	DF	NP	Y	1	24, 33, 93 (3)
	North Babb	1/0	0 **1975**	1	-	N	UNK	NP	-	0	25
	South Babb	1/0	0 **1975**	1	-	N	UNK	NP	-	0	27

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Flint	1/0	0 **1975**	1	-	N	UNK	NP	-	0	22
	Thompson	2/0	0 **1975**	1	-	N	UNK	NP	-	0	28, 46
	Quimby	1/0	0 **1975**	1	-	N	UNK	NP	-	0	26
	Fowler	1/0	0 **1975**	1	-	N	UNK	NP	-	0	23
	Yerba Buena	1/0	0 **1975**	1	-	N	UNK	NP	-	0	31
	Upper Silver	2/0	0 **1975**	1, 2	-	N	DF	NP	Y	0	30, 81, 93
	Fisher	1/0	0 **1975**	1	-	N	UNK	NP	-	0	21
	San Felipe	2/1	1961-1997	0, 1, 2	J/1; R/2	N	DF	DF	Y	1, 2, 3	47, 67
	Cow	1/1	1997	2	J/1; R/1	N	DF	DF	Y	1, 2, 3	67
	Packwood	1/0	1997	1	J/1; R/1	N	DF	DF	-	1, 2, 3	67
	Hoover	1/1	1997	2	J/1	N	DF	DF	Y	1, 2, 3	67
	Cañada de los Osos	1/0	1940	1	J/1	N	DF	UNK	Y	0	51, 85
	Hunting Hollow	1/0	0 **1940**	1	-	N	UNK	UNK	-	0	84

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Big Canyon	1/0	1999	1	J/1	N	DF	DF	-	1	67
	Middle Fork Coyote	3/2	1975-1997	1, 2	J/3; R/2	N	DF	DF	Y	1, 2, 3	44, 67
	East Fork Coyote	1/1	1995	2	R/1	N	DF	DF	Y	1, 2, 3	67
	Kelly Cabin	1/0	0 **1995**	2	-	N	PB	NP	Y	0	67 (4)
Guadalupe River	Guadalupe River	13/3	1898-2002	0, 1, 2, 3	J/3; S/1; R/2	Y	DF	DF	Y	1, 2, 3	18, 40, 54, 55, 58, 59, 64-67, 78, 93,102 (2, 4)
	Los Gatos	13/2	1937-2001	0, 1, 2, 3	J/3; R/2; M/4	Y	DF	DF	Y	1, 2, 3	11, 15, 38, 43, 49, 55, 60, 63, 65, 66, 93, 96, 98, 103 (1)
	Briggs	1/0	0 **1981**	1	-	N	UNK	UNK	-	0	65, 66
	Hooker Gulch	1/1	1981	3	J/1	N	DF	PB	Y	0	65, 66
	Austrian Gulch	1/1	1981-2005	3	J/1	N	DF	DF	Y	1,2,3	65, 66 (3)
	Ross	1/0	2001	3	M/1	N	DF	NP	Y	1	(1, 3)
	Guadalupe	7/2	1953-2001	1, 2, 3	J/3; R/1	Y	DF	DF	Y	1, 2, 3	55, 67, 70, 71, 94, 99 (1)

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Pheasant	1/0	1956	1	J/1	Y	DF	DF	Y	1,2,3	94, 99 (4)
	Hicks	1/0	1956	1	J/1	UNK	DF	UNK	Y	0	94, 99
	Rincon	3/1	1981-1999	1, 3	J/2; R/2	N	DF	DF	Y	1, 2, 3	48, 65-67
	Alamitos	1/1	1997	2	-	Y	DF	DF	-	1	1, 105
	Arroyo Calero	0	0	1	-	Y	DF	DF	-	1,2,3	(4)
	Barrett	0	0	0	-	N	DF	DF	-	1	67
	Herbert	0	0	0	-	N	DF	DF	-	1	67
San Tomas Aquino Ck./ Saratoga Ck.	San Tomas Aquino	2/0	1983	0, 1, 3	R/1	N	DF	NP	Y	0	7, 65, 66 (2)
	Saratoga (Campbell)	9/3	1905-2002	0, 1, 2, 3	J/4; R/3	N	DF	DF	Y	1, 2, 3	7, 13, 55, 61, 41, 65-67, 91, 95 (1)
	Bonjetti	2/2	1981-1996	2, 3	J/2; R/2	N	DF	DF	Y	1, 2, 3	65-67
	McElroy	1/1	1981	3	J/1	N	DF	PB	Y	0	65, 66
	Vasona	1/0	0 **1981**	3	-	N	UNK	UNK	-	0	65, 66

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Wildcat	0	0	-	-	N	UNK	NP	-	0	(3)
	Smith	1/0	0 **1987**	3	-	N	UNK	NP	-	0	65, 66 (2)
Calabazas Creek	Calabazas	2/0	1970s **1981**	0, 3	-	N	DF	NP	Y	0	57, 65, 66 (1)
	Prospect	1/0	0 **1981**	3	-	N	UNK	NP	-	0	65, 66
Stevens Creek	Stevens	11/5	1905- 1999	1, 2, 3	J/3; S/3; R/2	Y	DF	DF	Y	1, 2, 3	6, 14, 37, 54, 55, 65-67, 73, 98 (1)
	Swiss	1/0	0 **1981**	1, 3	-	N	DF	NP	-	0	65, 66, 75, 95 (2)
Perma-nente Creek	Perma-nente	3/0	1898 **1996**	3	R/1	N	DF	NP	Y	0	65-67, 98
	Hale	1/0	0 **1981**	3	-	N	PB	NP	-	0	65, 66
Adobe Creek	Adobe	4/0	1877 **2002**	3	-	N	DF	NP	Y	0	16, 45, 52, 65, 66, 98 (1)
Barron / Matadero Creeks	Matadero	8/0	1905- 1987 **1997**	0, 1, 2, 3	M/5	N	DF	NP	Y	0	65-67, 87, 100, 104 (2)
	Barron	1/0	0 **1981**	3	-	N	UNK	NP	-	0	65, 66
	Deer	2/0	0 **1981**	1, 3	-	N	UNK	NP	-	0	65, 66, 89

[a] Table headings and codes are defined in the Methods section of this report.

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Personal Communications

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2. Abel, J., e-mail correspondence with G. Becker, CEMAR, October 2, 2003, regarding distribution status of salmonids in Santa Clara County streams.
3. Salsbery, D., interview with G. Becker, CEMAR, May 25, 2005, in San Jose, CA, regarding distribution of *O. mykiss* in Santa Clara Valley streams.
4. Smith, J., San Jose State University, telephone conversation with G. Becker, CEMAR, October 1, 2003, regarding steelhead and rainbow trout distribution in streams of Santa Clara and San Mateo counties.

SANTA CLARA COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Santa Clara County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Santa Clara County, Caliornia.

San Francisquito Creek Watershed

San Francisquito Creek enters the San Francisco Estuary south of the Dumbarton Bridge and north of the Palo Alto Flood Basin. The watershed covers 42 square miles including drainages of the major tributaries, Los Trancos Creek, West Union Creek and Bear Creek. Searsville Dam, constructed in 1890 about 12.7 miles from the creek mouth, is impassable to in-migrating fish. The Lake Lagunita diversion dam is located about 2.5 miles downstream of Searsville Dam and also poses a significant barrier to spawning salmonids (Cogger et al. 1976d). A fishway was constructed on Lake Lagunita diversion dam in 1976.

San Francisquito Creek

A 1905 report notes *O. mykiss* in San Francisquito Creek (Snyder 1905). A 1953 DFG correspondence states that steelhead in San Francisquito Creek persist in portions of the creek even when the stream becomes intermittent, and that young steelhead have been observed in Lake Lagunita on the Stanford University campus (CDFG 1953). This lake receives creek water diverted via a dam and diversion channel.

A 1961 DFG letter regarding freeway construction notes a small run of steelhead most winters in San Francisquito Creek (Dillinger 1961). In March 1966, a DFG memorandum discussing a potential fish screen on the Lake Lagunita diversion channel noted reports that hundreds of small trout die there every year as it dries up (Strohschein 1966).

In July 1976, DFG visually surveyed San Francisquito Creek from the confluence with Bear Creek to the mouth. Staff cited severe drought conditions as resulting in low *O. mykiss* abundance (only ten YOY steelhead were observed) (Cogger et al. 1976d). Later that month, DFG electrofished four sites on San Francisquito Creek. Eight steelhead ranging from 43 to 147 mm were found in the vicinity of Junipero Serra Boulevard (Cogger et al. 1976a).

In June 1981, DFG visually surveyed San Francisquito Creek between El Camino Real and the Sand Hill Road crossing (on Bear Gulch Creek). Steelhead were common in the upper reaches and appeared to have recovered from the effects of the 1975-1976 drought (Emig and Chapman 1981).

San Francisquito Creek was sampled at five locations in August 1981 as part of a fish distribution study. Two *O. mykiss* (51, 73 mm) were collected near Alpine Road (Leidy 1984). Four downstream locations (three consisting of intermittent pools) did not appear to contain *O. mykiss*.

Leidy electrofished San Francisquito Creek upstream from the Los Trancos Creek confluence in January 1994. No *O. mykiss* were caught. However, in September 1994, he caught a 212 mm FL *O. mykiss* while sampling a 30-meter reach below Sand Hill Road (Leidy 2002).

Oncorhynchus mykiss were collected from San Francisquito Creek in summer and fall 1996 for a genetics study. Samples from 47 *O. mykiss* were analyzed, and the analysis report indicated that the fish were of native trout separable from hatchery strains (Nielsen 2000). In 1998, SCVWD staff rescued *O. mykiss* from the lower reach during dewatering of the channel (J. Abel pers.

comm.). Surveys conducted between 1999 and 2001 identified steelhead juveniles throughout San Francisquito Creek from Highway 101 to Searsville Dam (M. Stoecker pers. comm.).

In May 2002, photographs were taken of two adult steelhead (~630 mm) in lower San Francisquito Creek. A May 2002 migration barrier study reported Searsville Dam as the only complete barrier to migration on mainstem San Francisquito Creek. Removal of this dam was said to have the potential to restore ten miles of historic steelhead habitat (Stoecker 2002).

Los Trancos Creek

Los Trancos Creek drains an area of about seven square miles and consists of about 6.5 miles of channel (SCBWMI 2001). The creek flows generally north to join San Francisquito Creek near Interstate 280 west of Palo Alto.

In a 1962 report, Skinner indicated that Los Trancos Creek was "lightly used" as steelhead habitat (Skinner 1962).

The Department of Fish and Game electrofished three Los Trancos Creek sites in July 1976. At the lowermost Los Trancos Road crossing, a 300-meter reach produced 46 *O. mykiss* (38-236 mm FL), and YOY were numerous (Cogger et al. 1976b). According to DFG, most of the salmonids electroshocked from the receding flow of Los Trancos Creek were released into the large pools of upper San Francisquito Creek (Anderson 1976).

According to a 1979 DFG letter, sampling was performed on Los Trancos Creek under the I-280 bridge in June 1978. At that time, 412 YOY *O. mykiss* were found in the plunge pools of the fish passage weirs (Paulsen 1979).

Three sites on Los Trancos Creek were sampled in 1981 as part of a fish distribution study. Three-year classes of *O. mykiss* appeared to be represented in a 20 meter isolated pool immediately downstream of Arastradero Road. Fish collected included five *O. mykiss* measuring 71-92 mm FL and two larger individuals (190, 335 mm). Surveys at two downstream locations (at Westridge Drive and upstream from Interstate 280) and one upstream location (at the second Los Trancos Road crossing) revealed no *O. mykiss* (Leidy 1984).

In January and September 1994, Leidy electrofished a reach of Los Trancos Creek just upstream from the San Francisquito Creek confluence. He caught four *O. mykiss* (68, 68, 89, 90 mm FL) in January and estimated density at 10 per 30 meters (Leidy 2002). In September, he caught five *O. mykiss* (65–90 mm) and estimated density at 20 per 30 meters. In June 1998, Leidy electrofished Los Trancos Creek approximately 325 feet upstream from Pleasant Hill Road. No *O. mykiss* were found (Leidy 2002).

Stream surveys conducted from 1999-2001 found *O. mykiss* in Los Trancos Creek up to approximately 0.7 miles upstream from the east fork confluence. *Oncorhynchus mykiss* also were observed 150 feet upstream of the "PV Ranch tributary" and in the east fork up to a culvert under Los Trancos Road (M. Stoecker pers. comm.). In April 2003, an adult steelhead was sighted in Los Trancos Creek. Multiple age classes of *O. mykiss* and redds have been consistently identified from 1997 to the present (M. Stoecker pers. comm.).

Bear Creek

Bear Creek drains an area of about 13 square miles and is formed by two major tributaries, Bear Gulch Creek and West Union Creek. It flows generally south in the vicinity of the town of Woodside.
In July 1974, DFG electrofished three sites on Bear Creek. Results are presented in Table VI-1.

Table VI-1. DFG *O. mykiss* electrofishing results, Bear Creek, 1974

Location	**No.**	**Age Class (years)**	**Size Range (mm FL)**
50 m reach upstream from	31	YOY	~50
Sand Hill Rd.	17	1+	94-107
50 m reach downstream	7	YOY	61-64
from Fox Hollow Rd.	21	1+	79-97
	1	2+	145
At the Mountain Home	23	YOY	71-20
Rd. bridge	12	2+	160-211

(Strohschein 1974).

In June 1976, DFG visually surveyed Bear Creek between its mouth and headwaters at the confluence of West Union and Bear Gulch Creeks. The Department of Fish and Game found about 150 *O. mykiss* fingerlings, despite severe drought conditions in that year (Cogger et al. 1976c). In July 1976, DFG followed up the stream survey on Bear Creek with an electrofishing survey. A total of 36 *O. mykiss* (41-211 mm) were sampled from sites upstream of Sand Hill Road and upstream of Mountain Home Road (Cogger et al. 1976a). According to DFG, most of the salmonids electroshocked from the isolated pools of Bear Creek were released into the large pools of upper San Francisquito Creek (Anderson 1976).

In June 1978, DFG electrofished Bear Creek at Sand Hill Road and at Mountain Home Road. Two *O. mykiss* (81 and 97 mm FL) were caught and measured, while 50-75 YOY and three larger individuals (~125 mm) were observed but could not be captured due to faulty equipment (Torres and Paulsen 1978). In August 1979, DFG electrofished Bear Creek at Mountain Home Road. Three *O. mykiss* (170, 188, and 216 mm FL) and 82 YOY (51-104 mm) were collected. The Department of Fish and Game noted an apparent lack of age 1+ fish and attributed it to a lack of recruitment in 1978 (Anderson 1979).

In 1984, an isolated pool 0.2 miles downstream from Adobe Corner was sampled as part of a fish distribution study. Five *O. mykiss* (59-111 mm) were found in a ten-meter reach (Leidy 1984). In June 1985, DFG visually surveyed Bear Creek from the confluence of West Union and Bear Gulch Creeks to Sandhill Road. *Oncorhynchus mykiss* was observed, but the surveyor stated that positive identification could not be confirmed until electrofishing was employed (Bordenave and Ford 1985).

An adult steelhead was observed in Bear Creek in 1995 (685 mm) and in 1998 (760 mm), respectively (M. Stoecker pers. comm.). Surveys conducted from 1999 to 2001 identified juvenile steelhead throughout Bear Creek (M. Stoecker pers. comm.). As of 2003, an anadromous *Oncorhynchus mykiss* population appears to utilize the entire length of Bear Creek from the confluence of West Union and Bear Gulch creeks to the San Francisquito Creek confluence (M. Stoecker pers. comm.).

Dry Creek

Dry Creek is tributary to Bear Creek and runs from north to south parallel to Canada Road. In 1999 juvenile steelhead were observed fifty feet upstream from the Woodside Road crossing (M. Stoecker pers. comm.).

Bear Gulch Creek

Bear Gulch Creek is tributary to Bear Creek. An isolated pool at La Honda Road was sampled in August 1981 as part of a fish distribution study. Three *O. mykiss* (140, 143, 245 mm) were caught in a seven-meter reach (Leidy 1984).

In June 1999, an adult steelhead (790 mm) was rescued from a pool above Highway 84. Juvenile steelhead were observed throughout the creek below the diversion dam during surveys conducted between 1999 and 2001 (M. Stoecker pers. comm.).

A study of salmonid migration barriers on Bear Gulch Creek found the CalWater diversion dam, located approximately 0.25 miles upstream of the Highway 84 crossing, to be an impassable barrier for upstream migrating adult steelhead under most flow conditions (Stoecker 2002). An anadromous *O. mykiss* population successfully reproduces below this barrier. The creek upstream from this barrier is considered to provide high quality salmonid habitat, and currently supports a resident *O. mykiss* population (M. Stoecker pers. comm.).

West Union Creek

West Union Creek is tributary to Bear Creek and drains an area of about seven square miles. It flows generally south through the San Andreas rift zone.

The Department of Fish and Game electrofished a site on West Union Creek at the confluence with Bear Gulch Creek in July 1974. A total of 27 *O. mykiss* representing three age classes were collected (11: 48-53 mm FL; 15: 86-97 mm FL; 1: 173 mm FL) (Strohschein 1974).

In June 1976 (a drought year), DFG visually surveyed West Union Creek between the mouth and a twin natural falls. YOY and age 1+ and 2+ *O. mykiss* were observed in intermittent reaches from the mouth to 75 yards upstream of Kings Mountain Road (Cogger et al. 1976e). In July 1976, DFG followed up the stream survey on West Union Creek with an electrofishing survey. A total of 31 *O. mykiss* (43-224 mm FL) were collected upstream of Huddart Park and downstream of Kings Mountain Road (Cogger et al. 1976a). According to DFG, most of the salmonids electroshocked from isolated pools of West Union Creek were released into the large pools of upper San Francisquito Creek (Anderson 1976).

An isolated pool on West Union Creek near the confluence with Bear Creek was sampled in August 1984 as part of a fish distribution study. Four *O. mykiss* (51, 53, 106, 162 mm FL) were found in a three-meter reach, and another 12 (52-69 mm) in a five-meter pool immediately upstream (Leidy 1984).

In July 1985, DFG electrofished five West Union Creek sites above and below a diversion at 345 King's Mountain Road. Sixty-two *O. mykiss* (52-250 mm FL) were collected representing multiple age classes (Ford 1985b). The Department of Fish and Game also surveyed West Union Creek between the mouth and the twin falls in July 1985. *Oncorhynchus mykiss* (50-75 mm) were observed to be moderately abundant in pools from the mouth of West Union Creek to the second logjam above Squeler Gulch. A larger individual (100-125 mm) was seen upstream of Squeler Gulch (Ford 1985a).

The National Park Service (NPS) conducted snorkel surveys of West Union Creek sites in July 1996. The counts noted 143 steelhead in nine surveyed pools totaling 132 meters in length. Steelhead were mostly between 30 and 89 mm, with larger individuals (>120 mm) recorded at only two sites. Juvenile *O. mykiss* densities varied from about 0.3-5.4 per square meter (Fong 2002).

Leidy noted juvenile *O. mykiss* (50-75 mm TL) in pools between Huddart Park and the Phleger Estate fence in October 1999 (Leidy 2002). In July and November 1999, NPS again conducted snorkel surveys coupled with electrofishing in West Union Creek. About 69 *O. mykiss* were collected representing YOY and age 1+ and 2+ fish (44-178 mm) (Fong 2002). *Oncorhynchus mykiss* currently reproduce in West Union Creek from its confluence with Bear Gulch Creek upstream to a natural waterfall that presents a complete barrier to migration (M. Stoecker pers. comm.).

Squeler Gulch Creek

Squeler Gulch Creek is tributary to West Union Creek. In a 1990 survey, Smith found juvenile *O. mykiss* in the lower 0.5 mile of the creek (J. Smith pers. comm.).

McGarvey Gulch Creek

McGarvey Gulch Creek is tributary to Bear Creek. In July 1974, DFG electrofished a 90 meter reach of McGarvey Gulch Creek downstream from the Woodside Road Bridge. The survey noted 11 YOY *O. mykiss* (48-53 mm FL), 15 age 1+ (86-97 mm) and one larger individual (173 mm) (Strohschein 1974).

Stream surveys conducted between 1999 and 2001 identified juvenile steelhead in the lower 0.3 miles of the McGarvey Gulch Creek (M. Stoecker pers. comm.). Anadromous *O. mykiss* currently utilize McGarvey Gulch creek up to a bridge apron and culvert located about 0.7 miles upstream from the mouth (M. Stoecker pers. comm.).

Corte Madera Creek

Corte Madera Creek is tributary to San Francisquito Creek via Searsville Lake. It drains the San Andreas rift zone area south of the lake in the vicinity of Portola Valley.

In a 1962 report, Skinner indicated that Corte Madera Creek was an historical migration route for steelhead (Skinner 1962).

Oncorhynchus mykiss have been observed in Corte Madera Creek since at least the late 1970s (M. Stoecker pers. comm.). Three Corte Madera Creek locations were sampled in September 1981 as part of a fish distribution study. Fifty-two *O. mykiss* (35-86 mm FL) were found in a ten-meter reach at Willowbrook Road. At the junction of Coal Creek, 26 *O. mykiss* (32-62 mm) were caught in a 25-meter metreach along with two larger *O. mykiss* (98, 137 mm). A 15 meter isolated pool at Portola Valley Road produced no fish (Leidy 1984). In the spring of 1991, an adult steelhead (740 mm) was observed jumping at the base of Searsville Dam (M. Stoecker pers. comm.).

Oncorhynchus mykiss were observed throughout Corte Madera Creek from Searsville Reservoir upstream to a point 400 feet upstream of the Coal Creek confluence during barrier surveys conducted between 1999-2001 (M. Stoecker pers. comm.). In May 2002, the San Francisquito Watershed Council released a barrier survey including Corte Madera Creek. A private bridge apron adjacent to Willowbrook Drive and another downstream of the confluence with Damiani Creek (upstream from Searsville Lake) were described as impassable barriers to upstream migrating *O. mykiss* (Stoecker 2002).

Corte Madera Creek below Searsville Dam currently supports an anadromous *O. mykiss* population, and observations of juvenile *O. mykiss* have been made as recently as September 2003. A resident population exists above Searsville Reservoir upstream to the Old Alpine Road crossing (M. Stoecker pers. comm.).

Alambique Creek

The historical confluence of Alambique Creek with Corte Madera Creek was inundated by the construction of Searsville Lake. One Alambique Creek site was sampled in August 1981 as part of a fish distribution study. Two *O. mykiss* (45, 52 mm FL) were collected where the creek crosses La Honda Road (Leidy 1984). In May 2002, the culvert beneath Highway 84 was identified as an impassable barrier to upstream migration (Stoecker 2002).

Hamms Gulch Creek

Hamms Gulch is tributary to Corte Madera Creek. *Oncorhynchus mykiss* currently uses the lower 150 feet of Hamms Gulch Creek (M. Stoecker pers. comm.).

Damiani Gulch Creek

Damiani Gulch is one of the larger tributaries of Corte Madera Creek. *Oncorhynchus mykiss* are currently present in the lower 150 feet of Jones Gulch Creek (M. Stoecker pers. comm.).

Coal Creek

Coal Creek is tributary to Corte Madera Creek. Surveys from 1999-2001 consistently found *O. mykiss* in the lower 250 feet of the stream (M. Stoecker pers. comm.).

Assessment: The San Francisquito Creek drainage historically supported a steelhead run that continues, albeit in limited numbers, to the present day. Rearing habitat on mainstem San Francisquito Creek was reduced by the construction of Searsville Dam in 1890. Habitat is available in Los Trancos Creek, in the lower reaches of West Union Creek and Bear Creek, and in the upper reaches of San Francisquito Creek (Cogger et al. 1976e).

Redwood Creek Watershed

Redwood Creek drains the primarily urbanized environs of Redwood City. It issues into San Francisco Bay at Redwood Point.

Redwood Creek

Two Redwood Creek sites were sampled in August 1981 as part of a fish distribution study. Neither the north branch nor the south branch site contained *O. mykiss* (Leidy 1984).

Arroyo Ojo

Two Arroyo Ojo sites were sampled in August 1981 as part of a fish distribution study. *Oncorhynchus mykiss* was not detected (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Redwood Creek watershed.

Cordilleras Creek Watershed

Cordillera Creek originates in the Pulgras-Ridge Open Space Preserve west of Redwood City. It drains a primary urbanized landscape before issuing into Smith Slough at the San Carlos Airport.

Cordilleras Creek

Three Cordilleras Creek sites were sampled in August 1981 as part of a fish distribution study. No *O. mykiss* were found by seining at any of the sites between Grant-Industrial Road and Cordilleras Road (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Cordilleras Creek watershed.

Belmont Creek Watershed

Belmont Creek drains urbanized portions of the cities of Belmont and San Carlos. It enters the San Francisco Bay via Belmont Slough in the vicinity of Foster City.

Belmont Creek

Three Belmont Creek sites were sampled in August 1981 as part of a fish distribution study. *Oncorhynchus mykiss* was not found at any of the sites between Industrial Road and Belmont Reservoir. The survey noted that Belmont Creek was highly disturbed (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Belmont Creek watershed.

Laurel Creek Watershed

Laurel Creek originates in the developed area west of the city of Belmont and east of Highway 92. The creek appears to enter a below-grade culvert between El Camino Real and Highway 101 that carries the creek to the San Francisco Estuary.

Laurel Creek

Five Laurel Creek sites were sampled in August 1981 as part of a fish distribution study. No *O. mykiss* were found during seining at the sites between Hillsdale Mall and the end of Laurelwood Road. However, high quality habitat was noted at the upper location, and the researcher noted that a diversion tunnel just downstream of the sampling area appeared to pose a total barrier to migration (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Laurel Creek watershed.

San Mateo Creek Watershed

Crystal Springs Reservoir, constructed in 1877 and operated by the SFPUC, separated upstream and downstream salmonid populations. The outlet of Lower Crystal Springs Reservoir is located near the junction of Crystal Springs Road and Interstate 280. The creek flows then flows east to enter the San Francisco Bay near Seal Point Shoreline Park.

San Mateo Creek

In 1860, prior to the construction of San Andreas and Lower Crystal Springs reservoirs, *O. mykiss* specimens were collected from San Mateo Creek (Museum of Comparative Zoology 1860).

San Mateo Creek was sampled in August 1981 as part of a fish distribution study. Seven *O. mykiss* (50-131 mm FL) were collected by net in a 20-meter reach below Sierra Drive near Crystal Springs School. A single 108 mm *O. mykiss* was found in a 30-meter metreach on Crystal Springs Road (0.6 miles downstream from Polhemus Road), and two *O. mykiss* (91, 106 mm) were captured in a ten-meter reach at the junction of Crystal Springs and Polhemus Roads. An additional site 0.1-mile reach upstream produced no *O. mykiss* (Leidy 1984).

Leidy electrofished San Mateo Creek immediately upstream from Crystal Springs Reservoir in March 1988 and found 11 *O. mykiss* (9: 100-130mm; 2: ~90mm) in a 30-meter reach (Leidy 2002). During a survey of peninsula watershed lands in November 1991, *O. mykiss* was collected by electrofishing at two San Mateo Creek sites, the first immediately downstream of Mud Dam Lake and the second downstream of Crystal Springs Reservoir (Smith 1991). An additional six sites did not contain *O. mykiss.* The sampling was conducted during an extreme drought, which was said to have limited otherwise much more extensive habitat (Smith 1991). The survey report noted that the watershed lands around Crystal Springs Reservoir have been protected over a long period of time, offering the potential for retaining significant native fish populations (Smith 1991).

Leidy electrofished San Mateo Creek again in December 1993, finding *O. mykiss* at all four locations sampled (Leidy 2002). At Baywood Avenue, a 198 mm *O. mykiss* was the only fish in a 100-meter reach. However, upstream at Sierra Drive he caught 23 *O. mykiss* (59-280 mm) and observed ten in the same size range in a 30-meter reach. At the Tartan Trail Drive crossing, 13 *O. mykiss* (71-225 mm) were collected in a 50-meter reach, and five were observed in the same size range. And at Arroyo Court, just upstream from the De Ana Camp Historical Marker, Leidy caught two *O. mykiss* (192, 202mm) in a 30-meter reach.

Polhemus Creek

Polhemus Creek was sampled in August 1981 as part of a fish distribution study. Seven *O. mykiss* (196-322 mm FL) were collected in a ten-meter pool below a culvert located 0.3 miles upstream from the junction of Crystal Springs Road and Polhemus Road. Nine *O. mykiss* (72-122 mm) were found in a series of steep cascade pools about 160 feet downstream. The surveyors judged the culvert to be a migration barrier, which was supported by the absence of fish at an upstream location (Leidy 1984).

Assessment: The San Mateo Creek watershed historically supported *O. mykiss*, and small numbers of anadromous steelhead may use the area below Crystal Springs Reservoir. Additional sampling is recommended to characterize the *O. mykiss* resources of the reservoir and tributary areas upstream.

Sanchez Creek Watershed

Sanchez Creek drains urbanized areas in the vicinity of the cities of Hillsborough and Burlingame. It enters the San Francisco Estuary west of Coyote Point County Park.

Sanchez Creek

One Sanchez Creek site was sampled in August 1981 as part of a fish distribution study. No *O. mykiss* were found at the South Pacific Railroad Crossing and at Front View Avenue in Hillborough (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Sanchez Creek watershed.

Easton Creek Watershed

Easton Creek drains urbanized areas north of Hillsborough and west of Burlingame. The creek appears to enter a below-grade culvert in the vicinity of El Camino Real that carries flows to the San Francisco Estuary.

Easton Creek

Easton Creek was sampled near Roosevelt School as part of a fish distribution study in September 1981. No fish of any kind were encountered (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Easton Creek watershed.

Mills Creek Drainage

Mills Creek drains developed areas south of Millbrae. The creek appears to be channelized between the Southern Pacific Railroad right of way and the estuary to the east.

Mills Creek

A 1958 stream survey identified *O. mykiss* in Mills Creek (CDFG 1958). Mills Creek was sampled by pole-seine at California Drive in September 1981 as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984).

Assessment: Insufficient information exists to assess the historical distribution and current status of salmonids in the Mills Creek watershed.

Colma Creek Watershed

Colma Creek originates in the town of Colma, draining portions of Colma, San Bruno and South San Francisco. It enters the San Francisco Estuary south of Point San Bruno.

Colma Creek

Two Colma Creek sites were sampled in September 1981 as part of a fish distribution study. No *O. mykiss* were collected, and field notes state the creek was very disturbed (Leidy 1984).

In May 2002, Leidy surveyed Colma Creek between the mouth and headwaters. No *O. mykiss* were observed, nor was suitable habitat present (Leidy 2002).

Assessment: Insufficient information exists to assess the historical distribution of salmonids in the Colma Creek watershed. The watershed currently does not contain suitable habitat to support salmonids.

Table VI-2. Distribution status of O. mykiss in San Francisco Estuary streams of San Mateo and San Francisco Counties, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss Hist.	O. mykiss Current	Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
San Francisquito Creek	San Francisquito	12/4	1905-2002	0, 1, 2, 3	J/7; R/1; M/1	Y	DF	DF	Y	1, 2, 3	4, 6, 9, 11, 12, 16, 17, 19, 24-26 (1, 3)
	Los Trancos	15/4	1976-2003	1, 2, 3	J/14; R/9; M/1	Y	DF	DF	Y	1, 2, 3	1, 7, 16, 17, 20, 22 (3)
	Bear	11/7	1974-2003	1, 2	J/8; R/3; M/2	Y	DF	DF	Y	1, 2, 3	1-3, 6, 8, 16, 27, 28 (3)
	Dry	1/1	1999	1	J/1	Y	DF	DF	-	1	(3)
	Bear Gulch	4/2	1981-2003	3	J/4; R/1; M/1	Y	DF	DF	Y	1, 2, 3	16, 25 (3)
	West Union	6/6	1976-2003	1, 2, 3	J/6; R/4	Y	DF	DF	Y	1, 2, 3	1, 6, 10, 13-16, 27 (3)
	Squeler Gulch	1/0	1990	1	J/1	N	DF	DF	-	1, 2	(2)
	McGarvey Gulch	4/1	1974-2003	1, 2	J/4; R/1	Y	DF	DF	-	1, 2, 3	27 (3)
	Corte Madera	3/2	1981-2003	1, 3	J/2; M/1	Y	DF	DF	Y	1, 2, 3	16, 25 (3)
	Alambique	1/1	1981	3	J/1	N	DF	PB	-	1	16, 25
	Hamms Gulch	1/0	2003	1	-	N	DF	DF	-	1	(3)
	Damiani Gulch	1/0	2003	1	-	N	DF	DF	-	1	(3)

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Coal	1/0	1999-2001	1	-	N	DF	DF	-	1	(3)
Redwood Creek	Redwood	1/0	0 **1981**	3	-	N	UNK	NP	-	0	16
	Arroyo Ojo	1/0	0 **1981**	3	-	N	UNK	NP	-	0	16
Cordilleras Creek	Cordilleras	1/0	0 **1981**	3	-	N	UNK	UNK	-	0	16
Belmont Creek	Belmont	1/0	0 **1981**	3	-	N	UNK	UNK	-	0	16
Laurel Creek	Laurel	1/0	0 **1981**	3	-	N	UNK	UNK	-	0	16
San Mateo Creek	San Mateo	4/4	1860-93	2, 3	J/3; R/1	UNK	DF	DF	Y	1, 2, 3	16-18, 23
	Polhemus	1/1	1981	3	J/1; R/1	UNK	DF	PB	-	0	16
Sanchez Creek	Sanchez	1/0	0 **1981**	3	-	UNK	UNK	UNK	-	0	16
Easton Creek	Easton	1/0	0 **1981**	3	-	UNK	UNK	UNK	-	0	16
Mills Creek	Mills	2/0	1958 **1981**	1, 3	-	UNK	DF	UNK	Y	0	5, 16
Colma Creek	Colma	2/0	0 **2002**	1, 3	-	N	UNK	NP	-	0	16, 17

[a] Table headings and codes are defined in the Methods section of this report.

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28. Torres, S. G., and I. L. Paulsen, CDFG. 1978. Memo to Fisheries Management Region 3. Re: Fish Population Sampling, Bear Creek Drainage, San Mateo County; June 29, 1978. Dated August 9.

Personal Communications

1. Abel, J., SCVWD, interview with B. Harvey, CEMAR, March 21, 2002, in San Jose, CA, regarding anadromous salmonid observations in Santa Clara Country streams tributary to the San Francisco Bay.
2. Smith, J., San Jose State University, telephone conversation with G. Becker, CEMAR, October 1, 2003, regarding steelhead and rainbow trout distribution in streams of Santa Clara and San Mateo counties.
3. Stoecker, M., telephone conversation with B. Harvey, CEMAR, September 18, 2003, regarding observations of steelhead in the San Francisquito drainage.

SAN MATEO COUNTY & SAN FRANCISCO COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of San Mateo County & San Francisco County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of San Mateo County & San Francisco County, Caliornia.

Coyote Creek Watershed

Coyote Creek originates on the eastern face of the Marin Peninsula range and flows generally east to enter the San Francisco Estuary in Richardson Bay. The Coyote Creek watershed consists of about 3.6 square miles. Oakwood Valley Creek joins Coyote Creek from the south in the lower Tamalpais Valley.

Coyote Creek

According to local residents, Coyote Creek supported steelhead prior to the construction of a U.S. Army Corps flood project in 1965 (L. Lewis pers. comm.). One location on a branch of Coyote Creek at the GGNRA trailhead along Tennessee Valley Road was sampled in September 1981 as part of a fish distribution study. No salmonids were found (Leidy 1984). Leidy sampled Coyote Creek near the terminus of Northern Avenue in October 1993 and did not find any fish (Leidy 2002). Marin County PWA staff indicates that salmonids do not presently use Coyote Creek (L. Lewis pers. comm.).

Assessment: Coyote Creek likely supported steelhead historically. However, flood control projects and other watershed factors appear to have made the creek unusable by *O. mykiss* populations.

Arroyo Corte Madera Del Presidio Watershed

Arroyo Corte Madera del Presidio drains the east side of Mount Tamalpais and areas including and around the town of Mill Valley. The creek drains a watershed of about six square miles and its tributaries include Old Mill Creek, Reed Creek, Widow Reed Creek and Warner Creek. A fish passage assessment performed in 2002-2003 notes that several culverted portions of the arroyo impede fish passage and should be modified (Ross Taylor and Assoc. 2003). The reach immediately upstream from the Old Mill Creek confluence was ranked as a high priority passage improvement project.

Arroyo Corte Madera del Presidio

In January 1946, DFG visually surveyed several sites on Arroyo Corte Madera del Presidio. *Oncorhynchus mykiss* in good condition were identified at Montford Avenue and at Sunnyside Avenue. Two dead *O. mykiss* (100-125 mm) were found at the Park Avenue bridge (Shapovalov 1946a).

In July 1963, DFG visually surveyed the entire length of Arroyo Corte Madera del Presidio and its tributaries. Small numbers of fingerling and YOY steelhead were observed (10 per 30 meters) ranging in size from 50-150 mm, but predominantly 50 mm in length (Brackett 1963). The survey report noted that 3.5 miles of Corte Madera del Presidio are utilized for spawning and rearing purposes, and cited the creek as an important spawning and nursery area for steelhead and possibly salmon (Brackett 1963).

In August 1965, DFG visually surveyed Arroyo Corte Madera del Presidio, finding many “excellent” spawning areas and frequent, well-shaded pools. *Oncorhynchus mykiss* averaged approximately 75 per 30 meters of channel, and a sample of 20 fish ranged in size from 46-71 mm (Culley and Fox 1965). The creek was said to be a good spawning and nursery area for steelhead trout (Culley and Fox 1965).

In 1981,Arroyo Corte Madera del Presidio was sampled by dipnet at Locust Road. Eleven *O. mykiss* (52-109 mm FL) were collected (Leidy 1984).

As part of a restoration feasibility study, several Arroyo Corte Madera sites were sampled by electrofishing in October and November 1994. *Oncorhynchus mykiss* was collected near downtown Mill Valley and in Miller Grove Park, while downstream sites did not produce salmonids (Rich 1995). Population density at the two sites with *O. mykiss* were 0.7 per square meter and less than 0.1 per square meter, respectively. At the downtown Mill Valley site, *O. mykiss* found ranged from 40-90 mm in length, with one individual at 140-150 mm. The Miller Grove Park site had *O. mykiss* between 40 and 160 mm, with three fish between 170 and 200 mm. Three or four age classes were represented in the sample (Rich 1995).

In July 1997, Leidy electrofished Arroyo Corte Madera del Presidio at four locations and found at least four age classes of *O. mykiss* present (Leidy 2002). At La Gama Street he caught two *O. mykiss* (135, 150 mm FL) in a 30-meter reach. Immediately downstream of Park Avenue in Mill Valley, he caught 15 *O. mykiss* (100-307 mm) at an estimated density of 25 per 30 meters of stream. A 20-meter reach just downstream from Presidio Road yielded four *O. mykiss* (59-173 mm). Additionally, Leidy caught 12 *O. mykiss* (47-195 mm) in a 30-meter reach centered at West Blithedale Road (Leidy 2002).

Willow Reed Creek (Widow Creek)

Willow Reed Creek drains Homestead Valley and enters Arroyo Corte Madera del Presidio from the west. According to records of the Mill Valley Historical Society, Blithedale Dam was constructed on Widow Creek in the 1870s. The dam was equipped with a fish ladder known to pass anadromous salmonids (Rich 1995).

During observations in the summer of 2004, staff from Marin County noted YOY and age 1+ *O. mykiss* in Willow Reed Creek (L. Lewis pers. comm.). Successful *O. mykiss* reproduction is assumed to be occurring in the creek.

Warner Creek

Warner Creek originates near the Mill Valley Golf Club on the slopes north of Mill Valley. The creek drains an area of about 5.2 square miles.

In July 1963, DFG visually surveyed the entire length of Arroyo Corte Madera del Presidio Creek and its tributaries, including Warner Creek. Small numbers of fingerling and YOY steelhead were observed (10 per 30 meters) ranging in size from 50-150 mm, but predominantly 50 mm in length (Brackett 1963).

Leidy electrofished Warner Creek at Boyle Park off East Blithedale and Elm Boulevard in 1997. No *O. mykiss* were found (Leidy 2002). During observations in the summer of 2004, staff from Marin County noted YOY *O. mykiss* in Warner Creek (L. Lewis pers. comm.). Successful *O. mykiss* reproduction is assumed to be occurring in the creek.

Old Mill Creek

Old Mill Creek drains the southeastern slopes of Mt. Tamalpais and joins Arroyo Corte Madera del Presidio in the town of Mill Valley. A fish passage evaluation performed in 2002-2003 noted that the culverted reach of Old Mill Creek beneath the post office in Mill Valley is a severe barrier to migration of all life stages of steelhead (Ross Taylor and Assoc. 2003). According to records of the Mill Valley Historical Society, Cascade Dam, located on Old Mill Creek above the confluence with Cascade Creek, was constructed in the 1870s (Rich 1995). The dam constitutes a complete barrier to upstream fish passage.

A January 1946 DFG survey reported natural propagation of *O. mykiss* in Old Mill Creek as "fair" in the lower reach to "good" in the middle reach (Shapovalov 1946b). According to the survey report, steelhead were hampered in their ascent by an inclined concrete apron at the Cascade Drive bridge in Old Mill Park (Shapovalov 1946b). The Cascade Reservoir dam was identified as a complete barrier to migration (Shapovalov 1946b).

In July 1963, DFG visually surveyed Arroyo Corte Madera del Presidio Creek and its tributaries, including Old Mill Creek. Small numbers of fingerling and yearling steelhead were observed throughout the Arroyo Corte Madera del Presidio system (10 per 30 m), ranging in size from 50-150 mm, with most fish measuring approximately 50 mm (Brackett 1963).

In September 1981, a dip-net survey of three sites on Old Mill Creek found 15 *O. mykiss* approximately 0.5 miles above the junction of Cascade Drive and Lowell Avenue (Leidy 1984). Fish ranged in size from 62-116 mm, with one individual 174 mm in length recorded. At the Cascade Drive crossing near Josephine St., seven *O. mykiss* ranged in size from 50-71 mm. At Locust Road, 11 *O. mykiss* ranged from 52-109 mm (Leidy 1984).

As part of a restoration feasibility study, several Old Mill Creek sites were sampled by electrofishing in October and November 1994. *Oncorhynchus mykiss* was collected at multiple sites, with mostly YOY represented in the sample (Rich 1995). These *O. mykiss* were predominantly between 40 and 200 mm in length, with one individual between 250 and 260 mm. Three or four age classes were represented in the Old Mill Creek population (Rich 1995).

In July 1997, Leidy electrofished Old Mill Creek approximately 0.5 miles below Cascade Dam. He found 11 *O. mykiss* (47-69 mm FL) at an estimated density of 15 per 30 meters of stream (Leidy 2002). Steelhead YOY were found in Old Mill Creek during observations between 1998 and 2001 (Jones 2001).

Cascade Creek

Cascade Creek joins Old Mill Creek from the north approximately 0.4 mile below Cascade Dam. In July 1963, DFG visually surveyed the entire length of Arroyo Corte Madera del Presidio Creek and its tributaries, including Cascade Creek. Small numbers of fingerling and yearling steelhead were observed throughout the Arroyo Corte Madera del Presidio system (10 per 30 meters). Fish ranged in size from 50-150 mm, but were predominantly 50 mm in length (Brackett 1963).

In September 1981, two sites were dip-netted on Cascade Creek, but no *O. mykiss* were found (Leidy 1984). Leidy sampled Cascade Creek at the Old Mill Creek confluence in October 1993. No fish of any kind were found.

As part of a restoration feasibility study, Cascade Creek was sampled in October and November 1994. One *O. mykiss* was collected above the culvert at the entrance to the Cascade Falls trail (Rich 1995). In July 1997, Leidy electrofished a 20 meter reach of Cascade Creek upstream of the Old Mill Creek confluence and found five *O. mykiss* (50-75 mm FL) at an estimated density of 10 per 30 meters (Leidy 2002).

Assessment: Arroyo Corte Madera del Presidio and its tributaries historically supported both *O. mykiss*. Steelhead continue to enter the system and reproduce successfully.

Oncorhynchus mykiss abundance in the watershed appears to be limited by lack of water (Rich 1995). According to a restoration feasibility study for the Arroyo Corte Madera del Presidio drainage, Old Mill Creek provides the best remaining salmonid habitat in the watershed (Rich 1995).

Corte Madera Creek Watershed

The Corte Madera Creek watershed is 28 square miles and includes unincorporated portions of Marin County, the city of Larkspur, and the towns of Corte Madera, Ross, San Anselmo and Fairfax. Main stem Corte Madera Creek is formed by the union of San Anselmo and Sleepy Hollow Creeks, and flows generally southeast to enter the Bay at a point about nine miles north of the Golden Gate Bridge, just south of Point San Quentin.

Between 1967 and 1971, the Corps channelized a two-mile portion of Corte Madera Creek from Kentfield near its mouth to its inception at the confluence of San Anselmo and Sleepy Hollow Creeks. The concrete channel extends up the lower portions of all direct tributaries to Corte Madera Creek in this reach, including Ross, Sleepy Hollow, San Anselmo, and Fairfax creeks. The upper portion of this channel blocks migration to all spawning areas in the watershed, according to a 2002-2003 fish passage evaluation (Ross Taylor and Assoc. 2003).

Corte Madera Creek

In January 1960, DFG visually surveyed Corte Madera Creek from its mouth to the confluence with San Anselmo Creek. Although no fish were observed during the survey, residents estimated a run of 500-1,000 steelhead each year (Allen 1960a). According to DFG, the upper half of Corte Madera Creek is used by steelhead for both spawning and as a nursery area (Allen 1960a). The DFG report also speculated that the proposed channelization would cause destruction of the nursery area and eliminate the steelhead run (Allen 1960a).

Unsigned reports of minnow-seine surveys dating from 1963 to 1974 indicate that sampling regularly recorded *O. mykiss* in Corte Madera Creek (DFG 1963-1974). Sampling results are listed in Table VII-1.

Table VII-1. Corte Madera Creek minnow-seine sampling results, 1963-1974

Date	Location	*Oncorhynchus mykiss* No.	Size Range
November 1963	Lagunitas Rd. bridge	29	Fry
November 1963	~2 mi. downstream from Lagunitas Rd. bridge	0	--
May 1965	Ross/San Anselmo border and also Ross near bridge at fire station	36	--
October 1967	Ross near bridge	3	81-98
October 1968	Ross upstream from bridge	8	47-80
October 1968	Ross downstream from bridge	27	44-133
October 1969	Ross near bridge at fire station	3	64-81
September 1971	Lagunitas Rd. bridge	72	38-83
September 1972	Ross near bridge at fire station	19	50-85
September 1973	Ross near bridge at fire station	10	--
October 1974	Ross near bridge at fire station	5	64-95

(Source: DFG 1963-1974)

In July 1968, DFG visually surveyed Corte Madera Creek from its mouth to the San Anselmo confluence. *Oncorhynchus mykiss* were observed at a density of 75 per 30 meters of channel, ranging in size from 50-100 mm TL (Michaels and Thomson 1968). The survey reported that the limiting factors to the fishery included low stream flows and development. In addition, the survey recommended that the creek be managed as a steelhead spawning and nursery stream (Michaels and Thomson 1968).

In September 1969, DFG estimated population densities and sizes of *O. mykiss*, and evaluated habitat in Corte Madera Creek and its tributaries. Electro   In February 1976, DFG visually surveyed Corte Madera Creek between the Lagunitas Road Bridge and the denil fishway to determine the extent of salmonid migration and spawning during a drought year. No salmonids were seen. However, the local game warden reported seeing several salmonids successfully negotiating the fishway below Lagunitas Road (Scoppettone 1976).

In September 1980, DFG visually surveyed Corte Madera Creek from the concrete-lined channel in Ross upstream to its confluence with San Anselmo Creek. Forty diversions were counted, all for private homes. A few YOY steelhead were observed, but their location was not specified (Eimoto and Walkup 1980). The survey report noted that the Corte Madera Creek drainage sustained a steelhead resource, although diversions along the creek were believed to have contributed to portions of the creek going dry that historically had perennial flow (Eimoto and Walkup 1980).

In September 1981, a pole-seine survey found two *O. mykiss* (58, 72 mm FL) downstream of Madrone Drive (Leidy 1984). Corte Madera Creek was surveyed by RWQCB in July 1992. Seine netting and visual observation identified 11 *O. mykiss*, all in deep shaded pools toward the lower end of the creek (Marshall et al. 1994).

In July 1993, Leidy electrofished Corte Madera Creek immediately upstream from the fish ladder opposite the post office in Ross. He caught one *O. mykiss* (110 mm FL). At the Sylvan Road crossing, opposite the Ross fire department, he caught four *O. mykiss* (75-107 mm) and observed an additional ten in the same size range. Leidy estimated density at 25 per 30 meters of stream. In August, Leidy also electrofished Corte Madera Creek at Creek Park downstream from the pedestrian bridge and also immediately downstream of Winship Road. He found no *O. mykiss* at these sites (Leidy 2002).

In August 1997, Leidy again electrofished Corte Madera Creek at a site opposite the Ross postal office. A 30-meter reach yielded four *O. mykiss* (62-300 mm) at an estimated density of five per 30 meters (Leidy 2002).

Friends of Corte Madera Creek funded an electrofishing survey of Corte Madera Creek that occurred in August 1999. A total of 15 *O. mykiss* (68-110 mm FL) were found at four of 11 sites totaling 164 meters of stream sampled (Rich 1999).

Larkspur Creek

Larkspur Creek is tributary to Cote Madera Creek, and drains the area between the towns of Kentfield and Greenbrae. It enters Corte Madera Creek from the north near the uppermost extent of that creek's tidal portion.

In September 1981, Larkspur Creek was sampled by dip net at the terminus of Water Way off Madrone Avenue. Two *O. mykiss* (51-121 mm FL) were collected (Leidy 1984).

Tamalpais Creek

Tamalpais Creek flows west to east along Woodland Road and joins Corte Madera Creek southeast of the College of Marin in Kentfield. Staff from DFG electrofished Tamalpais Creek in August 1969 upstream of the Evergreen Street Bridge. A total of 21 *O. mykiss* (60-90 mm) were collected in a 30-meter reach (Jones 1969). The DFG report stated the area extending from Ridge View Road downstream to a Corps flood control project as containing nursery habitat, and estimated the steelhead population in the stream to be 552 based on a density of 21 per 30 meters (Jones 1969).

In July 1998, Leidy sampled a 30-meter reach of Tamalpais Creek centered on the lowermost Woodland Road crossing. He collected two *O. mykiss* (65, 87 mm FL) (Leidy 2002). Steelhead YOY were found in Tamalpais Creek during observations in 2000 and in 2001 (Jones 2001). In April 2002, Leidy and Lewis observed a single juvenile *O. mykiss* (estimated 75-100 mm TL) off Woodland Road near Laurel Way (Leidy and Lewis 2002).

Murphy Creek

Murphy Creek joins Corte Madera Creek northwest of the College of Marin in Kentfield. In April 2002, Leidy observed Murphy Creek at three locations near Hillside Avenue, at Bridge Road, and at Redwood Road. No *O. mykiss* were found (Leidy and Lewis 2002).

Ross Creek

Ross Creek is formed by the confluence of Phoenix and Bill Williams Creeks on the northeastern slopes of Mt. Tamalpais and enters Corte Madera Creek in the town of Ross. Phoenix Reservoir is an impassable barrier to upstream fish migration.

In January 1960, DFG visually surveyed Ross Creek from its confluence with Corte Madera Creek upstream to Phoenix Reservoir. No fish were observed at the time of the survey. However, residents reported that steelhead runs still occurred in some years (Allen 1960c). The survey report noted that prior to the construction of Phoenix Reservoir, Ross Creek was an important spawning and nursery tributary of Corte Madera Creek. Since construction of the reservoir, the stream dried out below the reservoir by mid-summer (Allen 1960c).

In August 1969, DFG electrofished a 30 meter reach near Ross Creek Park. A total of 109 *O. mykiss* (36-76 mm) were collected, yielding a density estimate of 113 per 30 meters (Jones 1969). The DFG report stated that a steelhead nursery area was available downstream from Phoenix Lake Dam extending to near the Glenwood Road Bridge, and that almost 3,000 juvenile steelhead were estimated to inhabit this reach (Jones 1969).

In July 1997, Leidy electrofished a 12 meter reach downstream from the Phoenix Park parking lot and found seven *O. mykiss* (67-180 mm FL) (Leidy 2002). Friends of Corte Madera Creek funded an electrofishing survey of Ross Creek in November 1999. Seven *O. mykiss* (82-164 mm FL) were found at one of two sites totaling 19 meters of stream sampled (Rich 1999). Steelhead YOY were also observed in Ross Creek in 2000 (Jones 2001).

In April 2002, Leidy and Lewis observed *Oncorhynchus* spp. to be common (25-200 individuals) at the entrance to Natalie Coffin Greene Park (Leidy and Lewis 2002). Two size classes of juveniles were present (~10-15 mm TL and ~25-30 mm TL). The smaller size class was identified as *O. mykiss*.

Sleepy Hollow Creek

Sleepy Hollow Creek drains Sleepy Hollow along Butterfield Road and joins with San Anselmo Creek to form Corte Madera Creek in the town of San Anselmo. As noted in a 2002-2003 passage evaluation, a box culvert at Deer Hollow Road seriously impedes upstream migration (Ross Taylor and Assoc. 2003). Modifying the culvert and removing Raven Dam, located about one mile upstream, would increase access to suitable habitat upstream substantially (Ross Taylor and Assoc. 2003).

In January 1960, DFG visually surveyed Sleepy Hollow Creek from the mouth to the headwaters and found it to be an excellent steelhead spawning and nursery area (Allen 1960e). No fish were noted during the survey, and residents reported that no steelhead run occurred in the winter immediately prior to the survey (Allen 1960e). Typically, moderate use by steelhead for spawning and rearing was expected (Allen 1960e).

A September 1969 DFG memorandum reported 1.5 miles of juvenile *O. mykiss* rearing area in Sleepy Hollow Creek with a population density of 39 per 30 meters (Jones 1969). Juvenile steelhead were reported 100 yards immediately upstream from San Anselmo Creek and from Arroyo Road Bridge upstream to a point about 200 yards upstream from Butterfield Road bridge (Jones 1969). Electrofishing caught 36 *O. mykiss* (31: 50-110 mm; 5: 115-190 mm) in a 30-meter reach. The stream was estimated to contain over 3,000 *O. mykiss* (Jones 1969).

In September 1981, a pole-seine survey was conducted upstream of the Butterfield Drive bridge. Seven *O. mykiss* (58-97 mm FL) were collected (Leidy 1984).

In October and November 1999, Friends of Corte Madera Creek funded an electrofishing survey of Sleepy Hollow Creek. A total of 23 *O. mykiss* (65-308 mm FL) were found at 11 of 39 sites that represented 378 meters of stream sampled (Rich 1999). Steelhead YOY also were observed in Sleepy Hollow Creek in 2000 (Jones 2001).

San Anselmo Creek

San Anselmo Creek is fed by several tributaries near the town of Fairfax. It joins Sleepy Hollow Creek in the town of San Anselmo and forms Corte Madera Creek. The Saunders Avenue crossing was noted as a migration impediment of high priority for modification in a 2002-2003 fish passage evaluation (Ross Taylor and Assoc. 2003). Both an existing fish ladder and the concrete channel reach immediately downstream appear to impede migration.

Oncorhynchus mykiss were collected from San Anselmo Creek in the town of San Anselmo in 1936. At this location, the stream was described as well shaded with no period of excessive dryness (Fry 1936).

Staff from DFG surveyed San Anselmo Creek in January 1960 between the mouth and 0.25 miles above the Cascade Creek confluence. No fish were observed, but the survey report noted local residents' accounts that moderate steelhead runs occurred approximately every other year (Allen 1960d). At least 90 percent of the nursery area was reported to be located in the lower half of the stream (Allen 1960d).

San Anselmo Creek was electrofished by DFG in August 1969 at the Pastori Avenue Bridge. A total of 183 *O. mykiss* (175: 41-110 mm; 8: 115-140 mm) were collected in a 30-meter reach, resulting in a population density estimate of 219 per 30 meters (Jones 1969). Steelhead juveniles were said to inhabit the two miles of the creek between the confluence with Fairfax Creek and the Winship Avenue Bridge (on Corte Madera Creek just upstream from its confluence with Ross Creek). The steelhead population in San Anselmo Creek was estimated to be more than 23,000 individuals (Jones 1969).

In July 1997, Leidy electrofished a ten-meter reach of San Anselmo Creek at a diversion dam near the end of Pacheco Avenue. He found four *O. mykiss* ranging in size from 73-140 mm FL (Leidy 2002).

Friends of Corte Madera Creek funded an electrofishing survey of San Anselmo Creek that occurred in September and October 1999. A total of 97 *O. mykiss* (43-198 mm FL) were found at 12 of 24 sites that represented 216 meters of stream sampled. Sixty-seven of the *O. mykiss* were found in the headwaters at three sites (a combined 18.3 meters of sampled reach) above the confluence with Cascade Creek (Rich 1999). Five juvenile *O. mykiss* (75-90 mm FL) were observed in a shallow isolated pool just upstream from the bridge on Meadow Way in July 2003 (Harvey 2003).

Fairfax Creek

Fairfax Creek is a tributary to San Anselmo Creek that flows generally south to enter San Anselmo Creek in the town of Fairfax. It consists of about 2.5 miles of channel. A 2002-2003 fish passage assessment noted a 458-foot box culvert immediately upstream from the confluence with San Anselmo Creek at Bolinas Avenue. Although a serious impediment to fish passage, the culvert was listed as a lower priority modification project than others in the watershed due to high cost (Ross Taylor and Assoc. 2003).

In January 1960, DFG visually surveyed Fairfax Creek from the mouth to the headwaters. No fish were observed during the survey. The DFG report noted that the creek was a steelhead spawning and nursery tributary that had largely been destroyed by lowering of the water table through heavy groundwater pumping (Allen 1960b).

A 1969 DFG survey of steelhead in Corte Madera Creek and its tributaries concluded that the culvert at the mouth of Fairfax Creek was a passage barrier that precluded use by steelhead. No direct observations were made on the creek (Jones 1969).

In July 1997, Leidy electrofished a site immediately downstream of the Fairfax Park footbridge and found no *O. mykiss* (Leidy 2002). In 2002, Marin County staff noted *O. mykiss* in Fairfax Creek believed to be resident (L. Lewis pers. comm.).

Cascade Creek (Corte Madera Creek watershed)

Cascade Creek is the uppermost headwater tributary to San Anselmo Creek. It drains the south face of White Hill and enters San Anselmo Creek from the north. Cascade Falls is a natural barrier that limits use by steelhead to the lower 0.4 mile of Cascade Creek.

In September 1969, DFG visually estimated the density of *O. mykiss* in Cascade Creek at 98 per 30 meters (Jones 1969). Steelhead were said to occur from the Cascade Creek falls downstream to the confluence with San Anselmo Creek (Jones 1969). The estimated number of *O. mykiss* in Cascade Creek was almost 1,300 (Jones 1969).

Friends of Corte Madera Creek funded an electrofishing survey of Cascade Creek that occurred in September 1999. A total of 26 *O. mykiss* (39-152 mm FL) were found at the three sites sampled that represented a combined length of 19 meters (Rich 1999).

Assessment: The Corte Madera Creek watershed historically supported steelhead runs and continues to support *O. mykiss* populations in its main stem and in various tributaries. The most important Corte Madera Creek tributary in terms of salmonid production appears to be San Anselmo Creek. In 1960, DFG determined that San Anselmo Creek contained much of the spawning and rearing habitat in the Corte Madera Creek watershed (Allen 1960d). Abundance estimates reported by DFG in 1969 suggested that San Anselmo Creek supported about 75 percent of the juvenile *O. mykiss* believed to occur in the drainage (Jones 1969). Other tributaries with steelhead populations are Ross, Sleepy Hollow and Cascade Creeks.

Sampling within the last ten years consistently indicates multiple *O. mykiss* age classes in the Corte Madera Creek watershed, suggesting good natural propagation. This drainage appears to have considerable ecological importance to Marin County and to the San Francisco Estuary in general for its ability to contribute regionally to steelhead numbers. Efforts to improve fish passage in the Corte Madera Creek channel would allow in-migration to suitable spawning and rearing habitat in Corte Madera Creek tributaries.

Miller Creek Watershed

Miller Creek drains an area of 12 square miles with headwaters above the Gallinas Valley and proceeds through the town of Marinwood, entering San Pablo Bay at John F. McInnis County Park.

Miller Creek

In September 1981, four sites on Miller Creek were electrofished as part of a fish distribution study. At a site upstream from the junction of Lucas Valley Road and Sequeira Road, more than 50 *O. mykiss* (38-86 mm FL) were caught. Seven *O. mykiss* (48-162 mm FL) with silver coloration were found at Las Gallinas Avenue (Leidy 1984).

In July 1993, Leidy electrofished Miller Creek and found *O. mykiss* at four out of five locations (Leidy 2002). He found one *O. mykiss* (179 mm FL) in a pool upstream from Las Gallinas Avenue. Downstream of the Miller Creek Road crossing in Marinwood Park he caught three *O. mykiss* (126, 129, 150 mm) in a 16-meter reach and estimated density at five per 30 meters of stream. Upstream of the lowest Lucas Valley Road crossing, a 30-meter reach yielded four *O. mykiss* (63-254 mm). Downstream from the Upper Lucas Valley Road crossing, a 46-meter reach produced 13 *O. mykiss* (69-157 mm). Leidy found no *O. mykiss* when he electrofished immediately upstream from Hwy. 101 (Leidy 2002). At least four *O. mykiss* age classes were identified in Miller Creek.

In June 1997, Leidy again electrofished Miller Creek upstream from Highway 101. He found two *O. mykiss* (170, 225 mm FL), and estimated their population density at five per 30 meters (Leidy 2002). Leidy also caught 15 *O. mykiss* (50-80 mm) downstream from Mt. Shasta Drive, where he estimated density at 20 per 30 meters of stream. In October 2001, NMFS electrofished Miller Creek downstream of the Mt. Lassen Drive Bridge. A total of 87 *O. mykiss* were recorded with a size range of 55-201 mm FL (Fish et al. 2001).

Assessment: The Miller Creek drainage suffers from a shortage of survey information, although *O. mykiss* clearly inhabited the watershed historically and populations have been found in recent sampling. Multiple age classes occur in Miller Creek, and *O. mykiss* production from the system is likely to constitute a relatively small but important part of regional production. The habitat function of this creek system should be protected to ensure continued contribution to the regional fishery.

Pacheco Creek Watershed

Pacheco Creek originates on the eastern end of Big Rock Ridge and flows east to Highway 101, where it turns north, entering Novato Creek at Pacheco Pond in the town of Ignacio. The Pacheco Creek watershed is about 2.1 square miles.

Pacheco Creek

In September 1981, Miller Creek was electrofished as part of a fish distribution study at Alameda del Prado immediately upstream from Highway 101. No *O. mykiss* were found (Leidy 1984). According to Marin County PWA staff, salmonids presently do not use Pacheco Creek (L. Lewis pers. comm.).

Assessment: Pacheco Creek is not is not used presently by salmonids.

Arroyo San Jose Watershed

Arroyo San Jose is formed by two streams draining the northeastern slopes of Big Rock Ridge, south of the town of Navato. The arroyo's watershed is about 5.7 square miles. It enters a lagoon known as Bel Marin Keys in the town of Ignacio, which is connected to San Pablo Bay by the historic Novato Creek channel and a series of canals within Hamilton Airforce Base. A 2002-2003 fish passage evaluation noted two areas of concrete flood control channel and weirs, both near Ignacio Boulevard, as creating "impassable condition for all species and life stages" (Ross Taylor and Assoc. 2003).

Arroyo San Jose

In September 1981, two sites on Arroyo San Jose were electrofished as part of a fish distribution survey. Three *O. mykiss* (61, 149, 161 mm FL) were found at Enfrente Boulevard, while no fish of any kind were found at Indian Way. (Leidy 1984).

In June 1997, Leidy electrofished Arroyo San Jose opposite the Novato Business Park, at the end of Digital Drive. No *O. mykiss* were found. However, adult steelhead were observed in Arroyo San Jose in 2000 and 2001 (Jones 2001).

Assessment: This relatively small watershed has been found to support multiple age classes of *O. mykiss* in the past and recent observations of adult spawners suggest current use, although successful hatching and rearing of juveniles has not been verified. Further investigation is recommended to inform management of the drainage as salmonid spawning and rearing habitat.

Novato Creek Watershed

This is the northernmost Marin County watershed as well as the largest drainage in the county covering 44 square miles. Novato Creek drains into a lagoon known as Bel Marin Keys and then flows east to enter the Estuary immediately south of the Highway 37 bridge near Black Point.

Novato Creek

As part of a fish distribution study, Novato Creek was sampled by pole seine and dip net during September, 1981. No *O. mykiss* were found at the three locations sampled between 7th Street in downtown Novato and the Novato Reservoir spillway (Leidy 1984).

Leidy electrofished seven sites on Novato Creek in June 1997. He found one *O. mykiss* (195 mm FL) in a 15-meter reach downstream from Diablo Avenue (Leidy 2002). In a ten meter reach along Hicks Valley Road approximately one mile below Stafford Lake Dam, he caught two *O. mykiss* (90, 130 mm). Immediately upstream he found four *O. mykiss* (55-65 mm) in a 30-meter reach. No *O. mykiss* were found when electrofishing at a 15 meter reach at the upper end of tidal influence, at a 20 meter reach immediately below the water treatment plant discharge at Stafford Lake Dam, or at a 12 meter reach above Stafford Lake (Leidy 2002).

In July 1997, Leidy electrofished a 30 meter reach at Hicks Valley Road within Miwok Park and caught 12 *O. mykiss* (52-152 mm) (Leidy 2002). Adult steelhead were observed in Novato Creek in 2000 and 2001 (Jones 2001). In April 2002, Leidy and Lewis observed abundant (>200 individuals) *O. mykiss* juveniles (25-35 mm TL) in a reach extending from the confluence with Bowman Canyon Creek downstream 150 meters (Leidy and Lewis 2002).

Arroyo Avichi

Arroyo Avichi flows northeast off the north slope of Big Rock Ridge and covers 1.8 square miles. Arroyo Avichi was sampled by dipnet at South Novato Boulevard in September 1981 as part of a fish distribution survey. No fish of any kind were found (Leidy 1984).

Warner Creek

Warner Creek is formed by the confluence of Vineyard Creek and Wilson Creek in the town of Novato. It flows east approximately 1.5 miles parallel to Novato Creek before the two creeks merge. Warner Creek was sampled by dip net and pole seine at McClay Road and at Diablo Road as part of a September 1981 fish distribution survey. No *O. mykiss* were encountered at either location (Leidy 1984).

Vineyard Creek

Vineyard Creek drains an area of 1.7 square miles. The creek flows northeast off the northwestern end of Big Rock Ridge, joining with Wilson Creek to form Warner Creek in the city of Novato.

In April 2002, Leidy and Lewis observed abundant (>200 individuals) *O. mykiss* juveniles (20-30 mm TL) in a reach extending 100 meters upstream from Mill Road (Leidy and Lewis 2002). Leidy also observed *O. mykiss* juveniles (25-30 mm TL) to be common (25-200 individuals) downstream from the concrete apron at the intersection of Santa Maria Drive and Brooke Drive. No fish were observed upstream of this concrete apron/invert, suggesting that it posed a complete barrier to upstream movement of fish.

Bowman Canyon Creek

Bowman Canyon Creek flows south out of Bowman Canyon, joining Novato Creek west of the city of Novato. In September 1981, Bowman Canyon Creek was sampled upstream of Hicks Valley Road by dip-net as part of a fish distribution survey. Three *O. mykiss* (61, 82, 86 mm FL) were collected (Leidy 1984). Steelhead YOY were observed in Bownman Canyon Creek in 1998 (Jones 2001). In April 2002, Leidy and Lewis observed *O. mykiss* juveniles (20-30 mm TL) to be common (25-200 individuals) from Novato Boulevard downstream to the confluence with Novato Creek (Leidy and Lewis 2002).

Assessment: The Novato Creek watershed has not been sampled adequately, although it certainly supported, and continues to support, anadromous *O. mykiss* populations. Multiple *O. mykiss* age classes have been found during recent sampling, and the drainage appears to offer spawning and rearing habitat despite being the driest of the Marin County drainages.

Table VII-2. Distribution status of O. mykiss in San Francisco Estuary streams of Marin County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss Hist.	O. mykiss Current	Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
Coyote Creek	Coyote	1/0	0 **1981**	0, 1, 3	-	N	PB	NP	Y	0	15, 16 (1)
Arroyo Corte Madera del Presidio	Arroyo Corte Madera del Presidio	6/6	1946-97	1, 2, 3	J/6; R/2	Y	DF	DF	Y	1, 2, 3	6-8, 15, 16, 20, 22, 24
	Willow Reed	1/0	1870s-2004	1	J/1	Y	DF	DF	-	1,2,3	21 (2)
	Warner	3/1	1963 **2004**	1, 3	J/2	Y	DF	DF	Y	1, 2, 3	6, 17 (2)
	Old Mill	5/4	1946-97	1, 2, 3	J/5; R/2	Y	DF	DF	Y	1, 2, 3	6, 14-16, 20, 22, 25
	Cascade	5/1	1963-97	1, 2, 3	J/2	Y	DF	DF	Y	1, 2, 3	6, 15, 16, 20
Corte Madera Creek	Corte Madera	17/10	1960-99	0, 1, 2, 3	J/11; R/1	N	DF	DF	Y	1, 2, 3	1, 8, 9, 13, 15, 17-19, 20, 21, 23
	Larkspur	1/1	1981	3	J/1	UNK	DF	UNK	-	0	15
	Tamalpais	3/2	1969-2002	1, 2	J/3	N	DF	DF	Y	1, 2, 3	13, 14, 17
	Murphy	1/0	0 **2002**	1	-	N	UNK	UNK	-		17
	Ross	6/3	1960-2002	0, 1, 2	J/4; R/1	N	DF	DF	Y	1, 2, 3	3, 13, 14, 16, 17, 21
	Sleepy Hollow	4/3	1960-99	0, 2, 3	J/3; R/2	N	DF	DF	Y	1, 2, 3	5, 13-15, 16, 21

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	San Anselmo	5/4	1936-2003	1, 2	J/4; R/1	N	DF	DF	Y	1, 2, 3	4, 11-13, 16, 21
	Fairfax	3/0	1960 **2002**	1	J/1	N	DF	DF	Y	1, 2, 3	2, 13, 17 (2)
	Cascade	2/2	1969-99	1, 2	J/2	N	DF	DF	Y	1, 2, 3	4, 14, 21
Miller Creek	Miller	4/4	1981-2001	2	J/4; S/1; R/3	Y	DF	DF	Y	1, 2, 3,	10, 15, 16
Pacheco Creek	Pacheco	1/0	0 **1981**	2	-	N	PS	NP	-	0	15 (1)
Arroyo San Jose	Arroyo San Jose	3/2	1981-2001	2	J/1	Y	DF	DF	Y	1	14, 15
Novato Creek	Novato	3/1	1997-2002	2	J/2	Y	DF	DF	Y	1, 2, 3	14-17
	Arroyo Avichi	1/0	0 **1981**	3	-	UNK	UNK	UNK	-	0	15
	Warner	1/0	0 **1981**	3	-	UNK	UNK	UNK	-	0	15
	Vineyard	1/0	2002	1	J/1	Y	DF	DF	-	1, 2, 3	17
	Bowman Canyon	2/1	1981-2002	1, 2	J/2	Y	DF	DF	Y	1, 2, 3	14, 15, 17

[a] Table headings and codes are defined in the Methods section of this report.

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2. Lewis, L., interview with G. Becker, CEMAR, May 25, 2005, regarding *O. mykiss* distribution in Marin County streams.

MARIN COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Marin County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Marin County, Caliornia.

SONOMA COUNTY

Petaluma River Watershed

The Petaluma River watershed lies within portions of Marin and Sonoma Counties. The river flows in a northwesterly to southeasterly direction into San Pablo Bay.

Petaluma River

In a 1962 report, Skinner indicated that the Petaluma River was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In July 1968, DFG surveyed portions of the Petaluma River accessible by automobile from the upstream limit of tidal influence to the headwaters. No *O. mykiss* were observed (Thomson and Michaels 1968d).

Leidy electrofished upstream from the Corona Road crossing in July 1993. No salmonids were found (Leidy 2002).

San Antonio Creek

San Antonio Creek is a tributary of Petaluma River and drains an area of approximately 12 square miles. The channel is the border between Sonoma and Marin Counties.

In a 1962 report, Skinner indicated that San Antonio Creek was an historical migration route for steelhead (Skinner 1962).
In July 1968, DFG visually surveyed San Antonio Creek from the San Antonio Slough upstream to Chileno Valley Road. Fishery value was deemed poor due to intermittent summer flows, scarce spawning gravel and suspected dairy effluent. No *O. mykiss* were observed (Michaels and Thomson 1968).

In September 1981, Leidy electrofished three sites on San Antonio Creek between Highway 101 and Chileno Valley Road. No *O. mykiss* were found (Leidy 1984).

Adobe Creek (Casa Grande Creek)

Adobe Creek originates on the southwest face of Sonoma Mountain, flowing south and west to its confluence with the Petaluma River. A 1968 DFG visual survey of Adobe Creek found juvenile *O. mykiss* (50-150 mm) at an estimated density of 150 per 30 meters of stream. This survey also found two ten-foot diversion dams that were complete barriers to fish migration. Several impoundments were noted on tributary streams as well (Thomson and Michaels 1968a).

In 1987, students of Casa Grande High School rescued approximately 2,000 steelhead planted earlier that year from isolated pools in Adobe Creek (Furrer 2003).

Juvenile *O. mykiss* were rescued from Adobe Creek in June 1993 (Emig 1993). Beginning in 1993, the students of Casa Grande High School operated a hatchery that supplemented naturally occurring *O. mykiss* populations with steelhead derived from Feather River stocks (Furrer 2003).

In November 1997, Leidy electrofished Adobe Creek approximately 100 meters upstream from the footbridge in Rancho Adobe State Park and caught 17 *O. mykiss* (74-198 mm FL) (Leidy 2002).

Lynch Creek

Lynch Creek drains the west face of Sonoma Mountain, joining the Petaluma River in the city of Petaluma. In July 1968, DFG visually surveyed Lynch Creek by car with frequent stops for closer inspection. Although no fish were seen, the survey report cites residents' reports of a small run of steelhead in the stream. The surveyors recommended that the stream be managed as a steelhead spawning and nursery area (Thomson and Michaels 1968c).

Staff from DFG reports a sighting of an adult *O. mykiss* in Lynch Creek in summer 1998 (W. Cox pers. comm.). In May 2000 DFG noted 3 YOY during an informal survey of the creek (W. Cox pers. comm.).

Washington Creek

Washington Creek originates in the lower foothills north of the city of Petaluma and runs a short distance to the Petaluma River. In July 1968, DFG visually surveyed Washington Creek from the mouth up to a four-foot fall located approximately 200 feet upstream from Adobe Road. No fish were observed, and the channel was largely dry (Michaels and Thomson 1969). Staff from DFG reports that Washington Creek does not support an *O. mykiss* population currently (W. Cox pers. comm.).

Willow Brook

In July 1968, DFG visually surveyed Willow Brook Creek from the mouth to the headwaters. The channel was primarily dry with warm, intermittent pools that appeared to be drying completely. No *O. mykiss* were observed. Because of poor summer conditions, DFG considered Willow Brook to have no fishery value (Thomson and Michaels 1968e). Staff from DFG reports that Willow Brook may support an *O. mykiss* population in some years (W. Cox pers. comm.).

Lichau Creek

Lichau Creek flows west out of the Sonoma Mountains, then south past the town of Penngrove. In July 1968, DFG visually surveyed Lichau Creek from the mouth to the headwaters. Approximately ten juvenile *O. mykiss* (50-180 mm) were found in two small headwater pools (Thomson and Michaels 1968b). Although no barriers were observed in the main channel, dams were observed in some tributary streams. Staff from DFG reports that Lichau Creek may support an *O. mykiss* population in some years (W. Cox pers. comm.).

Assessment: The Petaluma River watershed historically supported steelhead runs, although the habitat available in the system is of substantially lesser importance than the Sonoma Creek system to the east. The river has been referred to by DFG staff as

"Petaluma Dead-End Slough" for the low habitat value of tributaries to the watershed upstream of the tidal portion (W. Cox pers. comm.).

Sonoma Creek Watershed

The Sonoma Creek watershed encompasses 170 square miles including the relatively narrow north-south trending Sonoma Valley. The creek enters the San Francisco Estuary at the northernmost part of San Pablo Bay. Major tributaries to the upper reaches of the creek include Calabazas, Stuart, Graham, Asbury and Bear Creeks.

Sonoma Creek

Staff from DFG conducted a visual stream survey of Sonoma Creek in August 1946 from the mouth to a natural falls in the headwaters, a distance of about 52 miles. Staff found both sea-run steelhead and resident *O. mykiss* in the system, noting natural propagation of *O. mykiss* as evidenced by the common presence of juvenile fish (65-100 mm TL) (Shapovalov and Bruer 1946). According to the survey report, steelhead ascend Sonoma Creek to at least one mile upstream of "U station" which is located about 0.6 miles upstream of Golden Bear Lodge.

According to a DFG summary report, 3,580 fingerling steelhead were rescued from Sonoma Creek in 1954 (Pintler 1956). Rescued fish apparently were moved to other areas within the Sonoma Creek watershed that had wetted stream channel throughout the dry season.

A visual stream survey of Sonoma Creek was conducted by DFG in February 1957. The survey report declared that the creek is utilized by steelhead as a spawning and nursery grounds and noted very good spawning areas throughout the Adobe Canyon and main branches down to Boyes Hot Springs and further downstream (Elwell 1957). Both flashboard dams and water diversions were said to occur along the length of the entire stream, but no permanent barriers. The surveyors said steelhead fingerlings (50-75 mm TL) were quite common along the entire stream length and recommended management as a steelhead spawning and nursery ground (Elwell 1957).

Sonoma Creek rescue efforts by DFG in 1958 produced 910 fingerling steelhead in 1958 (Allen 1958). During 1959, DFG rescued 2,507 fingerling steelhead from Sonoma Creek (Allen 1962). According to a DFG summary report, 44,544 fingerling steelhead were rescued from Sonoma Creek in 1961 (Rowell 1961). (As this figure represents an order-of-magnitude increase from other rescue totals, we consider it less reliable than previously reported numbers.) Rescued fish apparently were moved to other areas within the Sonoma Creek watershed that had wetted stream channel throughout the dry season.

In a 1962 report, Skinner indicated that Sonoma Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

Staff from DFG responded to a landowner inquiry regarding a fish kill at the confluence of Sonoma Creek and Calabazas Creek in May 1965. The subsequent report noted a count of 271 dead steelhead juveniles (64-196 mm TL) (Kastner 1965). A 1965 DFG letter report stated that Sonoma Creek is inaccessible to steelhead about 1.5 miles upstream of the confluence with Bear Creek due to a 12+ meter fall, and described resident *O. mykiss* existing upstream of the falls (Meyer 1965). In two 1965 letters, DFG staff state that Sonoma Creek and all of its tributaries support a "fair" run of steelhead trout, estimated at 500 individuals or more (Greenwald 1965). The letters also cite a limited summer fishery for young steelhead throughout the upper reaches of the stream.

A 1966 DFG report summarized steelhead resources in the Sonoma Creek watershed, citing the upper reaches of the watershed as having a substantial summer trout fishery for juvenile steelhead and resident trout (Rockwood 1966). The report describes good to excellent spawning gravels and some adequate nursery areas in the drainage. According to the report, the prime spawning areas for steelhead are upstream from Boyes Hot Springs, while the prime nursery areas are upstream from Glen Ellen (Rockwood 1966). The report estimated the size of the steelhead run in Sonoma Creek to be about 500 individuals annually with great variation (Rockwood 1966).

Surveys performed in July 1966 by DFG staff indicated that mainstem Sonoma Creek contained about 15 miles of cold water stream accessible to steelhead trout upstream of Glen Ellen and downstream of the natural falls (Rockwood 1966). *Oncorhynchus mykiss* densities within this reach were estimated to be 15-60 per 30 meters. The survey report recommends establishing minimum flows in Sonoma Creek of five cubic feet per second to enhance *O. mykiss* habitat.

In 1977, DFG published a natural resources assessment of the Napa Marsh in which they estimated an annual steelhead run of approximately 1,200 adult fish in Sonoma Creek (Michaels 1977). Mainstem Sonoma Creek was sampled for fish with seines and dip nets at two locations in September 1981. *Oncorhynchus mykiss* were collected at a site immediately downstream of the junction of Warm Springs Road and Highway 12 (17: 71-143 mm FL) and at a location just downstream of the entrance to Sugerloaf Ridge State Park (17: 40-85 mm FL) (Leidy 1984).

Leidy sampled Sonoma Creek at numerous locations in June, July and August of 1993. *Oncorhynchus mykiss* collection results during this effort are in Table VIII-1 below.

Table VIII-1. Sampling results, Sonoma Creek, June-August 1993

Location	*Oncorhynchus mykiss*		
	No.	**Size Range (mm)**	**Estimate Density (per 30 m)**
Near Madrone Rd. bridge	2	80-107	5
Near Agua Caliente Rd. bridge	3	115-130	5
Stable in Sugarloaf Ridge State Park	15	90-235	25
Upstream of falls, Sugarloaf State Park	12	51-230	--
Downstream of falls, Sugarloaf State Park	7	69-237	10
Hwy. 12 ~ 0.5 mi. downstream Watmaugh Rd. bridge	0	--	--
Riverfront Rd. at Walnut Ave.	1	180	--
Mouth of Second Napa Slough	0	--	--
Boyes Rd. crossing	1	70	5
Leveroni Blvd, bridge	2	92, 132	5
Sonoma St. Hospital	17	--	30
Hwy. 126 crossing	2	200, 226	5

(Source: Leidy 2002)

Leidy's sampling produced records of both anadromous and resident *O. mykiss* occurring in mainstem Sonoma Creek with multiple age classes represented. The Sugarloaf Ridge State Park was found to contain excellent rearing habitat and fish in good condition. The Sonoma State Hospital site also had excellent spawning and rearing habitat for *O. mykiss* (Leidy 2002).

The Southern Sonoma County Resource Conservation District published the Sonoma Creek Habitat Inventory in December 1996. The report included the results of electofishing surveys performed in 1995 and 1996 on upper Sonoma Creek. The fish sampling found steelhead at five sites on mainstem Sonoma Creek as presented in Table VIII-2.

Table VIII-2. Electrofishing results, Sonoma Creek, 1995-96

Location	*Oncorhynchus mykiss* Age Class (years)	No.
Arnold Dr. bridge, Glen Ellen	--	6
Graham Creek confluence	YOY	4
	1+	7
1 mi. upstream Warm Springs/Bennet Valley Rds.	--	10
0.25 mi. upstream Lawndale Ave. bridge	YOY	22
	1+	2
	2+	1
Bear Creek confluence	YOY	71
	1+	4
	2+	1

(Source: SSCRCD 1996)

A summary statement issued with the report of electrofishing results characterized Sonoma Creek at the entrance to Sugerloaf Ridge State Park as being in the "trout zone" (after Moyle 1976), with conditions transitioning to warmer water and lower gradient downstream (SSCRCD 1996). The report further recommended management of Sonoma Creek as an anadromous, natural production stream.

Electrofishing was performed in October 2002 in various Sonoma Creek reaches. Data from sampling in four reaches indicate that multiple *O. mykiss* age classes are present in the creek (52-152 mm FL) (SEC 2002).

Fowler Creek

Fowler Creek is formed by the joining of Carriger and Felder Creeks. From this confluence, the creek runs in a southeasterly direction about two miles to Sonoma Creek. Some investigators appear to have referred to Carriger Creek as Fowler Creek and to Fowler Creek as Carriger Creek.

During the summer of 1986 approximately 275 *O. mykiss* fry and 5 1+ and 2+ fish were transferred by citizens from a desiccating pool on lower Fowler Creek off Fowler Creek Road to an unknown location on Fowler Creek near the lowermost crossing of Grover Street in the George Ranch area (Friends of Sonoma Creek 1987).

Rodgers Creek

The headwaters of Rodgers Creek begin on the southwest slopes of the Sonoma Mountains and drain in a southeasterly direction for a distance of 6.5 miles before joining Fowler Creek approximately 0.75 miles its confluence with Sonoma Creek. Together, Rodgers and Fowler Creeks form the longest tributary to Sonoma Creek. The drainage basin is approximately 6.2 square miles.

In 1958, DFG visually surveyed Rodgers Creek at the intersection of Arnold Road and Stage Gulch Road. No salmonids were observed (CDFG 1958). A visual stream survey of several reaches of Rodgers Creek in 1965 noted large numbers of juvenile *O. mykiss* present upstream of the "dairy" upstream from the Temelec, Inc. development (Meyer 1965). In a 1965 letter, the DFG noted that Rodgers Creek contained a small population of YOY steelhead limited by low summer flows (Greenwald 1965).

A visual stream survey of the Rodgers Creek watershed conducted by DFG in 1966 estimated YOY *O. mykiss* density at 10-20 fish per 30 meters in a reach downstream of a flashboard dam located approximately three miles upstream from the Sonoma Creek confluence (Rockwood 1966). Apparently the flashboard dam acted as an almost complete barrier to the upstream movement of fish. In the area 1-2.5 miles upstream from the Fowler Creek confluence, no salmonids were observed. Upstream of the flashboard dam, *O. mykiss* (100-250 mm) density was estimated at 1-2 fish per pool. Some "fair" spawning habitat was identified, while nursery habitat was "adequate" upstream of the lowermost 3.5 miles of stream. Overall, the survey noted that removal of the flash board dam could provide good spawning and nursery areas to anadromous fish (Rockwood 1966).

A 1966 DFG memorandum rated Rodgers Creek as a "fair" steelhead stream, with "good" to "excellent" nursery habitat from a point 1.6 miles upstream from the mouth to the headwaters (Evans 1966). The memorandum states that at a point approximately 1.9 miles upstream from where Rodgers Creek joins Fowler Creek, there is "excellent" nursery habitat with *O. mykiss* YOY estimated at a density of 10-20 per 30 meters (Evans 1966).

In 1975, DFG conducted a visual stream survey along a four-mile reach of Rodgers Creek from approximately 2.2 miles downstream from the headwaters to just upstream of the confluence with Fowler Creek. The upstream reach contained *O. mykiss* (51-178 mm TL) at an estimated density of 25-50 per 30 meters (Coleman and Van Zandt 1975). Fifty percent of this reach was said to be suitable for spawning *O. mykiss*, while the lower portion of the creek contained very little spawning habitat (Coleman and Van Zandt 1975). The survey report recommended management as a spawning and nursery area for steelhead.

As part of a fish distribution survey, a 20-meter reach of Rodgers Creek at the West Watmaugh Road crossing was sampled in September 1981. No fish were recorded (Leidy 1984). The stream channel was noted as extensively trampled by cattle and upstream diversions appeared to have caused dewatering of portions of the stream. Staff from the Sonoma Ecology Center noted juvenile *O. mykiss* in Rodgers Creek in spring 2004 (W. Pier pers. comm.).

Felder Creek

Felder Creek and Carriger Creek join to form Fowler Creek. Interviews with local landowners have established the historical use of Felder Creek by *O. mykiss* (W. Pier pers. comm.).

As part of a fish distribution survey, a 20-meter reach of Felder Creek approximately 0.2 miles downstream from the paved end of Felder Road was sampled in September 1981. No salmonids were recorded (Leidy 1984). Staff from the Sonoma Ecology Center noted juvenile *O. mykiss* in Felder Creek in spring 2004 (W. Pier pers. comm.).

Carriger Creek

The headwaters of Carriger Creek consist of three intermittent streams draining the Sonoma Mountains. The creek flows in a southeasterly direction for a distance of eight miles before joining Felder Creek. The junction of Carriger and Felder Creeks forms

Fowler Creek, which runs another two miles to its confluence with Sonoma Creek. The drainage basin is approximately 10.5 square miles.

In a 1953 DFG fish rescue, 4,679 fingerling steelhead were moved from Carriger Creek (Pintler 1954). According to a DFG summary report, 7,060 fingerling steelhead were rescued from Carriger Creek in 1954 (Pintler 1956). Rescued fish apparently were moved to other areas within the Sonoma Creek watershed that had wetted stream channel throughout the dry season. Fish rescues conducted by DFG in1958 included 1,131 juvenile steelhead (Allen 1958). In 1961, 4,641 fingerlings were rescued (Rowell 1961).

In a 1962 report, Skinner indicated that Carriger Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

A visual stream survey of several reaches of Carriger Creek in 1965 noted juvenile *O. mykiss* under the first downstream Grove Street crossing, as well an abundant juvenile population within a small, unnamed tributary entering Carriger Creek from a southwesterly direction just downstream of the bridge (Meyer 1965). In a 1965 letter, DFG called YOY steelhead in the creek "abundant" (Greenwald 1965).

A visual stream survey of the Carriger Creek watershed conducted by DFG in July 1966 estimated YOY *O. mykiss* at a density of 20-40 per 30 meters within a reach approximately 5.5-8.5 miles upstream from Sonoma Creek (Rockwood 1966). Unpublished files from DFG indicate that a barrier was constructed on Carriger Creek in the spring of 1966 that prevented fish migration upstream. Staff from DFG recommended addition of a fishway to allow passage. During a site visit in April 1966, DFG noted numerous young steelhead upstream of and downstream of the dam located just upstream of the lowermost Grove Street crossing (Jones 1966). Two dead *O. mykiss* estimated at 150-200 mm TL had been reported between rocks on the lower side of the dam.

Carriger Creek was visually surveyed by DFG from its headwaters to the confluence with Felder Creek in March 1976. *Oncorhynchus mykiss* (25-127 mm TL) were observed in the headwaters section at a density of 10-15 fish per 30 meters, and some spawning and nursery habitat were rated "excellent" (Steitz and Johnson 1976). The middle section also had "excellent" spawning and rearing habitat, with *O. mykiss* (51-178 mm TL) at 15-40 fish per 30 meters (Steitz and Johnson 1976). A dead adult steelhead (559 mm FL) was found at the downstream terminus of the channel culvert at the Grover Road crossing (Steitz and Johnson 1976). At the confluence of Felder Creek, 5-15 *O. mykiss* (51-203 mm) were seen per 30 meters, and spawning and nursery habitat were "limited" (Steitz and Johnson 1976). The Carriger Creek survey report recommended management as a steelhead spawning and nursery area (Steitz and Johnson 1976).

A fish distribution survey was conducted in September 1981 along a 10-meter reach of Carriger Creek, approximately 0.5 miles south from the Canyon Road crossing. Three *O. mykiss* (58-149 mm FL) were collected, and *O. mykiss* juvenile density was estimated at 10 per 30 meters (Leidy 1984).

Leidy sampled a 30-meter reach of Carriger Creek in December 1997 upstream from the O'Brien Road Bridge. He collected four steelhead between 46-238 mm FL, all in excellent condition (Leidy 2002). Leidy noted that Carriger Creek at this location contained good spawning and excellent rearing habitat for steelhead. A minimum of three steelhead year classes were seen during the sampling event (Leidy 2002).

Dowdall Creek

Dowdall Creek is an intermittent stream that flows in a southeasterly direction from the Sonoma Mountains for a distance approximately four miles to where it joins Sonoma Creek. The drainage basin is approximately 1.5 square miles.

During a stream survey conducted in 1977, DFG did not observe any fish (Rowser and Fong 1977). However, the survey report noted that a local resident observed an unknown number of steelhead in the creek under Riverside Road prior to the construction of a diversion to Dowdall Creek. Apparently, the diversion acts to bypass stream flows away from the lower mile of Dowdall Creek. The report rated Dowdall Creek as having little value as nursery or spawning habitat for fish due to the poor condition of potential spawning areas and barriers to upstream fish migration from vegetation growth in the lower two miles of streambed (Rowser and Fong 1977).

Agua Caliente Creek

The headwaters of Agua Caliente Creek begin as several tributaries on the southwest slopes of Bismark Knob and Hogback Mountain, and combine to flow in a west to southwest direction approximately 5.6 miles to the confluence with Sonoma Creek. The creek drains approximately ten square miles.

Between 1953 and 1961, DFG, State Hatchery and Wildlife Protection personnel rescued fish in drying portions of Agua Caliente Creek. The rescue data is summarized in Table VIII-3.

Table VIII-3. Fish rescued from Agua Caliente Creek, 1953-1961

Year	Total fish rescued	Size range
1953	3,206	1-2.5
1954	16,835	1.5
1961	4,600	-

(Source: Pintler 1954; Pintler 1956; Rowell 1961)

A visual survey of several reaches of Agua Caliente Creek in July 1965 noted steelhead in scattered pools at the end of Lomita Avenue off Arnold Drive (Meyer 1965). A visual survey also was conducted in August 1965 covering 7.5 miles from the Sonoma Creek confluence to the headwaters (Fox 1965). The survey report described juvenile steelhead (20-80 mm TL) density of about 25 per 30 meters, with individuals in “good condition.” The survey report called Agua Caliente Creek a good spawning and rearing stream and recommended management to support steelhead habitat (Fox 1965).

In a 1965 letter, DFG noted that Agua Caliente Creek contained salmonid nursery habitat and supported a small population of YOY steelhead (Greenwald 1965). A visual stream survey of the Agua Caliente Creek watershed conducted by DFG in 1966 estimated YOY *O. mykiss* at densities of greater than 50 fish per 30 meters along 1.5 miles (Rockwood 1966). Other reaches had densities ranging from 1 per 30 meters to 1 fish per 90 meters (Rockwood 1966). Overall, the survey concluded that Agua Caliente Creek was of little importance to anadromous fishes due mainly to poor spawning and rearing habitat availability (Rockwood 1966).

According to data complied by the Sonoma Ecology Center, *O. mykiss* were observed in Agua Caliente Creek in August and September 2001 (SEC 2003). Both YOY and age 1+ fish were noted.

Hooker Creek

The headwaters of Hooker Creek consist of two small perennial to intermittent, south to southwest flowing tributaries that join to flow west to the confluence with Sonoma Creek. Hooker Creek is over five miles in length and drains approximately 4.6 square miles, including the Wilson Creek watershed.

About two miles of Hooker Creek was visually surveyed by DFG in June 1966. No fish were observed, and the survey report stated that the creek lacked importance as a nursery area for anadromous fish (Rockwood 1966).

In 1977, DFG conducted a visual stream survey of Hooker Creek from its confluence with Sonoma Creek upstream a distance of five miles. According to the survey report, residents adjacent to Hooker Creek reported that trout had existed in the creek in the past but had not been seen within the previous two years. The report noted that the creek was probably a "fair" steelhead stream at one time (Spingla and Webb 1977a).

According to data complied by the Sonoma Ecology Center, *O. mykiss* were observed in Hooker Creek in May, June and July 2002 (SEC 2003). Both YOY and age 1+ fish were noted.

Wilson Creek

Wilson Creek is a tributary to Hooker Creek draining primarily grape fields and numerous smaller tributaries, including Butler and Withman Creeks, originating in local canyons.

In April 1977, DFG visually surveyed Wilson creek from the mouth to the headwaters. Because of unusually low rainfall, flow was isolated to the headwaters with intermittent pools between the mouth and Madrone Road. No fish were found, but DFG staff speculated that Wilson Creek might have served as steelhead rearing habitat in years with normal flows (Spingla and Webb 1977b). Staff from the Sonoma Ecology Center also expect that Wilson Creek supported *O. mykiss* historically (W. Pier pers. comm.).

Mill Creek

Mill Creek flows east out of the Sonoma Mountains from west of the town of Elridge. It joins Sonoma Creek in the vicinity of the Sonoma State Hospital.

Leidy sampled Mill Creek in December 1997. A 30-meter reach approximately 100 feet downstream of the road crossing at Sonoma State Hospital had seven *O. mykiss* (55-145 mm FL) (Leidy 2002).

According to data complied by the Sonoma Ecology Center, *O. mykiss* were observed in Mill Creek in June 2001 (SEC 2003). Both YOY and age 1+ fish were noted.

Asbury Creek

Asbury Creek is a perennial stream that begins on the north slopes of Sonoma Mountain and flows northeasterly for a distance of approximately 2.5 miles to its confluence with Sonoma Creek. The drainage basin of Asbury Creek and its tributaries is approximately five square miles.

A visual stream survey by DFG in July 1966 estimated YOY steelhead density at 1-5 fish per 30 meters in the lower 1.5 miles of stream and noted that local residents had observed small numbers of steelhead migrating to spawn during the two to three years prior to 1966 (Rockwood 1966). However, the report rated Asbury Creek of minor importance to steelhead due to relatively poor spawning and rearing habitat quality (Rockwood 1966).

A 1996 survey noted a 25 meter concrete flume located immediately upstream of the Sonoma Creek confluence as a potential barrier to fish passage during high stream flows (SSCRCD 1996). Researchers cited long-time residents who indicated that Asbury Creek was a productive steelhead stream at one time and associated steelhead population declines with installation of the culvert. A diversion pipe about two miles upstream also was termed a barrier to anadromous fish. Between the confluence and the diversion pipe, six steelhead (1 age 0+; 5 age 1+) were seen by the survey team (SSCRCD 1996). Surveyors characterized rearing habitat in the lower reaches of Asbury Creek as “limited,” with spawning habitat “impacted by fine sediment.” Upper reaches were said to comprise good spawning habitat, with spring-fed flows in the headwaters providing cool summer water temperatures (SSCRCD 1996).

Calabazas Creek

The headwaters of Calabazas Creek begin as several perennial drainages that join and run in a west-southwest direction through Nunns Canyon 5.2 miles to the confluence with Sonoma Creek. A natural barrier to anadromous fish passage exists approximately 1.5 miles upstream of the confluence. The drainage basin is approximately 7.7 square miles.

Calabazas Creek was surveyed by DFG from the mouth upstream approximately three miles to the headwaters in January 1961. Staff from DFG seined nine *O. mykiss* (76-178 mm TL)(Day 1961). Spawning areas for *O. mykiss* were observed to be suitable throughout the entire stream, with the most suitable spawning habitat located from Dunbar Road upstream for a distance of 1.5 miles. The survey concluded that Calabazas Creek is a “fairly good” spawning stream for steelhead in the lower and middle reaches and recommended that Calabazas Creek continue to be managed as a steelhead spawning and nursery area (Day 1961).

In a 1962 report, Skinner indicated that Calabazas Creek was an historical migration route for steelhead (Skinner 1962). A visual stream survey of the Calabazas Creek watershed was conducted by DFG in 1966. Staff estimated YOY *O. mykiss* at a density of 5-40 fish per 30 meters within a 3.5-mile reach upstream from the mouth to a series of impassable falls (Rockwood 1966). Some “excellent” spawning habitat was found, and the creek was called one of the better steelhead spawning and nursery tributaries to Sonoma Creek (Rockwood 1966).

Staff from DFG conducted a visual survey of Calabazas Creek in June 1974. While sampling locations are not provided in the survey record, the report concludes that Calabazas Creek is one of the more important steelhead spawning and rearing areas within the Sonoma Creek watershed (Jones 1974). The report noted that a “good” population of juvenile steelhead was present.

In September 1975, DFG performed visual surveys of Calabazas Creek along a five-mile reach from the mouth to the headwaters. Density of *O. mykiss* in the middle section was estimated to be 100 fish per 30 meters (Tyler and Coleman 1975). The survey report noted that Calabazas Creek provided good steelhead spawning and nursery area, but that steelhead were limited to the lower and middle areas by barriers and warm stream temperatures. The report recommended that Calabazas Creek be maintained as a steelhead spawning and nursery stream (Tyler and Coleman 1975).

Leidy sampled Calabazas Creek in June 1993. The sampling occurred at two reaches, one upstream and one downstream from the Atwood Ranch pump house. He collected 32 *O. mykiss* between 34-155 mm FL, all in excellent condition. Leidy visually estimated juvenile *O. mykiss* density to be 20 fish per 30 meters in a 200-meter reach upstream from the pump house (Leidy 2002). This reach of Calabazas Creek was said to contain high quality spawning and rearing habitat. At a 30-meter reach upstream from the Highway 129 bridge, four *O. mykiss* (54-72 mm FL) were collected (Leidy 2002).

In September1993Leidy sampled three additional reaches in the headwater and middle sections of the Calabazas Creek watershed. The uppermost sampling site was located approximately 1.5 miles upstream from an impassable bedrock falls. No fish were collected at this site (Leidy 2002). The second site was a large pool at the base of the falls approximately 1.5 miles upstream from the mouth, where Leidy collected juvenile and adult *O. mykiss* (17: 68-217 mm FL). At a site approximately 0.4 miles downstream from the bedrock falls, Leidy found *O. mykiss* (25: 39-185 mm FL) and estimated density of juveniles at 15 fish per 30 meters (Leidy 2002). Overall, Calabazas Creek was found to contain good spawning and excellent rearing habitat for *O. mykiss*, and at least four-year classes were noted (Leidy 2002).

Calabazas Creek was electrofished between the confluence with Sonoma Creek and a point 3.5 miles upstream in July of 1996. The survey team found five juvenile steelhead (3 age 0+; 1 age 1+; 1 age 2+) in a 183-meter reach downstream from the confluence of Stuart Creek. A second reach was electrofished downstream from Dunbar Road, resulting in a sample of 30 juvenile steelhead (27 age 0+; 3 age 1+). The survey report also notes visual observations of several steelhead trout on the Atwood Ranch in April 1996 and sightings of three age classes consistently throughout the creek (SSCRCD 1996).

Upstream portions of Calabazas Creek were characterized as being likely trout habitat and portions nearer the Sonoma Creek confluence as more characteristic of the “roach zone” (after Moyle 1976). A series of bedrock falls 3.5 miles from the confluence with Sonoma Creek were deemed barriers to migrating fish, and no fish were observed at locations upstream. The survey report concluded that Calabazas Creek contained “fair to good” salmonid habitat and recommended management as a steelhead stream (SSCRCD 1996).

Leidy again surveyed Calabazas Creek in July 1997. He collected seven *O. mykiss* (62-216 mm FL) in a 30-meter reach near Atwood Ranch (Leidy 2002). Electrofishing was performed in October 2002 in various Calabazas Creek. Juvenile *O. mykiss* (52-75 mm FL) were noted in the creek, indicating reproduction (SEC 2002).

Stuart Creek

Stuart Creek originates as several small drainages near the northwest slopes of Mt. Veeder and flows in a southwest to westerly direction approximately five miles to its confluence with Calabazas Creek. The Stuart Creek watershed is approximately five square miles.

A visual stream survey of the Stuart Creek watershed conducted by DFG in June 1966 estimated YOY *O. mykiss* density at 10-30 per 30 meters within a 2.2-mile reach from the mouth upstream to a series of impassable falls (Rockwood 1966). A pool downstream of a flashboard dam 1.2 miles from the confluence with Calabazas Creek had at least two-year classes of *O. mykiss* (20-30 YOY; 15: 100-150 mm TL).

A visual stream survey of Stuart Creek was conducted by DFG in October 1975 from its confluence with Calabazas Creek upstream a distance of 3.1 miles. A natural falls was noted about 1.9 miles upstream of the confluence, apparently serving as a passage barrier for anadromous fish. *Oncorhynchus mykiss* (50-254 mm TL) were observed upstream of the falls at a density of approximately 10 per 30 meters of stream. These fish were believed to be resident *O. mykiss* derived from 1930s stocking efforts (Holstine et al. 1975). Downstream of the falls, *O. mykiss* (102-152 mm TL) were observed at a density of 1 per 30 meters of stream (Holstine et al. 1975). The report concluded that Stuart Creek was a poor steelhead spawning stream, but contained "fair" nursery habitat (Holstine et al. 1975).

According to data complied by the Sonoma Ecology Center, *O. mykiss* were observed in Stuart Creek in June 1995 (SEC 2003). Both YOY and age 1+ fish were noted.

Visual surveys were conducted on Stuart Creek in July 1996, and the condition of anadromous fish habitat was assessed. The surveys were conducted between the confluence with Sonoma Creek and the waterfall 1.9 miles upstream. The lower portions of the creek from the confluence with Calabazas Creek to approximately 1.5 miles upstream contained salmonids (age 0+ and 1+) in low numbers, while upstream reaches were observed to have "good" numbers in each of three age classes (0+, 1+, 2+) (SSCRCD 1996). In general, lower portions of Stuart Creek were considered to have "poor" or "marginal" salmonid habitat due to channel dewatering, with upper reaches in good condition and containing some of the best habitat in the Sonoma Creek watershed (SSCRCD 1996).

Trinity Creek

Trinity Creek enters Calabazas Creek from the east upstream of Stuart Creek. Staff from the Sonoma Ecology Center believe that Trinity Creek likely supported *O. mykiss* historically. In a 2004 fish passage survey, staff noted *O. mykiss* in this creek (W. Pier pers. comm.).

Redwood Creek

Redwood Creek enters Calabazas Creek from the east upstream of Trinity Creek. Staff from the Sonoma Ecology Center have evidence that Trinity Creek supported *O. mykiss* historically. In a 2002 survey, staff noted *O. mykiss* in this creek (W. Pier pers. comm.).

Graham Creek

The headwaters of this perennial stream consist of three small drainages that originate on the northern slopes of Sonoma Mountain in Jack London State Park. These tributaries join to flow northeast approximately 1.9 miles to the confluence with Sonoma Creek near the intersection of Warm Springs Road and Sonoma Mountain Road. The drainage basin is approximately two square miles.

A 1946 visual stream survey by DFG noted that steelhead migrated upstream to a concrete diversion dam approximately 0.7 miles upstream from the confluence with Sonoma Creek (Curtis 1946). The DFG report characterized the portion of Graham Creek immediately upstream from Sonoma Creek as having “a few” salmonid spawning areas.

A visual stream survey by DFG in December 1959 reported only the lower 0.2 miles of Graham Creek as available to spawning steelhead due to complete barriers formed on the stream by water users (Day 1959). The biologist’s assessment of the stream was that it would contribute considerably to the steelhead runs of Sonoma Creek if migration barriers were removed (Day 1959). At the time of the survey, only small numbers of resident *O. mykiss* (50-200 mm TL) were seen in the creek. Staff from DFG estimated that steelhead would be able to use 2.5 miles of Graham Creek upstream of the mouth with barrier removal.

During another visual stream survey by DFG in February 1960, staff observed a spawning pair of steelhead in a riffle approximately 100 feet downstream from the Glen Ellen Water Company Dam (Day 1960). In April of 1960, DFG observed juvenile steelhead in “fair” numbers (38-50 mm TL) at various points from Warm Springs Creek Road upstream to the Glen Ellen Water Company dam (Day 1960).

A visual stream survey of the Graham Creek watershed conducted by DFG in July 1966 estimated YOY *O. mykiss* density to be 5-10 per 30 meters (Rockwood 1966). Habitat was deemed only “fair” for spawning and “adequate” for rearing. However, the survey noted that Graham Creek had the potential to be a good spawning and nursery area for anadromous fish with the removal of two barriers that blocked access to an additional one mile of stream. Resident trout were observed upstream of the barriers (100-200 mm TL) (Rockwood 1966).

In 1976, DFG conducted a visual stream survey of Graham Creek from the confluence with Sonoma Creek upstream a distance of approximately 2.5 miles. Juvenile steelhead (to 127 mm TL) were recorded at a density of 50 per 30 meters between the mouth and a 2.5-meter concrete dam (Pinkham 1976b). Upstream of the dam, few fish were observed, mostly YOY and some larger *O. mykiss* (to 200 mm TL). *Oncorhynchus mykiss* were present from this lowermost dam upstream to a 12-foot bedrock fall located about 2.5 miles upstream from Sonoma Creek. Spawning habitat for salmonids was rated as “fair” to “good” throughout the middle stream reaches and nursery habitat as “excellent” (Pinkham 1976b). The survey report recommended management as a steelhead spawning and nursery stream.

A 15-meter reach of Graham Creek approximately 0.5 miles upstream from the Warm Springs Road crossing was sampled as part of a fish distribution study in September 1981. Three *O. mykiss* were collected (59-132 mm FL), and the density of *O. mykiss* juveniles was visually estimated at 10 per 30 meters (Leidy 1984).

Leidy surveyed a 60-meter reach of Graham Creek upstream of Jack London State Park in October 1994. He collected 17 resident *O. mykiss* (47-190 mm FL).

Staff from DFG electrofished Graham Creek in the summer of 1996, finding steelhead at two locations: one just upstream from the confluence with Sonoma Creek and one in Jack London State Park. The first site yielded 30 juveniles (26 age 0+; 2 age 1+; 2 age 2+) in a 30-meter reach, while the second had 36 juveniles (18 age 0+; 15 age 1+; 3 age 2+) in a 60-meter reach. No salmonids were observed upstream of where a 14-foot log and debris/rock falls appeared to impede further passage. The report characterized Graham Creek as completely within the “trout” zone (after Moyle 1976) but found mostly “fair to poor” salmonid habitat due to a lack of suitable pools, shelter and depth needed for rearing, as well as spawning habitat impacted by fine sediment. However, the report recommended management as an anadromous, natural production stream (SSCRCD 1996).

Electrofishing was performed in October 2002 in Graham Creek. Data from sampling indicate that multiple *O. mykiss* age classes (46-165 mm FL) are present in the creek (SEC 2002).

Yulupa Creek

Yulupa Creek is a small, perennial stream that runs from the Sonoma Mountains in an easterly direction to its confluence with Sonoma Creek about 2.5 miles south of Kenwood. The Yulupa Creek watershed is approximately five square miles. The creek has two principal forks, with the south fork consisting of about 2.8 miles of channel and the north fork and its intermittent tributaries accounting for another 4.3 miles of stream.

A visual stream survey of the Yulupa Creek watershed was conducted by DFG in 1966. The density of YOY *O. mykiss* was estimated at 5-10 per 30 meters (Rockwood 1966). Some spawning habitat was called "fair," while nursery habitat was mostly "unsuitable" or "adequate." The survey report noted that each year local residents observed very few adult steelhead and that a flash board dam on the south fork was a barrier to upstream migration except during high stream flows.

Another visual stream survey of the Yulupa Creek watershed conducted by DFG in 1976 noted steelhead ranging in length from 10-28 mm TL. Fish were seen on the south fork downstream of a flash board near the confluence of the two forks as well as on the north fork about 650 feet upstream from this confluence (Pinkham 1976d). Steelhead density was visually estimated to be 10 per 30 meters. The survey report also indicated that resident *O. mykiss* were observed upstream of an earthen road crossing on the north fork. The report noted that the south fork of Yulupa Creek contained potentially "good" steelhead spawning and rearing habitat, but that barriers such as dams and low stream flows limited utilization of these habitats (Pinkham 1976d).
A 20 meter reach of Yulupa Creek approximately 400 meters upstream from the Warm Springs Road crossing was sampled as part of a fish distribution survey in September 1981. Three *O. mykiss* (72-173 mm FL) were collected (Leidy 1984). During the summer of 1986, approximately 125 *O. mykiss* fry were transferred by local citizens from a desiccating pool on the upper south fork of Yulupa Creek near Kieser Ranch Road to two unknown downstream locations with perennial flow (Coleman and Sanchietti 1987).

Kunde Creek

Kunde Creek enters Sonoma Creek from the east upstream of Yulupa Creek. Staff from the Sonoma Ecology Center believe that Kunde Creek likely supported *O. mykiss* historically. In a 2004 survey, staff noted *O. mykiss* in this creek (W. Pier pers. comm.).

Fisher Creek

Fisher Creek enters Sonoma Creek from the east upstream of Kunde Creek. Staff from the Sonoma Ecology Center believe that Fisher Creek likely supported *O. mykiss* historically. In a 2004 survey, staff noted *O. mykiss* in this creek (W. Pier pers. comm.).

Unnamed Tributary to Sonoma Creek near Kenwood

This small, intermittent stream drains about two square miles of the southwest slopes of Mt. Hood in Sonoma County. The tributary intersects Lawndale Road, Highway 12 and Pythian Road near Kenwood. A smaller tributary running easterly from the Sonoma Mountains joins the creek approximately 0.6 miles upstream from its confluence with Sonoma Creek. The headwater reach consists of two forks constituting approximately 1.5 miles of channel length.

Staff from DFG did not observe any fish during a stream survey conducted in May 1977 (Webb and Boccone 1977). However, the survey noted that local residents had observed over a 30-year period adult steelhead migrating through, and spawning within, a two-mile stream reach beginning at the confluence of Sonoma Creek and continuing a distance of about one mile upstream from the Highway 12 crossing. Upstream from this point, a series of cascades and waterfalls apparently served as barriers to further upstream migration (Webb and Boccone 1977). The one-mile reach between Highway 12 and Sonoma Creek was rated as "good" steelhead spawning habitat. According to local residents, stream flows ceased in most years by June and water diversions sometimes completely dried the stream as early as late spring, stranding adult resident *O. mykiss* (Webb and Boccone 1977).

Bear Creek

The headwaters of Bear Creek consist of three small perennial streams originating on the northeast slopes of Mt. Hood and the north and west slopes of Bald Mountain that join to flow south approximately two miles to the confluence with Sonoma Creek. The drainage basin is approximately 1.6 square miles. A series of six bedrock falls five to ten feet high occur on the creek. The first falls, located approximately 0.5 miles upstream from the confluence of Sonoma Creek, is a barrier to the upstream movement of anadromous fish.

A visual stream survey of the Sonoma Creek watershed conducted by DFG in August 1946 noted that "sea-run" steelhead spawn in Bear Creek (Shapovalov and Bruer 1946). In 1965, DFG stated that upper Sonoma Creek including Bear Creek contained *O. mykiss* nursery habitat, and that YOY were abundant (Greenwald 1965). Stream survey notes for the Sonoma Creek watershed compiled by DFG during the summer of 1966 note that Bear Creek contains "good" spawning and rearing habitat and a "good" *O. mykiss* population estimated at between 10-20 per 30 meters (Greenwald 1965).

A visual stream survey of Bear Creek was performed in June 1976 from the confluence upstream a distance of 1.2 miles. Steelhead YOY (100-130 mm TL) were reported in pools about 0.2 miles upstream of the Sonoma Creek confluence (Pinkham 1976a). The average density of fish was estimated to be 20 per 30 meters. The survey report called Bear Creek one of the few tributaries in the Sonoma Creek watershed providing good steelhead spawning and rearing habitat, and recommended management as one of the most important spawning and nursery streams in the watershed (Pinkham 1976a).

Leidy sampled various portions of Bear Creek in July and September 1993. In a 40-meter reach near the Sonoma Creek confluence, he collected 12 *O. mykiss* (38-208 mm FL) and visually estimated juvenile density at 30 per 30 meters (Leidy 2002). During the September survey, Leidy collected juvenile and adult *O. mykiss* (25: 35-164 mm FL) in a 24 meter reach approximately 0.2 miles upstream from the confluence with Sonoma Creek, and estimated juvenile density at 40 per 30 meters (Leidy 2002). Leidy found at least three *O. mykiss* year classes in Bear Creek during these sampling events. Bear Creek was found to contain good spawning and excellent rearing habitat for *O. mykiss* although the aerial extent was said to be limited by the small size of the stream. Cool water temperatures and constant stream flow during the summer months are typical due to the presence of seeps in the lower reach of the stream, and create good habitat conditions.

In 1996, DFG electrofished a Bear Creek site upstream from the Sonoma Creek confluence. One hundred ten juvenile steelhead (92 age 0+; 13 age 1+; 5 age 2+) were counted in a 90-meter reach (SSCRCD 1996). No steelhead YOY were seen upstream of an eight-foot bedrock fall located about 0.3 miles upstream of the Sonoma Creek confluence, and the researcher speculated that the fall was a barrier to upstream migration. *Oncorhynchus mykiss* assumed to be resident were observed upstream of the barrier (SSCRCD 1996).

Staff from DFG noted that Bear Creek offered the highest steelhead production capacity for its length (approximately 0.3 miles) of any Sonoma Creek watershed tributary. Favorable water temperature and canopy conditions were cited as contributing to the quality of salmonid habitat (SSCRCD 1996). The survey report concluded that Bear Creek should be managed as a steelhead stream.

Electrofishing was performed in October 2002 in Bear Creek. Data from sampling indicate that multiple *O. mykiss* age classes (38-138 mm FL) are present in the creek (SEC 2002).

Assessment: Sonoma Creek appears to have been an important contributor to regional steelhead resources based on the presence of runs of 500 individuals as late as 1965. Rescue data from 1954 also provide insight into the potential production of the system. Combined, Sonoma Creek, Agua Caliente Creek, and Carriger Creek produced a minimum of 27,475 juvenile *O. mykiss* in that year (Pintler 1956). These fish were derived from both anadromous stocks and fish rescued in previous years.

Populations of *O. mykiss* are consistently found in surveys of mainstem Sonoma Creek and its tributaries in the last ten years, and the presence of multiple year classes indicates natural propagation. A Sonoma Ecology Center sponsored assessment of salmonid habitat conditions, conducted in the Sonoma Creek watershed between June and December 1998, found that neither water temperature nor spawning gravel were factors limiting steelhead production based on sampling at several locations throughout the mainstem and at locations on Carriger, Calabazas, Graham and Bear Creeks (Katzel and McKnight 2001; McKnight and Katzel 2000). Sonoma Creek tributaries known to offer steelhead habitat include Agua Caliente Creek, Calabazas Creek and Stuart Creek. Bear Creek and the Sugarloaf Ridge State Park area provide additional important habitat resources.

Declines in the abundance of *O. mykiss* populations of the Sonoma Creek watershed and restriction of the species' distribution have been noted in various survey reports and in interviews with long-time Sonoma County residents. Causative factors most likely include dam construction, effects of deforestation, water withdrawals, and past over-fishing. Additional studies related to fisheries enhancement are currently being conducted under the auspices of the Sonoma Ecology Center that will improve the understanding of the distribution of *O. mykiss* in the watershed.

Schell Creek Watershed

The watershed areas of two tributaries, Arroyo Seco and Nathanson Creek, which originate on the Sonoma/Napa divide north and east of the city of Sonoma, constitute the majority of the Schell Creek drainage. Schell Creek is a 3.4-mile channel that begins on the floor of Sonoma Valley south of the city of Sonoma and flows in a south-southeast direction through agricultural fields until it issues into the tidally influenced Schell and Steamboat Sloughs within the Sonoma Creek/Napa River wetland complex. Schell Creek, Nathanson Creek and Arroyo Seco combine to form a drainage basin of 21.2 square miles.

Schell Creek

In June 1976, DFG conducted a visual stream survey of Schell Creek from the confluence with Schell Slough to the headwaters. The survey report cited Schell Creek as only a migratory corridor for *O. mykiss* known to spawn in the upstream reaches of Arroyo Seco and Nathanson Creek (Pinkham 1976c). Urbanization and agricultural development were cited as causing adverse impacts to the habitat value of the creek.

As part of a fish distribution study, a site on Schell Creek was sampled by pole-seine in September 1981. No *O. mykiss* were found (Leidy 1984). Based on the results of a 2004 survey by the Sonoma Ecology Center, *O. mykiss* are known to use Schell Creek currently (W. Pier pers. comm.).

Arroyo Seco

Arroyo Seco is one of two main tributaries (with Nathanson Creek) of Schell Creek. A 1966 DFG report cited *O. mykiss* YOY observed in the upper sections of Arroyo Seco (Rockwood 1966). Fishermen sighted spawning *O. mykiss* in Arroyo Seco in winter 2004 (W. Pier pers. comm.).

Haraszthy Creek

Haraszthy Creek is an intermittent tributary to Arroyo Seco that flows for a distance of 2.9 miles before joining Arroyo Seco. The Haraszthy Creek watershed is approximately 2.5 square miles.

Staff from DFG conducted a visual survey of Haraszthy Creek in June 1977 from the mouth to just upstream of Thornsberry Road, a distance of approximately three miles. No fish were observed during the survey, but the report noted "potentially good" spawning habitat approximately 0.5 miles upstream from its confluence with Arroyo Seco (Webb 1977). The DFG report recommended that Haraszthy Creek downstream of Haraszthy Falls be managed as steelhead spawning habitat.

We did not find evidence of recent use by *O. mykiss*. However, the creek may be accessed currently by spawning *O. mykiss* and is proximate to other streams known to be used (W. Pier pers. comm.).

Nathanson Creek

Nathanson Creek drains primarily south from Hogback Mountain for a distance of 7.5 miles before joining Schell Creek. The Nathanson Creek watershed is 15 square miles.

A visual survey of several reaches of Nathanson Creek in July 1965 noted the presence of "small" *mykiss* in the upper reaches upstream from the city of Sonoma (Meyer 1965). In a 1965 letter, DFG noted that Nathanson Creek contained a small population of young steelhead within the three miles of permanent stream (Greenwald 1965). A DFG survey in June 1966 found YOY *O. mykiss* in the upper section of Nathanson Creek but did not report size or density information (Rockwood 1966).

In 1974, DFG conducted a visual survey of Nathanson Creek from the mouth upstream about 7.5 miles. Juvenile *O. mykiss* (51-178 mm TL) were visually estimated at a density of 20 per pool in the reach downstream of a 60-foot natural falls. The falls are located about 2.5 miles upstream from the Lovall Valley Road crossing (Lincoln 1974). *Oncorhynchus mykiss* also were observed upstream of the falls, but no estimate of the number or size range of these fish is given. The survey report recommended management of the reach downstream of the falls as spawning and rearing habitat for steelhead (Lincoln 1974).

Nathanson Creek was sampled at East Napa Street in September 1981 as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984). In spring 2002, *O. mykiss* fry were seen in Nathanson Creek, and several year classes were seen in spring 2005 (W. Pier pers. comm.).

Assessment: Natural propagation of anadromous salmonids occurred in the Schell Creek watershed, particularly in Nathanson Creek, until at least 1976 and still occurs. However, insufficient recent information exists to assess the current contribution of this drainage to regional steelhead resources.

Table VIII-4. Distribution status of O. mykiss in San Francisco Estuary streams of Sonoma County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
Petaluma River	Petaluma	2/0	1962- **1993**	1, 2	-	Y	DF	DF	Y	1	23, 42, 50
	San Antonio	2/0	0 **1981**	1, 2	-	N	DF	PS	Y	0	22, 28, 42
	Adobe (Casa Grande)	3/2	1968-97	1, 2, 3	J/3; R/1	Y	DF	DF	-	1, 2, 3	11, 15, 23, 47,
	Lynch	2/1	1968-2000	0, 1	J/1	UNK	DF	DF	Y	1, 2, 3	49 (1)
	Washington	1/0	0 **1968**	1	-	N	UNK	NP	-	0	29 (1)
	Willow Brook	1/0	0 **1968**	1	-	UNK	UNK	PS	-	0	51 (1)
	Lichau	1/1	1968	1	J/1; R/1	UNK	DF	PS	Y	0	48 (1)
Sonoma Creek	Sonoma	8/6	1946-2002	0, 1, 2, 3	J/7; R/4; M/1	Y	DF	DF	Y	1, 2, 3	1, 2, 16, 20, 22, 23, 26, 27, 35-37, 39, 41, 42, 45, 57
	Fowler	1/1	1986	3	J/1; R/1	UNK	DF	PB	Y	0	14
	Rodgers	6/2	1958-2004	0, 1, 2	J/4; R/2	Y	DF	DF	Y	1,2,3	1, 3, 5, 12, 16, 22, 26, 36 (2)
	Felder	2/0	1970s-2004	0,1,3	J/1	Y	DF	DF	-	1,2,3	22 (2)
	Carriger	5/3	1962-97	1, 2, 3	J/5; R/2; M/1	Y	DF	DF	Y	1, 2, 3	1, 16, 18, 22, 23, 26, 34-37, 42, 46

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Dowdall	1/0	pre-diversion **1977**	0, 1	-	UNK	PB	NP	Y	0	38 (2)
	Agua Caliente	3/3	1965-2002	0, 1	J/3	UNK	DF	DF	Y	1, 2, 3	13, 16, 26, 34-37, 40
	Hooker	3/1	pre-1975 2002	0, 1	J/1	UNK	DF	DF	Y	1, 2, 3	36, 40, 43
	Wilson	1/0	0 **1977**	1	-	UNK	PB	UNK	-	0	44 (2)
	Mill	2/2	1997-2002	1, 2	J/2	Y	DF	DF	Y	1, 2, 3	23, 40
	Asbury	2/2	1966-96	0, 1	J/2; M/1	Y	DF	DF	Y	1, 2, 3	36, 45
	Calabazas	7/7	1961-2002	1, 2, 3	J/7; R/4	Y	DF	DF	-	1, 2, 3	9, 19, 23, 36, 39, 42, 45, 52
	Trinity	1/0	2004	1	J/1	Y	PB	DF	-	1, 2	(2)
	Redwood	2/0	1980s-2002	1	J/2	Y	DF	DF	-	1, 2	(2)
	Stuart	4/3	1966-96	1, 2	J/4; R/3	Y	DF	DF	-	1, 2, 3	17, 36, 40, 45
	Graham	9/8	1946-2002	0, 1, 2	J/8; R/5; M/2	Y	DF	DF	-	1, 2, 3	6-8, 22, 31, 36, 39, 45
	Yulupa	4/3	1966-86	0, 1, 2	J/3; R/2; M/1	UNK	DF	PB	Y	1	4, 22, 33, 36

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No.Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Kunde	1/0	2004	1	M/1	Y	PB	DF	-	1	(2)
	Fisher	2/0	2002-2004	1	M/1	Y	PB	DF	-	1	(2)
	Unnamed Trib. near Kenwood	1/0	1947-77	0, 1	-	UNK	DF	UNK	-	0	54
	Bear	7/6	1946-2002	0, 1, 2	J/5; R/3; M/1	Y	DF	DF	-	1, 2, 3	16, 21, 23, 25, 30, 35, 39, 41, 45
Schell Creek	Schell	3/0	2004	1,3	M/1	Y	DF	DF	Y	1	22, 32 (2)
	Arroyo Seco	2/0	1966-2004	1	J/1; M/1	Y	DF	DF	-	1	36 (2)
	Haraszthy	1/0	0 **1977**	1	-	UNK	PS	PS	-	0	53 (2)
	Nathanson	6/3	1965-2005	1, 3	J/5; R/1	Y	DF	DF	-	1, 2, 3	16, 22, 24, 26, 36 (2)

[a] Table headings and codes are defined in the Methods section of this report.

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Personal Communications

1. W. Cox, Department of Fish & Game, telephone conversations with G. Becker, CEMAR, on June 27, 2005, regarding *O. Mykiss* distribution in Sonoma County streams.
2. W. Pier, Sonoma Ecology Center, interview with G. Becker, CEMAR, on May 25, 2005 in Sonoma, California regarding *O. mykiss* distribution in Sonoma County streams.

SONOMA COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Sonoma County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Sonoma County, Caliornia.

NAPA COUNTY

Huichica Creek Watershed

The Huichica Creek watershed is in the southwest corner of Napa County. The creek flows in a generally southern direction into Hudeman Slough, which enters the Napa River via the Napa Slough. Huichica Creek consists of approximately eight miles of channel.

Huichica Creek

In March 1966 and in the winters of 1970 and 1971, DFG identified *O. mykiss* in Huichica Creek (Hallett and Lockbaum 1972; Jones 1966, as cited in Hallett, 1972). In December 1976, DFG visually surveyed Huichica Creek from the mouth to Route 121 and concluded that the area surveyed offered little or no value as spawning or nursery grounds for anadromous fish. However, the area was said to provide passage to more suitable areas upstream (Reed 1976).

In January 1980, DFG visually surveyed Huichica Creek from Route 121 upstream to the headwaters. *Oncorhynchus mykiss* ranging from 75–150 mm in length were numerous and were estimated at a density of 10 per 30 meters (Ellison 1980). The survey noted a six-foot falls approximately 1.75 miles upstream of Highway 121 as likely to be a complete barrier to upstream movement of steelhead (Ellison 1980).

A site on Huichica Creek at Highway 121 was sampled as part of a fish distribution study in September 1981. Two *O. mykiss* (79, 87 mm FL) were collected by dip net from a ten-meter reach (Leidy 1984).

In April 1983, DFG electrofished three stations on Huichica Creek. A site 1.5 miles upstream of Route 121 and another at Route 121 contained *O. mykiss* (42-252 mm FL) at densities estimated to be 3 per 30 meters. *Oncorhynchus mykiss* also were identified downstream of Route 121 but not collected (Jong 1983). In September 1985, DFG electrofished the same three stations on Huichica Creek. Two *O. mykiss* (~197 mm FL) were caught about 1.5 miles upstream of Route 121, while three *O. mykiss* (~214 mm) were collected at Route 121. No *O. mykiss* were found downstream of Route 121 (Gray 1985).

In July 1988, DFG electrofished Huichica Creek at Route 121 and caught 19 *O. mykiss* ranging from 60-186 mm FL (Montoya 1988a). In November 1989, DFG electrofished an established site approximately 1.5 miles upstream of Route 121 as well as a new site approximately 0.75 mile upstream of Route 121 at the confluence of an unnamed tributary. The established site yielded three *O. mykiss,* ranging in size from 95–110 mm FL. The new site yielded six *O. mykiss* (90–120 mm FL) (Gray 1989a).

Ecotrust and FONR surveyed Huichica Creek between May and September 2002. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. *Oncorhynchus mykiss* were observed in numerous Huichica Creek reaches, with five reaches having density level "3" (Ecotrust and FONR 2002).

Assessment: Huichica Creek appears to have hosted a steelhead run historically. In 1980, DFG categorized Huichica Creek as a moderate size drainage providing steelhead spawning and nursery habitat (Ellison 1980). Recent surveys in Huichica Creek by FONR and Ecotrust established that *O. mykiss* persists in the drainage, including areas of high relative density.

Napa River Watershed

Mainstem Napa River consists of about 40 miles of channel and covers 426 square miles. The river enters San Pablo Bay at the city of Vallejo. Lower Napa River is tidal to approximately 0.25 mile upstream of Trancas Bridge in the city of Napa. Major tributaries include Dry Creek, Redwood Creek, Sulphur Creek, Conn Creek, Soda Creek, Milliken Creek, and Napa Creek. Kimball Canyon Dam, near the headwaters of Napa River, is a complete barrier to upstream fish migration. The channel upstream from the dam is known as Kimball Canyon Creek.

A rare, watershed-wide steelhead resource analysis was performed by DFG in 1969 for the Napa River drainage. In the final document, DFG estimated the standing crop of juvenile steelhead at 87,300 to 144,600 fish (Anderson 1969f). According to DFG, this crop would result in an adult run of 580 to 960 steelhead given a return of 0.5 percent, or 1,160 to 1,930 steelhead based on a return of 1.0 percent (Anderson 1969f). The report also found larger populations of smaller-sized juvenile steelhead in the upper reaches of tributary streams, while lower reaches of tributary streams and isolated sections of Napa River supported smaller populations of larger-sized juveniles (Anderson 1969f). Mean juvenile fork length was about 25 mm less in upper reaches of tributary streams (64 mm) than in the mainstem Napa River (89 mm).

From October 1973 to February 1979, DFG conducted large-mesh and small-mesh gill-net surveys of fish in South, Dutchman, Devil's and Hudeman sloughs in the Napa River Marsh with results provided in Table IX-1.

Table IX-1. DFG *Oncorhynchus mykiss* sampling in the Napa River Marsh, 1973-1979

	Number *Oncorhynchus mykiss* Collected						
	1973	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**
South slough	--	--	3	--	--	2	4
Dutchman slough	--	4	2	--	1	1	--
Devil's slough	--	--	1	1	--	--	2
Hudeman slough	1	--	5	6	--	1	--
Total	**1**	**4**	**11**	**7**	**1**	**4**	**6**

(Source: Kohlhorst 1973, 1976; Kohlhorst 1979).

Napa River

A 1959 DFG survey of the Napa River included mention of a creel survey during the winter of 1954-55. The creel survey found that almost 400 steelhead were harvested from the mouth upstream to Lincoln Bridge in the city of Calistoga (Fisher 1959c).

In June 1961, DFG visually surveyed the Napa River from one mile north of Calistoga downstream to Zinfandel Lane. In this 11.5-mile reach, 26 YOY *O. mykiss* were observed up to about 75 mm in length (Day 1961b). Staff from DFG considered this reach of the Napa River to be the most important spawning and nursery area of the mainstem, but it was said to act primarily as a migration route for adult steelhead returning to spawn in the tributaries (Day 1961a).

In July 1965, DFG visually surveyed the Napa River and found it almost completely dry downstream of the Kimball Canyon Dam. No *O. mykiss* were observed in the few warm, isolated pools (Culley and Fox 1965). In February 1966, DFG surveyed two miles of the Napa River downstream of Kimball Canyon Dam and observed no fish (Brackett 1966a).

In July and August 1969, DFG electrofished seven stations on mainstem Napa River between the Blossom and Dry creek confluences. *Oncorhynchus mykiss* were collected at three stations near the Sulphur Creek confluence, with a total of 37 juvenile steelhead recorded (Anderson 1969a). Most of the steelhead were caught at Zinfandel Lane, including 30 fish ranging from 69-122 mm FL. Steelhead densities were estimated at 39 per 30 meters at Zinfandel Lane and four per 30 meters at both Pratt Avenue and Pope Street. The report included an estimate of 3,000 juvenile steelhead in the standing crop of 1969 between Calistoga and Yountville (Anderson 1969a).

In August 1969, DFG electrofished the upper Napa River about 0.25 miles downstream of Kimball Canyon Dam. Steelhead ranged in size from 69-104 mm FL, and had an estimated population density of 24 per 30 meters (Anderson 1969b). At this time, the standing crop of juvenile steelhead in the Napa River upstream of Blossom Creek was estimated to be between 600 and 2,500 fish (Anderson 1969f). In 1977 DFG published a natural resources assessment of the Napa Marsh in which the agency estimated the standing crop of juvenile steelhead from the Napa River drainage to be approximately 116,000 to 193,000 fish (Michaels 1977).

An employee of the Napa Water Department reported that he observed steelhead runs up to the base of Kimball Canyon Dam until the 1976 drought. After 1976, he observed only small trout in pools downstream of the dam (D. Anderson, pers. comm., cited in Leidy 2002).

In October 1988, DFG electrofished the Napa River from the confluence with Bell Canyon Creek downstream to Lodi Lane. No *O. mykiss* were caught (Montoya 1988c). In early October 1989, DFG set gill-nets in the Napa River downstream of the city of Napa and caught one steelhead (398 mm FL) (Gray 1989b).

Leidy found no *O. mykiss* when he electrofished four locations between Yountville and Calistoga in August and September 1993, nor when he conducted otter-trawls at four locations in the Napa sloughs in July 1994 (Leidy 2002). In July 1997, Leidy electrofished a pool on the upper Napa River, immediately downstream of an arizona crossing at the Calistoga water treatment plant. He caught two *O. mykiss* (255, 210 mm FL) with a silvery appearance suggesting anadromy (Leidy 2002).

Leidy electrofished a Napa River site in Calistoga in August 1997 and did not encounter *O. mykiss*. Another site immediately upstream of the lower spillway at Pioneer Park did not produce *O. mykiss* (Leidy 2002).

In September 1998, the Corps and USFWS sampled 12 locations with 50-foot beach seines within the area of tidal influence on the Napa River in a reach from Lincoln Avenue in the city of Napa (RM 17.3) downstream to the Rocktram Steel Pipe Factory (RM 11.6). No salmonids were caught, but the report of the seining effort cited the typical steelhead run size (as of 1999) as being between about six thousand to a few hundred fish (Wilkinson 1999).

Carneros Creek

Carneros Creek drains an area of about nine square miles including a headwaters area consisting of the hills west of the city of Napa. It enters the Napa River at Cutting's Wharf, south of the city of Napa (DCE 1999).

In November 1958, DFG visually surveyed areas accessible by car on Carneros Creek between Cuttings Wharf and a point 6.5 miles upstream. No fish were observed, but the local game warden and residents reported small runs of steelhead and a small resident trout fishery in the uppermost headwaters (Elwell 1958g).

In December 1976, DFG visually surveyed Carneros Creek from Cuttings Wharf to a point 3.0 miles upstream. This reach was reported as poor nursery habitat for steelhead, serving only as a migration route (Gillespie and Reed 1976).

In June 1981, DFG surveyed the lower 4.1 miles of Carneros Creek to locate stranded steelhead. Intermittent water was present throughout the surveyed reach, but no fish were observed. Three dams were found, two at ten feet high and another six feet high. All were considered complete barriers to migration (Harris and Ambrosins 1981b).

Ecotrust and FONR surveyed Carneros Creek between May and September 2002. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. *Oncorhynchus mykiss* were observed in numerous Carneros Creek reaches, with six reaches having density level "3" (Ecotrust and FONR 2002).

Suscol Creek

Suscol Creek consists of about eight miles of channel that drains the hills southeast of the city of Napa. It enters the lower Napa River about five miles south of the city of Napa.

In a 1949 letter, a landowner along Suscol Creek reported observing spawning steelhead in the winter and juveniles throughout the year (Berry 1949). The author noted perennial flows in the creek. In January 1955, DFG visually surveyed Suscol Creek in response to a proposed diversion for pasture irrigation. *Oncorhynchus mykiss* were observed and natural propagation was rated as "fair" (CDFG 1955).

In May 1973, DFG visually surveyed Suscol Creek from the mouth to the headwaters. Steelhead were observed throughout the stream, ranging in length from 25-205 mm, at estimated densities of 25-200 per 30 meters of stream (Reynolds 1973).

In January 1997, Leidy electrofished 30 meters of Suscol Creek between Devlin Road and highways 29/37. He caught eight *O. mykiss* ranging from 86–255 mm FL (Leidy 2002). The largest fish (178-255 mm) displayed smolt characteristics.

Ecotrust and FONR surveyed Huichica Creek between May and September 2002. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. *Oncorhynchus mykiss* were observed in six Suscol Creek reaches, with two reaches having density level "2" (Ecotrust and FONR 2002).

Tulucay Creek

Tulucay Creek consists of approximately eight miles of channel draining an area of 13 square miles. The creek enters the Napa River about 1.5 miles south of Imola Avenue (DCE 1999).

In November 1958, DFG surveyed points accessible by car on Tulucay Creek from the mouth to its headwaters. *Oncorhynchus mykiss* averaging 75-100 mm in length were noted but generally were scarce (Elwell 1958o). The report noted that Tulucay Creek supported nursery areas in the mid-section of the drainage adequate to sustain a population of trout (Elwell 1958f).

In June 1981, DFG visually surveyed Tulucay Creek from the mouth to the Green Valley Road crossing for the purpose of rescuing fish stranded by low flows. Several *O. mykiss* 75-200 mm were observed in perennial pools of the upper reach (Harris and Ambrosins 1981f). The Green Valley Road crossing was identified as a passage barrier.

In July 1992, DFG electrofished four Tulucay Creek sites downstream of the confluence with Murphy Creek. A pool at the Fourth Avenue Bridge contained one *O. mykiss* (240 mm FL) (Emig 1992a). The survey report noted that the population probably had been reduced because of low flows resulting from the lack of bypass requirements for upstream diversions (Emig 1992a).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. One reach of Tulucay Creek was found to have *O. mykiss* at density level "1" (Ecotrust and FONR 2001).

Murphy Creek

Murphy Creek drains about one square mile directly east of the city of Napa. It is a perennial creek that joins Spencer Creek to form Tulucay Creek.

In June 1968, DFG investigated reports of a fish kill involving large numbers of Murphy Creek steelhead. During a subsequent survey, juvenile *O. mykiss* were observed between 38-100 mm in length at an estimated density of 20 per 30 meters of stream throughout the surveyed area (Jones 1968).

In August 1990, DFG electrofished pool sites upstream of the crossing at Shady Brook Lane. Five *O. mykiss* were caught ranging in size from 103-210 mm. An additional three to four *O. mykiss* (50-150 mm) were observed but not caught (Gray 1990d). The survey report noted a local resident's statement that, until about 1970, many adult steelhead, typically 610-660 mm long, migrated up Murphy Creek.

In July 1992, DFG electrofished pools at two Murphy Creek sites. *Oncorhynchus mykiss* were found at both sites and ranged from 126-249 mm (Emig 1992a).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Two reaches of Murphy Creek were found to have *O. mykiss* at density level "1" and one headwaters reach had level "2" (Ecotrust and FONR 2001).

Spencer Creek

Spencer Creek is tributary to Tulacay Creek and drains the area directly east of the city of Napa. Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. One headwater reach of Spencer Creek was found to have *O. mykiss* at density level "2" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in one Spencer Creek reach (Ecotrust and FONR 2002).

Napa Creek

Napa Creek is formed by the confluence of Browns Valley Creek and Redwood Creek in Browns Valley west of the city of Napa. Napa Creek is contained almost wholly within the city of Napa. The combined drainage area of Napa Creek and its tributaries is 15 square miles (DCE 1999).

In November 1958, DFG visually surveyed easily accessible reaches of Napa Creek from the confluence with the Napa River to the headwaters. No *O. mykiss* were found in the reach below the confluence of Redwood Creek and Brown Valley Creek (Elwell 1958k).

Leidy sampled Napa Creek in January 1994 upstream of Jefferson Street. He did not find *O. mykiss* (Leidy 2002). Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Napa Creek was found to have *O. mykiss* at density level "1" (Ecotrust and FONR 2001).

Browns Valley Creek

Browns Valley Creek consists of approximately 4.5 miles of channel flowing generally southeast to the city of Napa. It is tributary to Napa Creek.

In November 1958, DFG visually surveyed portions of Browns Valley Creek accessible by car. No fish were found. Because Browns Valley Creek typically dried by early spring, DFG considered this creek to have no fishery functions except contributing flows to Napa Creek (Elwell 1958l). In October 1966, DFG again visually surveyed Browns Valley Creek from the mouth to the headwaters. No *O. mykiss* were observed, and DFG reported that the creek did not support *O. mykiss* (McCurdy 1966).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. One reach (of four) in Browns Valley Creek was found to have *O. mykiss* at density level "1" (Ecotrust and FONR 2001).

Redwood Creek

Redwood Creek is tributary to Napa Creek. It consists of approximately 13 miles of channel draining about 15 square miles.

In November 1958, DFG visually surveyed easily accessible reaches of Redwood Creek from the confluence with the Napa River to the headwaters. *Oncorhynchus mykiss* (75-100 mm average length) was found to be fairly common in the reach that sustained perennial flow, beginning just upstream of the junction of Browns Valley and Redwood roads and continuing upstream 3.5 miles to a natural falls. As a result, this reach of Redwood Creek was considered to be an excellent nursery ground for juvenile steelhead (Elwell 1958k).

In April 1965, the Napa Water Department inadvertently discharged chlorine into Redwood Creek, killing more than 10,000 fingerling steelhead in a 1.5 mile reach (Greenwald 1965a). In June 1966, DFG visually surveyed portions of Redwood Creek accessible by automobile. *Oncorhynchus mykiss* were found at a density of 250-330 per 30 meters upstream of the Redwood and Mt. Veeder roads junction. Most of the fish sighted were YOY, with only a very few larger than 75 mm FL. Upstream of the confluence with Pickle Canyon Creek, YOY and other *O. mykiss* up to 230 mm in length were observed at an estimated density of 70-100 per 30 meters. Two five-pound steelhead also were observed in the upper reach (Hicks and McCurdy 1966b). According to DFG, natural propagation appeared to be good throughout the section surveyed (Hicks and McCurdy 1966b).

In June 1967, DFG surveyed Redwood Creek upstream of the confluence of Redwood and Pickle Canyon creeks. *Oncorhynchus mykiss* density in two miles of the creek was estimated on average to be 25 per 30 meters. The greatest densities occurred immediately upstream of the Pickle Canyon Creek confluence, where *O. mykiss* density was estimated at 50 per 30 meters. Fish captured ranged between 25 and 75 mm in length (Thompson 1967b). Using population densities from earlier surveys, DFG estimated that 24,200 and 8,600 juvenile steelhead used 4.25 miles of Redwood Creek for "nursery purposes" in 1966 and 1967, respectively (Jones 1967).

In October 1969, DFG electrofished Redwood Creek one mile northwest of Mont La Salle School, near the end of Redwood Road. Of the 70 *O. mykiss* collected, 68 had fork lengths ranging from 38-76 mm (Anderson 1969c). A 112 mm and a 132 mm steelhead also were noted. Density was estimated at 75 per 30 meters. Based on the survey results, DFG estimated the 1969 standing crop of steelhead juveniles to be between 21,400 and 29,700 fish in Redwood Creek and its tributaries (Anderson 1969c).

In April 1977, DFG visually surveyed Redwood Creek from the mouth to near the headwaters. A small flowing reach near the mouth did not support live *O. mykiss*, although a dead adult steelhead was found at the upstream end of this reach. From five miles upstream of the mouth to the headwaters, *O. mykiss* (100–180 mm) were found at an estimated density of 10 per 30 meters (Gillespie and Rowser 1977).

In October and November 1984, DFG visually surveyed Redwood Creek from the Redwood Road crossing near Dry Creek Road upstream to the end of Redwood Road. *Oncorhynchus mykiss* (50–125 mm) was observed most commonly in the main canyon upstream of the Mt. Veeder Road crossing (Emig 1984c).

In November 1985, DFG electrofished two Redwood Creek sites, one immediately downstream, the other extending 0.25 miles upstream from the intersection of Redwood and Mount Veeder roads. Two juvenile steelhead were caught, one 91 mm in length and the other 92 mm in length (Gray 1986c).

In June and July 1987, DFG visually surveyed Redwood Creek from Castle Rock to the mouth. *Oncorhynchus mykiss* was observed throughout the creek, with various age classes in the upper portion but very few YOY. In the lower part of the creek, most of the trout were YOY (Montoya 1987c). *Oncorhynchus mykiss* was estimated to average 65 mm in length (Montoya 1987c).
Leidy sampled 30-meter reaches at three Napa River locations in January 1994. About 0.3 miles upstream from Castle Rock, he caught 13 *O. mykiss* (50-132 mm FL) and two larger *O. mykiss* (245, 260 mm) (Leidy 2002). The lack of spotting on the sides and the condition of the anal and pectoral fins suggested anadromy in the larger fish. At Castle Rock, Leidy caught five *O. mykiss* (57-93 mm) and observed six others reflecting two size classes (4: 60-100 mm; 2: 125-150 mm). The most downstream station, immediately downstream of the Redwood Road Bridge, produced three *O. mykiss* (104, 119, 122 mm).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of 21 Redwood Creek reaches, eight were found to have *O. mykiss* at density level "1," while five reaches had density level "2" and three reaches had level "3" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in numerous Redwood Creek reaches, including two reaches at density level "2" (Ecotrust and FONR 2002).

Pickle Canyon Creek

Pickle Canyon Creek is tributary to Redwood Creek and consists of about 3.5 miles of channel. It drains a relatively undeveloped area southwest of the city of Yountville.

In June 1966, DFG visually surveyed Pickle Canyon Creek from the mouth to the headwaters. Numerous juvenile *O. mykiss* (25-75 mm) and a few fish ranging from 150-250 mm in length were observed in the lower two miles of stream. Densities were estimated at 50-70 per 30 meters (Hicks and McCurdy 1966a). In June 1967, DFG again surveyed the entire creek length. *Oncorhynchus mykiss* densities were estimated at 25-30 per 30 meters in the lower two miles of stream. In the upper survey area, densities dropped to less than one fish per 30 meters (Thompson 1967a). Using population densities from earlier surveys, DFG estimated that 6,200 and 2,900 juvenile steelhead used two miles of Pickle Canyon Creek for rearing in 1966 and 1967, respectively (Jones 1967).

In May 1978, DFG electrofished four stations on Pickle Canyon Creek upstream and downstream of its confluence with an unnamed tributary. A total of 36 *O. mykiss* were caught at the four sites. Fish ranged in length from 61–84 mm FL (Baracco 1978). Population densities were found to range between 6.5 and 11.5 per 30 meters of stream.

In June 1981, DFG surveyed the lower 3.2 miles of Pickle Creek to locate stranded steelhead juveniles for rescue. Most of the creek was dry, although a few steelhead juveniles were spotted in isolated pools (Ambrosins 1981c).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of eight Pickle Canyon Creek reaches, two were found to have *O. mykiss* at density level "1," while two reaches had density level "2" and two reaches had level "3" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in two Pickle Canyon Creek reaches (Ecotrust and FONR 2002).

Milliken Creek

Milliken Creek drains an area of 30 square miles (DCE 1999). The city of Napa's Lake Milliken dam was constructed on the creek in 1924 without a fishway and serves as an impassable barrier to upstream migration.

A June 1940 DFG lake survey report noted natural populations of steelhead having moderate success in Milliken Reservoir with YOY (50-65 mm) observed in inlet streams (Shapovalov 1940a). Draining of Milliken Reservoir in 1954 revealed only a few trout (Evans 1954). In 1958, DFG characterized the six miles of Milliken Creek downstream of the reservoir as useful for spawning by steelhead (Elwell 1958c).

In February 1959, DFG surveyed Milliken Creek upstream of Milliken Reservoir, including a two mile reach downstream of a 40 foot falls that served as a complete barrier to fish migration. Although no fish were observed, the dam's caretaker reported spawning runs of *O. mykiss* from the lake upstream in Milliken Creek in late fall of that year (Fisher 1959b).

In May 1966, DFG visually surveyed Milliken Creek from the mouth upstream to Milliken Reservoir. One 405 mm *O. mykiss* was found at the base of the Silverado Country Club Diversion Dam upstream from Atlas Peak Road. Between the diversion dam and Milliken Reservoir, *O. mykiss* were observed ranging from 50-150 mm and at an estimated density of 40 per 30 meters (Brackett 1966b).

In March 1967, DFG visually surveyed Milliken Creek from the mouth to Milliken Reservoir. A 510 mm steelhead was observed at the base of the Silverado Country Club Diversion Dam (Thompson 1967c).

In July 1975, DFG visually surveyed Milliken Creek from Milliken Reservoir upstream 3.6 miles. Downstream of a natural falls, *O. mykiss* ranging in size from 50-100 mm were observed at an estimated density of 5 per 30 meters. No *O. mykiss* were found upstream of the falls (Henry and Coleman 1975).

In November and December 1975, DFG visually surveyed Milliken Creek from the Silverado Country Club Diversion Dam to Milliken Reservoir. About two miles upstream of the country club, a 20-foot barrier was identified where the city of Napa built a diversion dam at a bedrock outcrop. No fish were found upstream of this barrier. Steelhead were observed ranging from 50-255 mm downstream of the barrier, at an estimated density of 20 per 30 meters (Tyler and Holstine 1975).

In April and May 1980, DFG visually surveyed Milliken Creek from its mouth to the Napa Diversion Dam. This effort was followed up with an electrofishing survey at four stations. Upstream of the Napa City Diversion Dam, five *O. mykiss* were caught ranging from 115-199 mm FL. At the mouth of Milliken Canyon, 13 *O. mykiss* were caught ranging from 117–187 mm in length. Numerous *O. mykiss* fry were seen but not collected (Ellison et al. 1980).

In June 1981, DFG visually surveyed Milliken Creek from the mouth to the Silverado Country Club Diversion Dam in order to locate steelhead stranded by low flows. No steelhead were found (Ambrosins 1981b).

In July 1987, DFG visually surveyed Milliken Creek from its mouth to Milliken Reservoir, and recorded two *O. mykiss* (50, 380 mm) (Montoya 1987b). In July 1988, DFG electrofished Milliken Creek at the Silverado Country Club and found 11 *O. mykiss* from 61–268 mm (Montoya 1988b).

Leidy found no *O. mykiss* when electrofishing at the Trancos Road Bridge in August 1993 (Leidy 2002). However, in June 1998, he found *O. mykiss* at two other sites electrofished on Milliken Creek. At Atlas Peak Road, Leidy caught one *O. mykiss* (61 mm FL) and at Westgate Drive in the Silverado Country Club he caught two *O. mykiss* (50, 53mm FL) (Leidy 2002).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of seven Milliken Creek reaches, three were found to have *O. mykiss* at density level "1," while two reaches had density level "3" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in numerous Milliken Creek and Millien Creek tributary reaches, including three reaches at density level "3" (Ecotrust and FONR 2002).

Sarco Creek

Sarco Creek drains the area northeast of the city of Napa. Its mouth on Milliken Creek is located immediately upstream from Milliken Creek's confluence with the Napa River.

In August 1987, DFG visually surveyed the lower five miles of Sarco Creek from the mouth to Mount George, and also the lower 3.9 miles of a major unnamed tributary that joins Sarco Creek just upstream of its confluence with Milliken Creek. No *O. mykiss* were observed in either creek (Montoya 1987d, 1987e).

In August 1990, DFG electrofished Sarco Creek at an area off Langley Park Lane. One *O. mykiss* (210 mm FL) was caught. Three *O. mykiss* of comparable size as well as two smaller individuals were observed but not caught (Gray 1990g). The survey report noted that the fish were presumed to be resident forms of an ancestral stock of steelhead.

In August 1993, Leidy electrofished Sarco Creek at the Trancos Road Bridge. No *O. mykiss* were found (Leidy 2002). Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of two Sarco Creek reaches, one was found to have *O. mykiss* at density level "1" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in five Sarco Creek reaches, including one reach at density level "2" (Ecotrust and FONR 2002).

Camp Creek

Camp Creek is tributary to Milliken Reservoir. In June 1940, DFG identified *O. mykiss* ranging from 50-65 mm in length in a flowing reach of Camp Creek just upstream of the mouth. According to the Milliken Reservoir caretaker, steelhead spawned in portions of the creek downstream from an impassable natural falls (Shapovalov 1941).

Salvador Outfall Channel

Salvador Outfall Channel is the local name for an otherwise unnamed tributary to the Napa River. Its confluence with the Napa River is located north of Trancas Avenue.

In March 1977, DFG surveyed approximately one mile of the Salvador Outfall Channel from Vintage High School to the mouth. Six adult steelhead were observed between Big Ranch Road and the mouth. Staff from DFG speculated that adult steelhead used this stream when low flows prevented access to more suitable upstream tributaries of the Napa River, but that flows and water quality were inadequate for juvenile fish (Baracco 1977).

Soda Creek

This Napa River tributary consists of approximately six miles of channel between the headwaters and the mouth. Soda Creek joins the Napa River approximately three miles north of the city of Napa. A natural falls occurs nearly three miles upstream of the mouth and appears to constitute a barrier to upstream migration.

In June 1940, DFG identified *O. mykiss* ranging from 50 to 75 mm in length near the mouth of an unnamed tributary of Soda Creek (Shapovalov 1940d). In November 1958, DFG visually surveyed Soda Creek from the mouth to the headwaters. Small numbers of *O. mykiss* ranging between 75 and100 mm in length were observed in the middle section of drainage that had recorded flows on this date (Elwell 1958n). The upper and lower reaches were dry at the time of the survey. In the survey report, DFG cited the local warden as saying that each year steelhead runs occurred that were smaller than only the Dry Creek and Redwood Creek runs. A 14-foot bedrock barrier was described near the junction of Soda Canyon and Soda Springs roads. (Elwell 1958n).

A November 1958 DFG report noted that the lowermost three miles of Soda Creek was utilized by steelhead for spawning purposes (Elwell 1958e). The report also noted that the lowest one-mile portion of this reach maintained permanent flows and served as a nursery area for juvenile steelhead (Elwell 1958n).

In February 1964, ten female and four male steelhead kelts were rescued from a drying pool in Soda Creek approximately two miles upstream of the mouth. The rescued fish were transported to the Napa River. Additional fish were reportedly poached in the previous week (Jones 1964a).

In May 1980, Soda Creek was surveyed visually from the Silverado Trail to the headwaters. Three sites were electrofished. The first station, at the first junction with Soda Canyon Road, produced seven *O. mykiss* (52-67 mm). The second site, at Loma Vista Drive, had six *O. mykiss* (57-69 mm). The last site, approximately 2.3 mile upstream of the mouth, had 37 *O. mykiss* (60-279 mm) (Ellison and Carnine 1980).

In December 1985, DFG caught 18 wild *O. mykiss* in Soda Creek while monitoring the movement of stocked steelhead. Sizes of fish ranged from 79-202 mm, and a 159 mm male was found to be sexually mature (Gray 1986a). Planted *O. mykiss* also were recovered during the survey. In February 1986, three wild *O. mykiss* (75-125 mm) and 104 planted steelhead were caught during a monitoring study (Gray 1986d). In May 1986, an additional 16 *O. mykiss* (180-270 mm) were caught, nine of which were assumed to be wild (Gray 1986e).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system between June and September 2002. *Oncorhynchus mykiss* were found in four Soda Creek reaches (Ecotrust and FONR 2002).

Dry Creek

Dry Creek drains an area of 20 square miles (DCE 1999). From its headwaters near Bald Mountain, the creek flows generally southeast to its confluence with the Napa River north of the city of Napa.

In October 1969, DFG electrofished Dry Creek in the vicinity of Dry Creek Road. Steelhead ranged in size from 38-81 mm, with one 170 mm trout. Estimated density of fish was 92 per 30 meters (Anderson 1969a).

In June 1981, DFG electrofished Dry Creek and caught more than 200 steelhead ranging in size from 33-86 mm FL (Ellison 1981c). In June 1981, DFG rescued 970 steelhead YOY, presumably trapped in drying portions of Dry Creek, and transferred them to the Silverado Field Operations Base (Baker 1981). Another 212 *O. mykiss* were reported dead.

In 1983, a DFG fish population survey included an estimate of steelhead density of 46 fish per 30 meters (Emig 1992b). In March 1987, DFG electrofished lower Dry Creek and caught a juvenile steelhead (50 mm FL). Several adult steelhead were seen spawning nearby (Gray 1987b).

Leidy electrofished Dry Creek in June 1996 and again in August 1997. In 1996, he caught 16 *O. mykiss* (58-210 mm FL) at the intersection of Oakville Grade and Dry Creek Road, and estimated trout density at 25 per 30 meters of stream. Leidy found four *O. mykiss* (110-210 mm) at the Highway 29 frontage road, with an estimated fish density of 10 per 30 m. In 1997, about one mile upstream from the lower one-lane bridge on Dry Creek Road, Leidy caught two *O. mykiss* (140, 147 mm) and estimated fish density at 5 per 30 meters. Immediately upstream, he collected five *O. mykiss* (125-142 mm) and estimated density at 10 per 30 meters (Leidy 2002).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of 17 Dry Creek reaches, four were found to have *O. mykiss* at density level "1," while six reaches had density level "2" and three reaches had level "3" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in numerous Dry Creek and Dry Creek tributary reaches, including 31 reaches at density level "3" (Ecotrust and FONR 2002).

Hopper Creek

Hopper Creek is tributary to Dry Creek. A reservoir on Hopper Creek formerly supplied water supply for the city of Yountville and constituted the upper limit of the system for anadromous fish usage. The reservoir appears to have been constructed immediately upstream from a natural falls that acted as a passage barrier (Pinkham 1976).

In August 1976, DFG visually surveyed Hopper Creek from Highway 29 to its headwaters. No *O. mykiss* were observed, but local residents reported that the stream downstream of the reservoir supported runs of steelhead during high water years (Pinkham 1976).

In June 1981, DFG visually surveyed the lower 1.9 miles of Hopper Creek to locate stranded steelhead juveniles for rescue. No *O. mykiss* were observed (Harris and Ambrosins 1981e).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. One Hopper Creek reach was surveyed and *O. mykiss* were not observed (Ecotrust and FONR 2001). Staff from the Napa County Resource Conservation District report that the creek is likely to be used by *O. mykiss* in some years (J. Koehler pers. comm.).

Hinman Creek

Hinman Creek drains an area of about 2.5square miles and is tributary to Hopper Creek. Hinman Reservoir dam is a fish passage barrier occurring about 2.5 miles upstream from the mouth.

In June 1966, DFG visually surveyed Hinman Creek from the mouth to Hinman Reservoir. No *O. mykiss* were observed (Hicks 1966). Hinman Reservoir was sampled by DFG using gill nets in November 1974 and again no *O. mykiss* were found in the fish assemblage. In January 1975, 25 *O. mykiss* 50–75 mm in length were found when Hinman Reservoir was drained. At this time, DFG also poisoned the creek immediately upstream of the reservoir and afterward found six dead *O. mykiss*. Dorsal fin deformation indicated that these fish were of hatchery origin (Week 1975).

In January 1984, DFG electrofished Hinman Creek near the Domaine Chandon property and found four *O. mykiss* ranging from 50-160 mm in length (Gray 1990b). In April 1987, DFG electrofished the same reach of Hinman Creek but did not encounter *O. mykiss* (Gray 1990b). The survey report speculated that *O. mykiss* probably were present in the system. Staff from the Napa County Resource Conservation District report that the creek may be used by *O. mykiss* in some years (J. Koehler pers. comm.).

Segassia Canyon Creek

Segassia Canyon Creek is tributary to Dry Creek from the west. The creek appears to be less than one mile in length, draining the eastern slopes of Mt. Veeder.

Ecotrust and FONR carried out surveys in tributaries of the Napa River system between June and September 2002. *Oncorhynchus mykiss* were found in several Segassia Canyon Creek reaches, including one reach at density level “3” (Ecotrust and FONR 2002).

Wing Canyon Creek

Wing Canyon Creek is tributary to Dry Creek from the west. The creek appears to be less than one mile in length, draining the eastern slopes of Mt. Veeder.

Ecotrust and FONR carried out surveys in tributaries of the Napa River system between June and September 2002. *Oncorhynchus mykiss* were found in several Wing Canyon Creek and tributary creek reaches, including six reaches at density level “3” (Ecotrust and FONR 2002).

Campbell Creek

Campbell Creek is the local name for an otherwise unnamed tributary of Dry Creek. A February 1997 DFG field note reported that Campell Creek was known to have populations of steelhead (Emig 1997).

In June 1996, Leidy electrofished an unnamed tributary of Dry Creek known locally as Carmel Creek or Campbell Creek immediately upstream of Oakville Grade Road. He caught ten *O. mykiss* averaging from 41-73 mm FL, and estimated population density at 20 per 30 meters (Leidy 2002).

Montgomery Creek

Montgomery Creek is a seasonal tributary to Dry Creek with a watershed of about two square miles. It drains a portion of the range forming the west side of the Napa Valley and flows generally north to join Dry Creek at the junction of Dry Creek and Mt. Veeder roads.

In December 1975, DFG visually surveyed Montgomery Creek from the mouth to the Mount Veeder Road crossing. No fish were observed. In the survey report DFG noted residents' reports that the creek dried up early in spring (Holstine 1975).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of three Montgomery Creek reaches and two reaches in a tributary, one reach was found to have *O. mykiss* at density level "2," while two reaches had density level "3" (Ecotrust and FONR 2001).

Conn Creek

Conn Creek drains an area of 60 square miles (DCE 1999). Construction of the Conn Valley Reservoir (Lake Hennessey) in 1945 completely curtailed access to more than eight miles of Conn Creek and numerous tributary streams, including Chiles, Moore, Sage and Fir creeks.

In September 1945, DFG observed large numbers of trout in the upper sections of Conn Creek (Ott 1945). In 1946, DFG noted that a moderately large population of trout, from fingerlings to 200 mm in length, was present in the tributary streams of Conn Valley Reservoir (Murphy 1949). In a May 1947 creel census, DFG found both hatchery and wild *O. mykiss* in the group taken by anglers from the reservoir. However, by 1948, practically no trout were present in the tributary streams (Murphy 1949). The Department of Fish and Game concluded that the trout fishery would not be self-maintaining even in years of "good" flows in spawning streams because of low survival of adults in the reservoir (Murphy 1949).

In February 1959, DFG made a cursory survey of eight sites near road access on Conn Creek upstream of Lake Hennessey. No *O. mykiss* were observed, but residents reported catching small numbers of *O. mykiss* up to 300 mm in length (Fisher 1959a).

In April 1979, DFG electrofished two sites above the reservoir on Conn Creek in relation to an oil spill. Approximately 400 feet upstream of Linda Falls, five *O. mykiss* were caught (131-192 mm FL). Behind the Angwin Fire Station on College Road, another seven *O. mykiss* were collected (95-157 mm). Additional *O. mykiss* were seen at both sites, but evaded capture (Cox 1979).

In September 1988, DFG electrofished two reaches on Conn Creek above the reservoir, near the Rossi Road Bridge. A total of seven *O. mykiss* were caught measuring 55-186 mm in length (Gray 1988a).

Leidy found *O. mykiss* downstream of the reservoir at two locations electrofished in July 1994. Just downstream from Domain Chandon vineyard he caught five *O. mykiss* (78-100 mm FL) with an estimated density at 10 per 30 meters of stream. At the confluence with Rector Creek, he collected two *O. mykiss* (75, 95 mm) and estimated density at 5 fish per 30 meters (Leidy 2002).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Two Conn Creek reaches were surveyed, and *O. mykiss* were not observed (Ecotrust and FONR 2001).

Rector Creek

Rector Creek is tributary to Conn Creek downstream of Hennessey Reservoir. It drains an area of 12 square miles (DCE 1999). Rector Reservoir, located immediately upstream of the Silverado Trail, is a complete barrier to upstream steelhead migration.

In December 1985, DFG electrofished a 300 meter reach of Rector Creek upstream of Rector Reservoir. A total of 41 *O. mykiss* (52-116 mm FL) were caught and kept for disease analysis. One female and three males were found to be sexually mature (Gray 1986b).

In March 1986 DFG electrofished Rector Creek between the Silverado Trail and the spillway of Rector Reservoir, which was spilling at the time of the survey. Three adult *O. mykiss* (approximately 305 mm FL) and 30 *O. mykiss* juveniles (100-150 mm) were caught. Some fish were silvery, indicating smolt transformation (Emig 1986).

In February 1988, DFG electrofished approximately 600 meters of Rector Creek upstream from the reservoir collecting *O. mykiss* for bacterial kidney disease analysis. A total of 53 *O. mykiss* were caught ranging in size from 60-400 mm FL. According to DFG, the two largest individuals (315 and 400 mm) were in spawning condition (Gray 1988b). A 2004 survey found *O. mykiss* in Rector Creek (J. Koehler pers. comm.).

Chiles Creek

Chiles Creek originates in Chiles Valley and drains an area of about 20 square miles. The creek has a channel length between the headwaters and the mouth of approximately 7.8 miles. Chiles Creek is tributary to Conn Creek via Lake Hennesey and has one major tributary, Moore Creek.

In July 1945, the year Hennesey Dam was constructed, DFG sampled Chiles Creek upstream of the mouth of Moore Creek and caught *O. mykiss* to 75 mm in length (Curtis 1945a). In August 1945, several 100 mm *O. mykiss* were observed during a poisoning operation (Curtis 1945b). In September 1945, DFG found that the lower two miles of Chiles Creek were dry, but noted numerous *O. mykiss* upstream (Ott 1945).

In 1946, DFG noted that a moderately large population of trout, from fingerlings to 200 mm in length, was present in the tributary streams of Conn Valley Reservoir (Murphy 1949). By 1948, practically no trout were seen in the tributary streams (Murphy 1949).

Six *O. mykiss* were collected by DFG from Chiles Creek in April 1947. The fish ranged from 148-320 mm in length. Scale analysis demonstrated that they were not hatchery fish (CDFG 1947). The resulting report noted that the presence of large numbers of trout fingerlings indicated that steelhead stock had spawned in Chiles Creek that season (Curtis 1947a). A DFG note indicated that conservatively, 75,000 *O. mykiss* YOY were present in three miles of Chiles Creek examined in May 1947 (Shapovalov 1948).

In August 1947, DFG found no trout at several sites upstream of the Whiskey Crossing Bridge (*i.e.*, two miles upstream of the mouth), but found several 150-255 mm *O. mykiss* immediately downstream of the bridge (Curtis 1947a). In July 1949, thorough surveys in this reach revealed no YOY *O. mykiss*, although a few 150-255 mm *O. mykiss* were found just downstream of the Whiskey Crossing Bridge (CDFG 1950).

In August 1956, DFG visually surveyed Chiles Creek where access permitted, between the mouth and 0.5 mile upstream of the headwater fork. A few rainbow trout were seen in the middle flowing portion of the stream (Fisher 1956).

In September 1990, DFG electrofished one site on Chiles Creek along Chiles-Pope Valley Road near Mile Marker 2.75. One *O. mykiss* (150 mm FL) was caught and at least two of the same size were observed but evaded capture (Gray 1990a).

Moore Creek

Moore Creek flows generally south to join Chiles Creek about one and one-half mile east and upstream of Lake Hennessey. The creek's headwaters are east of the town of Angwin and are perennial.

A July 1945 DFG field note reported *O. mykiss* in Moore Creek approximately 1.5 miles upstream of the Chiles Creek confluence (Curtis 1945c). In August 1945, DFG staff observed numerous trout in Moore Creek (Ott 1945).

In September 1990, DFG electrofished sites up- and downstream of a wooden bridge over the creek. A total of 30 *O. mykiss* were caught ranging from 48-146 mm FL (Gray 1990c).

Sage Creek

Sage Creek is tributary to Conn Creek via Lake Hennessey. The creek consists of approximately 5.2 miles of channel.

In June 1940, a DFG visual survey of the entire length of Sage Creek found steelhead (100-125 mm) to be common (Shapovalov 1940c). In July 1945, DFG siene sampling on Sage Creek approximately four miles upstream of Chiles Creek produced only YOY *O. mykiss* (Curtis 1945a). A subsequent poisoning operation found 104 *O. mykiss* ranging from 40-65 mm in length, and one 75 mm individual in an isolated pool (Curtis 1945b).

In 1946, DFG noted that a moderately large population of trout, from fingerlings to 200 mm in length, was present in the tributary streams of Conn Valley Reservoir (Murphy 1949). In August 1947, DFG found *O. mykiss* fingerlings to be fairly plentiful in Sage Creek at a reach about two miles upstream of the mouth (Curtis 1947b). By 1948, DFG noted that practically no trout were present in the tributary streams (Murphy 1949).

In March 1956, DFG received reliable reports that an *O. mykiss* spawning run occurred up Sage Creek from Lake Hennessey in the early spring (Evans 1956). In August 1956, DFG found *O. mykiss* ranging in size from 125-255 mm to be common in the middle section of the creek (Evans et al. 1956). *Oncorhynchus mykiss* were assumed to be derived from the steelhead stock that migrated into the reaches upstream from the lake prior to its filling (Evans et al. 1956).

In September 1990, DFG electrofished Sage Creek near the confluence of its tributary, Fir Canyon Creek. A total of six *O. mykiss* were collected from the main channel and the tributary (Gray 1990f).

Leidy caught two *O. mykiss* (81, 160 mm FL) when he electrofished Sage Creek immediately upstream from the junction of Pope Valley and Sage Creek roads in July 1996 (Leidy 2002).

Bale Slough

Bale Slough is a small Napa River tributary that enters the river from the west in the vicinity of Rutherford. According to DFG, Bale Slough serves primarily as a migration corridor for steelhead into and out of Bear Canyon Creek (Elwell 1958a).

In June 1981, DFG visually surveyed the lower one-mile of Bale Slough to locate stranded steelhead. The channel was dry and thus no fish were observed (Ambrosins 1981a). Juvenile *O. mykiss* were observed in Bale Slough in 2004 (J. Koehler pers. comm.).

Bear Canyon Creek

Bear Canyon Creek flows generally east from its headwaters near the Sonoma/Napa county border. The creek is perennial and is tributary to Bale Slough.

In October 1958, DFG visually surveyed the lower 4.5 miles of Bear Canyon Creek. Approximately 1.5 miles upstream of the confluence with Bale Slough, a 25-foot concrete dam at the Inglenook Winery was identified as a barrier to upstream migration. *Oncorhynchus mykiss* averaging 75 mm in length were fairly common in the 0.5-mile section of the creek with water in it downstream of the Inglenook Dam. Also, *O. mykiss* from 75–150 mm were common throughout the three miles surveyed upstream of the dam (Elwell 1958h). The survey noted that this stream was one of the better spawning reaches in the Napa River drainage (Elwell 1958h).

In May 1966, DFG surveyed Bear Canyon Creek downstream of the Inglenook dam. Steelhead juveniles at an estimated density of 15 per 30 meters were found in the 0.5-mile perennial reach directly downstream of the dam (CDFG 1966).

In September 1975, DFG surveyed the lower 3.3 miles of Bear Canyon Creek and the tributaries in this reach. *Oncorhynchus mykiss* were observed throughout the surveyed reach, but were most abundant upstream of the Inglenook Dam. *Oncorhynchus mykiss* ranged in size from 25–255 mm TL and averaged 75–100 mm (Henry and Van Zandt 1975). Density was estimated at 35 fish per 30 meters throughout the surveyed section.

In regards to an application to divert water from Bear Valley Creek in 1995, DFG stated that Bear Valley Creek supported a run of steelhead trout (Turner 1995). Minimum in-stream flows were required as a condition of approval of the proposed diversion. The application was later withdrawn.

Sulphur Creek

Sulphur Creek drains an area of about ten square miles and consists of about 4.2 miles of channel (DCE 1999). It is perennial in its upper reaches and flows generally east from its headwaters near the Sonoma/Napa county border to join the Napa River east of the town of St. Helena.

In August 1941, a DFG survey noted *O. mykiss* in Sulphur Creek at the McLure Kelley Ranch. Residents reported a steelhead run. Stocking was not recommended, presumably because the lower reach was reported to dry up in July before reaching the Napa River (Curtis 1941a).

In 1957 the local game warden identified Sulphur Creek as one of the most important steelhead spawning tributaries to the Napa River (Elwell 1957b). The warden had observed steelhead in the 1.5 mile reach upstream from the bridge at Highway 29. In October 1958, DFG visually surveyed Sulphur Creek from the mouth to the headwaters. *Oncorhynchus mykiss* ranging from 50-150 mm long were common in the lower section of the creek. The upper-most portion had fewer trout. The survey report noted that the lower portion of the creek was typically dry during the summer (Elwell and Jones 1958).

In August 1969 DFG electrofished Sulphur Creek at Sulphur Canyon Road. Steelhead density was estimated at 170 fish per 30 meters of stream for the reach. A total of 164 fish were collected, with 35 measured fish having a size range of 33-86 mm FL and one larger individual measuring 135 mm (Anderson 1969f).

In May 1980, DFG visually surveyed Sulphur Creek from the mouth to the headwaters, and electrofished four sites. Six *O. mykiss* ranging from 39-63 mm in length were caught in St. Helena near the confluence with the Napa River. Two *O. mykiss* (57 mm and 245 mm) were collected in Sulphur Canyon and 17 *O. mykiss* (33-270 mm) were caught at the headwater fork (Ellison and Hobson 1980).

In June 1981, DFG rescued 525 steelhead YOY trapped in a drying, intermittent reach of Sulphur Creek. Another 165 YOY steelhead (37-82 mm FL) died due to handling. The largest fish was positively identified as YOY by scale analysis (Ellison 1981b).

In July 1989, DFG electrofished three sites on Sulphur Creek from the White Sulphur Springs Resort to the confluence with Iron Mine Creek. All sites had juvenile steelhead measuring approximately 60 mm FL, with one individual at nearly 80 mm FL (Week 1989).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of five Sulphur Creek reaches and two reaches in a tributary, three reaches were found to have *O. mykiss* at density level "1," while one reach had density level "2" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in numerous Sulphur Creek reaches, including three reaches at density level "3" (Ecotrust and FONR 2002).

Heath Canyon Creek

Heath Canyon Creek is tributary to Sulphur Creek. According to staff at the Napa County Resource Conservation District, local landowners report the presence of *O. mykiss* in this stream historically (J. Koehler pers. comm.). A 2001 survey noted juvenile *O. mykiss* in Heath Canyon Creek (J. Koehler pers. comm.).

Iron Mine Creek

Iron Mine Creek is tributary to Sulphur Creek. In July 1989, DFG electrofished the lower 0.1 mile of Iron Mine Creek as well as a site on the Marston Vineyard near a water diversion. One *O. mykiss* (60 mm FL) was found approximately 300 yards upstream of the mouth (Week 1989).

Staff from the Napa County Resource Conservation District report juvenile *O. mykiss* in the south fork of Sulphur Creek (Iron Mine Creek) currently. Snorkel survey and visual observations were made in 2001 and 2002, respectively (J. Koehler pers. comm.).

York Creek

York Creek originates on the western side of the Napa Valley and joins the Napa River near the city of St. Helena. St. Helena operates diversion facilities in the York Creek channel that divert water into a larger off-channel reservoir. The creek drains about six square miles and consists of approximately 7.2 miles of channel, including tributary reaches.

A 1941 DFG report noted anecdotal evidence of trout in York Creek upstream of a 12-foot dam in the middle reach of the creek (Curtis 1941b). In 1962, DFG determined that two diversion dams restricted all flow during the critical steelhead egg incubation period. A study was recommended to determine adequate flow releases to protect steelhead spawning and whether to require provision for fish passage at the dams (Day 1962).

In July 1973, DFG visually surveyed portions of York Creek from the mouth to the second diversion dam. No *O. mykiss* were observed (Nelson and Finlayson 1973). In June 1974, DFG again surveyed York Creek from the mouth to the upper end of St. Helena's reservoir. Both YOY (estimated at over 100 per 30 meters) and age 1+ steelhead (20 per 30 meters) were abundant between the Spring Mountain Road Bridge in St. Helena and the upper reservoir (Bruns 1974).

In August 1975, DFG visually surveyed York Creek from the city of St. Helena reservoir upstream to the headwaters. *Oncorhynchus mykiss* juveniles (25-100 mm) believed to be from steelhead decent were observed at approximately 20 per 30 meters throughout the surveyed reach (Henry 1975).

In June 1981, while locating stranded fish for rescue, DFG observed salmonids in York Creek near the Highway 29 crossing and the mouth (Ambrosins and Hams 1981). In April 1986, DFG electrofished a 150 meter reach upstream from the in-channel reservoir. A total of ten *O. mykiss* were caught ranging in size from 92-198 mm (Gray 1986f). The fish were assumed to be resident, as the two downstream dams were deemed impassable to steelhead (Gray 1986f).

In August 1992, DFG identified one dead *O. mykiss* in York Creek and discovered evidence of more dead *O. mykiss* that had been consumed by scavengers. The DFG report noted the presence of recent sediment deposition up to 18 inches deep, which likely resulted from operations at the city of St. Helena in-channel reservoir (Emig 1992c).

In September 2000, DFG electrofished York Creek downstream of the York dam along Spring Mountain Road. Juvenile steelhead were abundant and uniformly distributed throughout the entire reach (Cox 2000). The vast majority was YOY (40-100 mm), with lesser numbers of age 1+ (100-140 mm) and still fewer age 2+ and 3+ individuals (140-180 mm). The survey also revealed an unusually large number of older *O. mykiss* (200-250 mm), which was attributed to particularly good physical conditions (e.g., shade, pools, food, and instream cover) rather than anadromy (Cox 2000).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of seven York Creek reaches, two were found to have *O. mykiss* at density level "1," while two reaches had density level "2" (Ecotrust and FONR 2001).

Bell Canyon Creek (Howell Creek)

Bell Canyon Creek drains approximately 14 square miles. It enters the Napa River about 2.5 miles north of St. Helena. The creek historically was a perennial steelhead stream that maintained flow in the headwaters even after numerous diversions caused the lower reach to become intermittent. Bell Canyon Reservoir, constructed in 1958, blocked steelhead passage to the upper, perennial reaches. The dam is located about two miles upstream from the Napa River confluence.

In February 1957, DFG visually surveyed portions of Bell Canyon Creek accessible by car, from the mouth upstream about 3.5 miles. No *O. mykiss* were observed, but residents stated that they had observed many small steelhead in the middle and lower sections of the creek in the early part of the year (Elwell 1957a).

In May 1958, DFG visually surveyed Bell Canyon Creek from the headwaters to a point approximately 3.5 miles upstream from the mouth. *Oncorhynchus mykiss* (40-50 mm) were common in the lower portion of the surveyed reach and appeared to be YOY (Elwell 1958i). A large population of *O. mykiss* (100-150 mm) that was deemed to be native stock was observed downstream of a natural falls about 5.5 miles upstream of the mouth (Elwell 1958i).

A May 1966 DFG field note identified *O. mykiss* (40-100 mm) at 5 per 30 meters in a flowing reach of Bell Canyon Creek downstream of Bell Canyon Reservoir. In another downstream reach with water in the channel, *O. mykiss* were estimated at 100 per 30 meters. In the lower 30 meters of this reach, approximately 100 dead *O. mykiss* were found (Brackett and Duff 1966).

A 1967 DFG memorandum stated that 2.5 miles of Bell Canyon Creek were available to steelhead prior to construction of Bell Canyon Reservoir. The memo noted the obligation by DFG to substantiate their claim for a flow release of 5 cubic feet per second from the reservoir (Nokes 1967).

In June 1969, DFG visually surveyed two miles of Bell Canyon Creek from the mouth to the reservoir. *Oncorhynchus mykiss* (25-365 mm) were observed in intermittently flowing reaches at densities of 50-100 fish per 30 meters. Maximum density was noted immediately upstream of the confluence of the south fork (Howell Creek) (Thompson and Michaels 1969). In July 1969, DFG conducted an electrofishing survey in the same reach. Steelhead (40-150 mm FL) were estimated at 86 fish per 30 meters at a site one mile downstream of the Bell Canyon Dam, and 34 fish per 30 meters at the confluence with the south fork. The report conservatively estimated a steelhead standing crop of 4,100 fish (Anderson 1969e).

A 1970 DFG memorandum regarding St. Helena water rights states that Bell Canyon Creek at that time supported an average annual run of approximately 40 to 50 adult steelhead. The memo included an estimate of run size prior to construction of the reservoir of about 100 adult fish (Greenwald 1970).

In July 1975, DFG visually surveyed Bell Canyon Creek from the mouth to the reservoir. Intermittently flowing reaches had *O. mykiss* from 13-100 mm in length, at approximately 25 fish per 30 meters (Coleman and Van Zandt 1975). In April 1978, DFG investigated a fish kill downstream of the Bell Canyon Reservoir chlorination facility. Staff found 106 dead YOY steelhead (mean length 57 mm) and one larger individual (~200 mm) (Cox 1978).

In July 1981, DFG observed steelhead juveniles at the Silverado Trail and the Glen Mountain Lane crossings, but found the mile of channel below the reservoir to be dry (Harris and Ambrosins 1981a). In June 1987, DFG visually surveyed Bell Canyon Creek from the mouth to the reservoir. *Oncorhynchus mykiss* were observed averaging 50 mm in length. Natural propagation of *O. mykiss* was not considered “good” in the system (Montoya 1987a).

In August 1990, DFG electrofished Bell Canyon Creek sites to determine if the reach upstream of the reservoir contained *O. mykiss*. The survey area upstream from Angwin contained pools suitable as trout habitat, but no *O. mykiss* were observed (Gray 1990h).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of *O. mykiss* was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of four Bell Canyon Creek reaches, one was found to have *O. mykiss* at density level “1” (Ecotrust and FONR 2001).

Mill Creek

Mill Creek consists of about 3.2 miles of channel draining about 1.75 square miles. The creek enters the Napa River about three miles north of St. Helena.

In July 1965, DFG visually surveyed the length of Mill Creek between the mouth and Stone Hill Winery. The stream was dry at the mouth, but the flowing middle reach had 150-200 *O. mykiss* fingerlings per 30 meters (Culley and Fox 1965). Survey notes from May 1966 indicated that DFG found *O. mykiss* (25-175 mm) at densities of 25-50 fish per 30 meters throughout the length of Mill Creek (Brackett and Duff 1966).

In August 1978, DFG visually surveyed Mill Creek from its mouth to one mile downstream of the headwaters. *Oncorhynchus mykiss* averaging 50 mm in length were observed with estimated densities of 25-50 fish per 30 meters in the upper and lower surveyed reaches, and 5-10 fish per 30 meters in the middle reach (Lee and Namba 1978a).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of nine Mill Creek reaches, three were found to have *O. mykiss* at density level "1," while two reaches had density level "2" and one reach had level "3" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in numerous Mill Creek reaches, including two reaches at density level "3" (Ecotrust and FONR 2002).

Ritchie Creek

Ritchie Creek drains an area of 2.8 square miles and consists of approximately 3.5 miles of channel. The creek joins the Napa River approximately three miles south of the city of Calistoga.

In March 1964, DFG responded to reports of adult steelhead attempting to jump a diversion dam in Bothe-Napa Valley State Park. Up to ten adult steelhead had been seen by park officials at any one time attempting to pass the obstacle. Staff from DFG found an adult male (510 mm) and female (660 mm) that were moved upstream of the dam (Jones 1964b). In December 1965, DFG requested the State Division of Beaches and Parks remove or modify the dam for fish passage (Greenwald 1965b).

In July 1967, DFG visually surveyed Ritchie Creek between the mouth and the headwaters. Upstream of the eight foot diversion dam, juvenile steelhead (50 -75 mm) were estimated at a density of five individuals per 30 meters. Upstream from the Highway 29 bridge, steelhead density was determined to be10 per 30 meters, and six measured fish ranged from 50-140 mm. Near the mouth, steelhead were estimated at 25 fish per 30 meters in pools, with the largest individual measuring approximately 250 mm (Thompson 1967d).

In August 1969, DFG electrofished Ritchie Creek at two locations. At a site just upstream of Highway 29, 40 *O. mykiss* were caught (43-152 mm FL), at an estimated density of 52 individuals per 30 meters. Upstream of the diversion dam, 56 *O. mykiss* were caught, with lengths measuring from 46-79 mm excluding a 102 mm and a 122 mm fish. Density upstream of the dam was estimated at 71 fish per 30 meters. Based on the sampling results, a standing crop of 7,000 juvenile steelhead was estimated for Ritchie Creek (Anderson 1969d).

In October 1973, DFG visually surveyed Ritchie Creek from the mouth to the headwaters. Steelhead from 75–150 mm were observed at densities of 15 fish per 30 meters downstream of the diversion dam, and 40 fish per 30 meters upstream of the dam (Finlayson 1973). According to DFG, the creek at that time offered good spawning and nursery areas for steelhead trout (Finlayson 1973).

In July 1978, DFG visually surveyed Ritchie Creek from its mouth to the headwaters. Steelhead 50–100 mm in length were observed in the upper portions of the creek. Estimated population density was five fish per 30 meters (Lee and Namba 1978b).

In May 1984, DFG visually surveyed Ritchie Creek from its mouth to the headwaters. Juvenile *O. mykiss* were observed from immediately upstream of its confluence with the Napa River, to the upper reaches of the stream (Emig 1984d). In addition to numerous 40-50 mm juveniles attributed to a recent stocking event, additional *O. mykiss* ranging from 25–150 mm were believed to indicate that recent spawning of anadromous steelhead had occurred (Emig 1984d).

In December 1989, DFG electrofished Ritchie Creek upstream of the diversion dam within Bothe Napa Valley State Park. A total of seven *O. mykiss* were caught ranging from 57–148 mm FL (Gray 1990e).

A 1993 correspondence states the intention of California Department of Parks and Recreation in cooperation with DFG to remove the diversion dam on Ritchie Creek. The removal was to make an estimated two miles of spawning and rearing habitat available to steelhead (Hunter and Getty 1993).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of seven Ritchie Creek reaches, three were found to have *O. mykiss* at density level "1," while three reaches had density level "2" (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in numerous Ritchie Creek reaches, including four reaches at density level "3" (Ecotrust and FONR 2002).

Dutch Henry Creek

Dutch Henry Creek consists of about 4.5 miles of stream channel and enters the Napa River near the midway point between Calistoga and St. Helena. It is characterized as having intermittent flow and has one notable tributary, Biter Creek.

In November 1958, DFG visually surveyed Dutch Henry Creek from the mouth to its headwaters. Although the lower channel was completely dry, *O. mykiss* averaging 75-125 mm in length were present in the intermittent, spring-fed pools in the middle and upper sections of the drainage (Elwell 1958j). A 1958 DFG evaluation stated that all of the approximately four miles of stream in the Dutch Henry Creek drainage was used by steelhead (Elwell 1958b). The evaluation noted that, except for intermittent springs in the upper portion of the drainage, the entire stream was dry in the summer-fall months (Elwell 1958b).

In June 1981, DFG visually surveyed 1.8 miles of Dutch Henry Creek upstream from its mouth. The channel was completely dry and no fish were found (Harris and Ambrosins 1981d). On two occasions in February 1987, DFG electrofished the creek immediately upstream and downstream of the Silverado Trail. During the first sampling, four *O. mykiss* were caught, ranging from 150-200 mm FL in size. The second sampling produced several *O. mykiss*, ranging in length from 50-75 mm. In the week between the sampling events, stream flow decreased from 3-4 cubic feet per second to 0 cubic feet per second (Gray 1987a). Staff of the Napa County Resource Conservation District reports observations of *O. mykiss* in Dutch Henry Creek in 2001 (J. Koehler pers. comm.).

Nash Creek

Nash Creek is tributary to the Napa River and drains a portion of the western slopes of the Napa Valley. Flow is intermittent, with springs present in the upper reaches.

In July 1965, DFG visually surveyed the approximately two-mile length of Nash Creek and found it completely dry (Culley and Fox 1965). The DFG surveyor stated there were no spawning or nursery areas in the creek.

In May 1974, DFG visually surveyed Nash Creek from the mouth to a diversion dam approximately 0.7 miles upstream. With the exception of the intermittent reaches adjacent to springs, the channel was dry. No fish were observed, but the DFG surveyor speculated that prior to water diversions, Dutch Henry Creek was capable of supporting steelhead runs (Lee 1974).

Diamond Mountain Creek

Diamond Mountain Creek is tributary to St. Helena Reservoir and consists of about 1.5 miles of channel. Both spawning and rearing habitats for *O. mykiss* have been identified in the creek (Culley and Fox 1965).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Diamond Mountain Creek was found to have *O. mykiss* at level "1" density (Ecotrust and FONR 2001).

Simmons Creek

Simmons Creek consists of about 3.5 miles of channel and joins the Napa River approximately one mile southeast of the town of Calistoga. Its headwaters are on the slopes of the Napa Valley northeast of Calistoga.

In November 1958, DFG visually surveyed the lower reaches of Simmons Creek by car and the upper reaches on foot. No fish were observed. The local game warden reported he had never seen steelhead in Simmons Creek. The DFG surveyor suggested the absence of fish was the result of the stream's tendency to become dry as early as late April (Elwell 1958m). In a 1958 letter, DFG stated that two miles of Simmons Creek were utilized by spawning steelhead (Elwell 1958d).

In June 1981, DFG visually surveyed the lower 1.8 miles of Simmons Creek for the purpose of rescuing steelhead stranded by low flows. Small numbers of *O. mykiss* were observed in pools downstream of a spring located approximately 0.5 miles upstream of the mouth (Ambrosins and Harris 1981).

Cyrus Creek

Cyrus Creek is tributary to Porter Creek. It consists of about 1.75 miles of channel. The creeks' confluence is located approximately one mile west of Calistoga. A steelhead barrier is presented by the Calistoga water supply reservoir on the creek 0.2 miles upstream of the Porter Creek confluence (Jones 1964c).

In January 1964, DFG visually surveyed Cyrus Creek from the mouth to the headwaters. *Oncorhynchus mykiss* (65-100 mm) were observed in bedrock areas at about 5-8 per 30 meters. Propagation and conditions were considered successful enough to warrant protection of flows and to consider modifying a diversion dam to allow steelhead migration (Jones 1964c).

In June 1981, DFG visually surveyed the lower 1.2 miles of Cyrus Creek again, finding surface water only in standing pools near the mouth. No *O. mykiss* (or any other fish) were seen (Harris and Ambrosins 1981c).

Leidy found *O. mykiss* at two locations electrofished on Cyrus Creek in July and August 1997 (Leidy 2002). Immediately downstream of Calistoga's old water supply reservoir he rescued seven *O. mykiss* (111-195 mm FL) from an isolated pool. At 501 Petrified Forest Road Leidy caught ten *O. mykiss* (47-250 mm) in a 30-meter reach (Leidy 2002).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Two Cyrus Creek reaches were surveyed, and *O. mykiss* were not observed (Ecotrust and FONR 2001). Follow-up surveys were performed between June and September 2002. *Oncorhynchus mykiss* were found in four Cyrus Creek reaches (Ecotrust and FONR 2002).

Garnett Creek

Garnett Creek originates on the northeast side of the Napa Valley, north of Calistoga. It drains approximately six square miles of the southern slopes of Mount Saint Helena and The Palisades.

In June 1970, DFG visually surveyed Garnett Creek from the mouth to 1.5 miles upstream of the Highway 29 Bridge. *Oncorhynchus mykiss* were observed ranging in size from 50-180 mm. Fish were present in intermittent and flowing reaches at densities of approximately 40 per 30 meters in the upper reaches, and 10 per 30 meters in the lower reaches. Residents told the DFG surveyors that springs provided perennial flow in the headwaters (Albert et al. 1970).

In May 1981, DFG rescued 1,189 YOY steelhead from eight isolated pools in Garnett Creek. An additional108 steelhead died in the process. *Oncorhynchus mykiss* ranged in size from 40-70 mm FL (Ellison 1981a).

In July 1984, DFG visually surveyed Garnett Creek from just downstream of Highway 29 to the Old Toll Road crossing. Although much of the streambed was dry, steelhead were abundant in pools at all sites where water was found. Steelhead typically ranged from 50-75 mm TL, with one 150 mm trout observed (Emig 1984a).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of four Garnett Creek reaches, one was found to have *O. mykiss* at density level “1” (Ecotrust and FONR 2001).

Jericho Canyon Creek

Jericho Canyon Creek drains an area of about one square mile. It enters Garnett Creek approximately 0.25 miles upstream from Highway 29.

In July 1970, DFG visually surveyed approximately two miles of Jericho Canyon Creek upstream from the mouth. The channel was dry or intermittent for approximately 0.5 miles upstream of the confluence with Garnett Creek. *Oncorhynchus mykiss* (50-330 mm) were found downstream of a series of falls located about 0.5 miles upstream of the Old Toll Road Bridge. Densities were estimated at 30 fish per 30 meters in the middle sections and10 fish per 30 meters in the upper sections (Albert and Thompson 1970).

In July 1984, DFG visually surveyed Jericho Canyon Creek from its mouth to one mile upstream of the Highway 29 crossing. The lower section of the stream was dry, but juvenile steelhead (50-75 mm FL) at an estimated density of 200 fish per 30 meters were observed at RM 1.5 downstream of an impassable barrier. The barrier was a 15-foot chute located about 0.5 miles upstream of the Old Toll Road crossing. No fish were observed in the approximately two miles of the survey area upstream of the chute. Numerous other potentially impassable barriers were found upstream of the chute (Emig 1984b).

Ecotrust and FONR carried out surveys in tributaries of the Napa River system in July and August 2001. Relative density of steelhead was noted between 1 and 3, with 3 indicating greater than one individual per square meter. Of three Jericho Canyon Creek reaches, one was found to have *O. mykiss* at density level "3" (Ecotrust and FONR 2001).

Kimball Canyon Creek

The Napa River becomes Kimball Canyon Creek above St. Helena Reservoir. Kimball Canyon Creek consists of about 5.5 miles of channel draining the area north and slightly west of Calistoga. St. Helena Reservoir, operated by the St. Helena Water District, is located approximately four miles upstream of the mouth. This reservoir controls flows into the creek and is a complete barrier to upstream migration.

In May 1957, DFG visually surveyed points accessible by car on Kimball Canyon Creek. A few fingerling steelhead (25-40 mm) were observed and were deemed to have originated from a natural population. The game warden observed that steelhead used Kimball Canyon Creek about one in every four years, as flows permitted (Allen 1957).

In July 1965, DFG visually surveyed a headwaters tributary to the Napa River west of Kimball Canyon Creek from the mouth to the headwaters. Surveyors estimated the density of *O. mykiss* fingerlings at 100-200 fish per 30 meters of stream (Culley and Fox 1965).

Leidy electrofished Kimball Canyon Creek at two locations in July 1997. He caught no *O. mykiss* in a pool at the mouth of the creek below the elevation of the full reservoir (Leidy 2002). However, approximately 0.2 miles upstream he found 12 *O. mykiss* (50-242 mm FL) in a five-meter riffle-pool sequence.

Assessment: In 1962, DFG called the Napa River "the most important steelhead stream in the counties bordering San Francisco Bay" (CDFG 1962, p. 1). Steelhead historically reproduced in most of the tributary and headwater drainages of the Napa River, although they now are reduced substantially in abundance. We are not aware of recent estimates of the size of the Napa River steelhead run. However, previous estimates place the historical run in the range of 6,000 to 8,000 individuals (Anderson 1972; USFWS and CDFG 1968).

In a 1940 DFG report, Shapovalov observed that the Napa River and its tributaries typically had very low water in the dry season, and that the carrying capacity of these streams for trout was filled by naturally propagated steelhead (Shapovalov 1940b). More recent DFG assessments of the Napa River watershed also indicated that the main limiting factor for steelhead production in the drainage was the lack of adequate nursery areas.

Water diversions from the basin that affect over-summering habitat in quality or extent, therefore, would be expected to directly impact the Napa River system *O. mykiss* population. In 1963, DFG noted, "With the increasing water development in the drainage, nursery areas are disappearing fast" (Robinson 1963, p. 1). A 1969 DFG paper noted that Dry Creek provided the greatest amount of nursery habitat in the Napa River watershed, and that Redwood Creek and Sulphur Creek also were important contributors to the steelhead standing crop (Anderson 1969f). In 1962, DFG listed these three creeks, as well as Soda Creek, as "major" spawning areas (CDFG 1962). Diversions from these drainages are particularly important to steelhead abundance.

Recent surveys carried out by the Friends of the Napa River and Ecotrust indicated that *O. mykiss* are still present in numerous Napa River watershed tributaries, with the highest densities typically recorded in Napa Valley's west-side tributaries such as Redwood and Dry creeks (Ecotrust and FONR 2001). *Oncorhynchus mykiss* density in Sulphur Creek appears to be reduced substantially from historical levels.

The Napa River drainage possibly remains the most important steelhead fishery resource for the San Francisco Estuary, although on-going water development for agricultural uses poses a serious threat to this status. Recovery strategies for Napa River steelhead must address instream flow provisions in order to be successful.

Fagan Creek Watershed

Fagan Creek issues into the Napa River tidal slough. A 15-foot drop on the south side of the Highway 12 crossing may serve as a barrier to migration.

Fagan Creek

In September 1981, two Fagan Creek sites were sampled by dip net as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984). Ecotrust and FONR surveyed Fagan Creek between May and September 2002. *Oncorhynchus mykiss* were not observed in Fagan Creek reaches (Ecotrust and FONR 2002).

Assessment: Insufficient information is available to assess the historical and current status of Fagan Creek as a resource contributing to salmonid populations. Recent surveys indicate that the creek system likely is not used by anadromous fish.

American Canyon Creek Watershed

American Canyon Creek issues into the Napa River tidal slough. It drains the area immediately north of the city of Vallejo.

American Canyon Creek

Two American Canyon Creek sites were sampled with dip nets as part of a fish distribution study in September 1981. No *O. mykiss* were found at either the American Canyon Road or the Elliot Road sampling sites (Leidy 1984).

A 30-meter reach of American Canyon Creek was sampled by electrofishing in October 1997. *Oncorhynchus mykiss* was not found (Leidy 2002). Ecotrust and FONR surveyed the north and east forks of American Canyon Creek between May and September 2002. *Oncorhynchus mykiss* were not observed in American Canyon Creek reaches (Ecotrust and FONR 2002).

Assessment: Insufficient information is available to assess the historical status of American Canyon Creek as a resource contributing to salmonid populations. Recent surveys indicate that the creek system likely is not used by anadromous fish.

Table IX-2. Distribution status of O. mykiss in San Francisco Estuary streams of Napa County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
Huichica Creek	Huichica	11/7	1970-2002	1, 2, 3	J/5; R/3	Y	DF	DF	Y	1	46, 47, 91, 102, 115, 133, 143, 152
Napa River	Napa River	11/4	1961-97 **1998**	0. 1, 2, 3	J/3; S/1; M/2	Y	DF	DF	Y	1, 2, 3	9, 10, 14, 22, 33, 41, 42, 88, 103, 144, 146, 154, 179
	Carneros	4/1	1958-2002	0, 1, 3	R/1; M/1	Y	DF	DF	Y	1	44, 46, 62, 89, 117
	Suscol	6/4	1949-2002	0, 1, 2, 3	J/3; S/1; R/1; M/1	Y	DF	DF	Y	1, 2, 3	19, 26, 46, 144, 161
	Tulucay	4/2	1958-2001	1, 2, 3	J/2; R/2	Y	DF	DF	Y	1, 2, 3	44, 45, 61, 70, 72, 121
	Murphy	4/4	1968-2001	1, 2, 3	J/3; R/2; M/1	Y	DF	DF	Y	1, 2, 3	45, 77, 107, 135
	Spencer	2/2	2001-2002	3	-	Y	DF	DF	-	1	45, 46
	Napa	3/1	1958-2001	1, 2, 3	-	Y	DF	DF	Y	1	44, 45, 66, 144
	Browns Valley	2/0	2001	1	-	Y	DF	DF	-	1	45, 67, 145
	Redwood	12/8	1958-2002	1, 2, 3	J/10; R/4; M/2	Y	DF	DF	Y	1, 2, 3	11, 45, 46, 66, 74, 90, 94, 112, 127, 134, 144, 149, 171
	Pickle Canyon	6/5	1966-2002	1, 2, 3	J/4; R/1	Y	DF	DF	Y	1	6, 18, 45, 46, 126, 134, 170
	Milliken	15/9	1940-2002	1, 2, 3	J/8; R/4; M/3	Y	DF	DF	Y	1, 2, 3	5, 21, 44-46, 51, 81, 87, 123, 144, 148, 153, 172, 175

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Sarco	5/3	1990-2002	1, 2, 3	J/1; R/1	Y	DF	DF	Y	1, 2, 3	45, 46, 110, 144, 150, 151
	Camp	1/0	1940	1	J/1; R/1	N	DF	UNK	Y	0	167
	Salvador Outfall Channel	2/0	1977 **1987**	1, 2	M/1	UNK	DF	UNK	Y	0	17
	Soda	7/4	1940-2002	1, 2	J/3; R/1; M/2	UNK	DF	DF	Y	1	46, 50, 60, 69, 92, 95, 96, 166
	Dry	7/7	1969-2002	1, 2, 3	J/6; R/2; M/1	Y	DF	DF	Y	1, 2, 3	9, 16, 44-46, 53, 78, 99, 144
	Hopper	3/0	1976 **2001**	0, 1, 3	M/1	UNK	DF	PB	Y	0	45, 120, 159 (1)
	Hinman	4/1	1966-84 **1987**	1, 2, 3	J/2	UNK	DF	PS	Y	0	105, 125, 177 (1)
	Segassia Canyon	1/1	2002	1	-	UNK	DF	DF	-	1	46
	Wing Canyon	1/1	2002	1	-	UNK	DF	DF	-	1	46
	Campbell	2/1	1996-1997	0, 1, 2	J/2	Y	DF	DF	-	1, 2	80, 144
	Mont-gomery	2/1	2001	1, 3	-	Y	DF	DF	-	1	45, 128
	Conn	9/3	1945-94 **2001**	1, 2, 3	J/4; R/5	Y	DF	DF	Y	1, 2, 3	30, 44, 45, 86, 100, 155, 158

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Rector	4/4	1985-2004	2, 3	J/4; S/1; R/3	UNK	DF	DF	Y	1, 2	44, 76, 93, 101 (1)
	Chiles	7/2	1945-90	1, 2, 3	J/5; R/3	N	DF	PB	Y	0	24, 25, 36, 37, 39, 85, 104, 155, 158, 168
	Moore	2/1	1945-90	1, 2	J/1	N	DF	PS	Y	1	38, 106, 158
	Sage	8/2	1940-96	0, 1, 2, 3	J/6; R/2	N	DF	DF	Y	1, 2, 3	36, 37, 40, 82, 83, 109, 144, 155, 165
	Bale Slough	2/1	2004	1, 3	J/1	Y	DF	DF	-	1, 2	4, 56 (1)
	Bear Canyon	3/2	1958-75	1	J/3; R/1	UNK	DF	PB	Y	1	28, 63, 124, 174
	Sulphur	7/4	1941-2001	0, 1, 2, 3	J/5; R/1; M/2	Y	DF	DF	Y	1	14, 34, 44-46, 49, 52, 55, 71, 178
	Heath Canyon	2/1	2001	0, 3	J/1	Y	DF	DF	-	1, 2	(1)
	Iron Mine	1/1	1989	2	J/1	Y	DF	DF	Y	1	178 (1)
	York	9/4	1941-2001	0, 1, 2, 3	J/4; R/2	Y	DF	DF	Y	1, 2, 3	7, 23, 31, 35, 43, 45, 79, 97, 122, 178
	Bell Canyon	11/5	1957-2001	0, 1	J/8; R/2; M/1	Y	DF	DF	Y	1	13, 29, 32, 45, 54, 64, 66, 111, 114, 116, 147, 157, 169
	Mill	4/4	1965-2002	1, 3	J/2	Y	DF	DF	Y	1	22, 33, 45, 46, 141

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss		Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
							Hist.	Current			
	Ritchie	9/8	1965-2002	1, 2, 3	J/6; R/1; M/1	UNK	DF	DF	Y	1	12, 45, 46, 75, 84, 108, 113, 129, 131, 142, 173
	Dutch Henry	4/2	1958-2001	1, 2, 3	J/3; R/1	Y	DF	DF	Y	1, 2	57, 65, 98, 119 (1)
	Nash	2/0	0 **1974**	1	-	N	PS	NP	-	0	33, 140
	Diamond Mountain	2/2	1965	1, 3	J/1	N	PB	DF	Y	1	45, 140
	Simmons	2/0	1958-81	1	-	UNK	DF	PS	Y	0	8, 59, 68
	Cyrus	5/3	1964-2002	1, 2, 3	J/2; R/1	UNK	DF	DF	Y	1, 2, 3	45, 46, 118, 132, 144
	Garnett	4/4	1970-2001	1, 3	J/3; R/1	Y	DF	DF	Y	1	1, 45, 48, 72
	Jericho Canyon	3/3	1970-2001	1	J/2; R/1	Y	DF	DF	Y	1	2, 45, 73
	Kimball Canyon	4/2	1957-97	1, 2	J/2; R/1; M/1	N	DF	DF	Y	1, 2, 3	3, 33, 144
Fagan Creek	Fagan	2/0	0 2002	3	-	N	PS	NP	-	0	46, 143
American Canyon Creek	American Canyon	3/0	0 2002	2, 3	-	N	UNK	NP	-	0	46, 143, 144

[a] Table headings and codes are defined in the Methods section of this report.

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NAPA COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Napa County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Napa County, Caliornia.

SOLANO COUNTY

Unnamed Creek to Cordelia Slough Watershed

This creek drains the area between American and Jameson Canyons. It flows generally east to enter Cordelia Slough about one-half mile south of the town of Cordelia.

Unnamed Creek to Cordelia Slough

In July 1996, Leidy sampled the unnamed creek where it flowed through Ridgeview Park in the Oakbrook Drive development south of Cordelia and west of Interstate 680. He sampled the creek again in October, about 650 feet further upstream. *Oncorhynchus mykiss* was not found during either sampling effort (Leidy 2002).

In July 2003, *O. mykiss* were noted in an unnamed tributary to Cordelia Slough. Two *O. mykiss* (~175-200 mm) were seen in a pool east of Interstate 80, approximately 200 yards upstream of the Pacific Gas and Electric tower where a two-foot diameter pipe crossed the stream (Field biologist pers. comm.). Subsequent surveys found juvenile *O. mykiss*.

Green Valley Creek Watershed

Green Valley Creek is an intermittent to perennial stream that runs southeast where it is joined by Cook Canyon Creek, and then by Wild Horse Creek before entering the Green Valley. Green Valley Creek runs approximately 4.7 miles to Cordelia Slough.

Green Valley Creek

In 1958, DFG staff described the reach immediately above Highway 40 as having negligible function for fisheries (Elwell 1958). In a 1962 report, Skinner indicated that Green Valley Creek was an historical migration route and habitat for steelhead (Skinner 1962).

In October 1974, DFG surveyed Green Valley Creek in relation to the Via Palo Linda Bridge project. The survey report noted several juvenile steelhead observed upstream from the site (Week 1975).

In January 1975, DFG sampled four sites on Green Valley Creek by electrofishing. The sites were pairs of 30-meter reaches in downstream and upstream locations. *Oncorhynchus mykiss* occurred in each of the sites as follows: 1,500 feet downstream of the project site, 15 steelhead; 200 feet downstream, four steelhead; 300 feet upstream, 39 steelhead; and 1,750 feet upstream, 96 steelhead (Week 1975). Based on these results, DFG calculated the average *O. mykiss* density for undisturbed sections of the creek to be about 68 fish per 30 meters (Week 1975).

In June 1976, more than 50 YOY steelhead were reported in an unnamed tributary of Green Valley Creek flowing through the Green Valley Country Club. Thirty YOY steelhead were electroshocked, collected, and moved to the Napa River (Pinkham and Johnson 1976). The incident report noted some suitable spawning and rearing habitat areas in upstream portions of this creek, as well as YOY present in these reaches (Pinkham and Johnson 1976). One *O. mykiss* measuring 73.5 mm SL was collected from Green Valley Creek near Lake Frey in January 1979 (Courtois 1979).

According to residents living upstream of the Via Palo Alto Bridge, a steelhead run persisted in Green Valley Creek until approximately 1986 (Gray 1990). The Department of Fish and Game sampled this area by electrofishing in September 1990 and found one *O. mykiss* measuring 222 mm FL (Gray 1990).

Leidy sampled Green Valley Creek at two locations in 1994 and one location in 1996, all downstream of Interstate 80, and did not collect *O. mykiss* (Leidy 2002). However, in January 1997 he caught one *O. mykiss* (102 mm FL) approximately one mile upstream of Interstate 80 at Pavallion Court and another individual (100 mm) at a site about two miles upstream from Interstate 80 (Leidy 2002). The second site also contained one dead *O. mykiss* (~150 mm). Near Country Club Drive in Green Valley, Leidy caught one adult steelhead (480 mm) and two juveniles (92 mm, 92 mm) (Leidy 2002).

Wild Horse Valley Creek

Lake Frey and Lake Madigan were created on Wild Horse Valley Creek by construction of dams in 1894 and 1908, respectively. Fishways were not included in the dams. In 1940, DFG reported that the local warden considered both lakes to be "fine" trout lakes, but that steelhead stocking would be necessary for a continued fishery. Shapovalov cited absent or extremely limited spawning areas upstream of Lake Frey as precluding a self-sustaining steelhead population (Shapovalov 1940).

Assessment: *Oncorhynchus mykiss* has been collected in the Green Valley Creek drainage from the 1950s to the present. While the watershed is relatively small, its position adjacent to the Suisun Creek drainage provides habitat opportunities to salmonids migrating upstream from the Suisun and Cordelia Slough area.

Suisun Creek Watershed

Suisun Creek drains a 52 square mile drainage on the west side of the Vaca Mountains. The creek flows south where it is joined by Wooden Valley, Gordon Valley and Green Valley creeks. Suisun Creek enters Grizzly Bay in the northern part of the San Francisco Estuary via Cordelia Slough.

Suisun Creek

Lake Curry was formed by the construction of Gordon Valley Dam on Suisun Creek in 1926. No fishway was built as part of this project (Shapovalov 1940). In a 1940 report, DFG cited the reservoir caretaker as seeing "sea-run" steelhead running up Suisun Creek to the dam spillway.

A May 1956 DFG survey found steelhead fingerlings "abundant" in the upper portions of Suisun Creek and its tributaries, particularly in and just below the confluence of Wooden Valley Creek (Westgate 1956). Steelhead also were present, although in smaller numbers, downstream to the mouth. The survey report stated DFG's opinion that the Suisun Creek system could not support a substantial trout fishery due to over-appropriation of water (Westgate 1956).

In a 1962 report, Skinner indicated that Suisun Creek was an historical migration route and habitat for steelhead (Skinner 1962). At that time, the creek was said to be "lightly used" as steelhead habitat (Skinner 1962).

In April 1964, DFG sampled Suisun Creek at the upper end of Suisun Valley near Mankas Corner. Several *O. mykiss* (~150 mm) were observed, and the survey report noted some spawning gravels present in the vicinity of the site (Gerstung 1964).

A 1969 DFG memorandum noted an estimated run of less than 50 steelhead in the Suisun Creek watershed (Greenwald 1969). The Department of Fish and Game stated that juvenile steelhead were observed throughout the watershed and further noted a lack of nursery habitat as the population's limiting factor (Greenwald 1969).

In February 1975, DFG electrofished 30-meter reaches near the Rockville Road bridge construction site. Thirty-nine steelhead were found in the reach immediately upstream and 96 in the reach immediately downstream of the site (Rugg 1975). Rockville Road crosses Suisun Creek immediately upstream of Interstate 80.

In July 1980, DFG visually surveyed and electrofished Suisun Creek between the Southern Pacific Railroad Bridge, downstream of Interstate 80, and the Wooden Valley Creek confluence. No *O. mykiss* were found, but the survey report stated that the creek sustained a winter steelhead run (Cox 1980). The report noted anglers taking steelhead in the summer of 1979, as well as local residents' claims that runs had decreased in recent years (Cox 1980). The Department of Fish and Game recommended management for steelhead by removing barriers, improving agricultural practices, and preventing dumping.

Three Suisun Creek sites downstream of Lake Curry were sampled in October 1981 as part of a fish distribution study. No *O. mykiss* were found (Leidy 1984). In a 1984 report, DFG noted that Suisun Creek had a self-sustaining, natural steelhead population (Meyer 1984).

Between March and July 2001, *O. mykiss* were observed in Suisun Creek by people performing habitat mapping and monitoring activities. In March, an adult female steelhead (673 mm FL) was found approximately 0.25 miles downstream of the Wooden Valley Creek confluence (Hanson Environmental 2001). In June and early July, three additional adult steelhead (530 to approximately 640 mm) were observed in the creek between approximately six and 11 miles downstream of Lake Curry. Juvenile *O. mykiss* also were observed downstream of the dam. These fish typically ranged from 160-170 mm in length (Hanson Environmental 2001).

Wooden Valley Creek

The Department of Fish and Game reported in 1940 that the caretaker of Lake Curry (on Suisun Creek) observed steelhead runs in Wooden Valley Creek (Shapovalov 1940). In May 1956, DFG sampled throughout the Suisun Creek drainage, and stated in a report that steelhead in the Suisun Creek system were most abundant in Wooden Valley Creek downstream from Wooden Valley (Westgate 1956).

A 1959 DFG correspondence cited Mr. Bolten Hall, the local game warden, as saying that Wooden Valley Creek supported a small run of steelhead trout every year (Jones 1959). The letter stated DFG position that Wooden Valley Creek provided a steelhead trout fishery that was worth preserving through insurance of adequate flows (Jones 1959).

In April 1964, DFG surveyed Wooden Valley Creek in the canyon downstream of Wooden Valley. Two to eight *O. mykiss* juveniles were noted in deeper pools in the reach (Gerstung 1964). Numerous *O. mykiss* juveniles to 150 mm in length were observed in the canyon below Wooden Valley. The survey report noted patches of "excellent" spawning gravels (Gerstung 1964).

A 1965 DFG letter regarding a box culvert on Wooden Valley Creek noted that the stream was important to salmonid populations. The letter contained recommendations for providing fish passage at the project (Jones 1965). A 1969 DFG memorandum identified the greatest concentrations of steelhead juveniles in the Suisun Creek system to be in Wooden Valley Creek (Greenwald 1969). A 1980 DFG stream survey report for Suisun Creek noted that juvenile *O. mykiss* were seen in surveys of Wooden Valley Creek that year (Cox 1980).

Wooden Valley Creek was sampled in October 1981 as part of a fish distribution study. No *O. mykiss* were collected in a 15-meter reach along Wooden Valley Road (Leidy 1984). An undated draft letter from DFG to the City of Vallejo Water Superintendent identified the lack of surface flows below Lake Curry as the principal element limiting the productivity of steelhead in Suisun Creek (Hunter *n.d.*).

In December 2001, a pair of spawning "salmon" were observed constructing a redd in the lower reach of Wooden Valley Creek near Wooden Valley Road (Blizard 2001). A pair of spawned out carcasses (1 male, 1 female) and possibly another male salmon also were observed (Blizard 2001).

In June 2002, a survey of Wooden Valley Creek between the mouth and the White Creek confluence was conducted. Juvenile *O. mykiss* were observed near the headwaters and at various other locations throughout the length of the survey area (L. Marcus pers. comm.). Residents in the vicinity reported adult *O. mykiss* had been present in the creek in recent years.

White Creek

White Creek is a tributary of Wooden Valley Creek and flows through the property of Wild Horse Valley Ranch. In 1980 Professor John Hopkirk of Sonoma State University identified White Creek as one of the last remaining spawning streams for steelhead trout within the Suisun Creek system (Hopkirk 1980).

Assessment: The Suisun Creek watershed formerly supported steelhead runs, although the *O. mykiss* population likely was substantially affected by the construction of Gordon Valley Dam (Lake Curry) in 1926 and subsequent water developments. *Oncorhynchus mykiss* persists in the drainage, although recent surveys have not included estimates of density. Adult *O. mykiss* believed to be wild have been noted in main stem Suisun Creek and in its major tributary, Wooden Valley Creek (L. Marcus pers. comm.). Restoration planning is now being developed for the watershed, with likely recommendations to include habitat improvements such as invasive species control and instream flow modifications to improve over-summering habitat conditions (J. Beuttlier pers. comm.).

Table X-1. Distribution status of O. mykiss in San Francisco Estuary streams of Solano County, California[a]

Watershed	Stream/ Tributary	Yrs. Surveyed/ Quant. Data	Max. Period of Record	Data Type	Life Hist. Stage/ No. Yrs. Data	Anad. Life-Cycle Possible	O. mykiss Hist.	O. mykiss Current	Evidence of Pop. Decline	Current Pop. Status	References (Pers. Comm.)
Unnamed creek to Cordelia Slough	Unnamed to Cordelia Slough	3/0	2003	1, 2	J/1	Y	PB	DF	-	1, 2, 3	14 (2)
Green Valley Creek	Green Valley	9/4	1962-97	0, 1, 2, 3	J/3; R/1; M/2	Y	DF	DF	Y	1, 2, 3	2, 4, 6, 14, 16, 19, 20
	Wild Horse Valley	1/0	1940	0, 1	-	UNK	DF	PS	-	0	18
Suisun Creek	Suisun	10/3	1940-2001	0, 1	J/4; M/4	Y	DF	DF	Y	1, 2, 3	3, 5, 7, 8, 13, 15, 17-19, 21 (1)
	Wooden Valley	7/1	1940-2002	0, 1	J/4; M/3	Y	DF	DF	Y	1, 2, 3	1, 3, 5, 7, 10-13, 18, 21 (3)
	White	1/0	1980	0	-	UNK	DF	UNK	Y	0	9

[a] Table headings and codes are defined in the Methods section of this report.

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2. Field biologist, telephone conversation with G. Becker, CEMAR, July 17, 2003, 2003, in Oakland, regarding steelhead in unnamed tributary to Cordelia Slough.
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SOLANO COUNTY MAPS

Historical status of *Oncorhynchus mykiss* in streams of Solano County, Caliornia.

Current status of *Oncorhynchus mykiss* in streams of Solano County, Caliornia.

DISCUSSION

Our report documents available information regarding the historical status and current distribution of rainbow trout/steelhead (*Oncorhynchus mykiss*) in 277 streams tributary to the San Francisco Estuary. This report section summarizes distribution status, including our observations regarding potential causes of reduced range over time. Our findings regarding the distribution and persistence of *O. mykiss* are consistent with the species' spawning and rearing habitat requirements. Specifically, steelhead persist in San Francisco Estuary streams that maintain at least minimal relatively cold pools throughout the dry seasons of most years. The declining distribution and abundance of *O. mykiss* suggest a possible management strategy for San Francisco Estuary streams that we outline here. Also, we briefly describe other characteristics of a program to restore steelhead habitat and monitor distribution and abundance.

Estuary streams steelhead resources

Historically, steelhead appear to have used the vast majority of creeks, streams and rivers tributary to the San Francisco Estuary for spawning and rearing prior to extensive development of the region. We found evidence sufficient to designate a definite historical run or population (DF) in 196 Bay Area streams. Thus, more than 70 percent of the streams examined in this study were formerly "steelhead streams." We designated an additional 18 streams (six percent) as having probable runs or populations (PB) and 10 streams (four percent) as having possible runs or populations (PS). We assume that virtually all streams supporting *O. mykiss* historically were hydrologically connected to the estuary at least in some years, and that the populations in these streams were of relatively recent anadromous ancestry.

None of the materials we reviewed suggested that steelhead historically *did not use* specific watersheds. Therefore, we did not assign the NP (no run or population) value in the historical status column. (Please see the Methods section for further explanation of the terms used in the distribution and status tables.) We should note that drainages with the smallest sub-basin areas, particularly those in the most arid portions of the Bay Area, likely never supported salmonids. However, the confirmed presence of *O. mykiss* in many small, ephemeral tributaries suggests against assuming lack of historical use. In 53 instances (19 percent), we could not find sufficient information to justify one of the four status designations, leading to characterization as unknown (UNK).

The current distribution status of *O. mykiss* (within the last ten years) is as follows: 150 San Francisco Estuary streams (or 54 percent of our study streams) are DF status, seven streams (three percent) are assigned PB status, and twelve streams (four percent) are PS status. Since genetics information is available for a small number of the *O. mykiss* observations we reviewed, we are unable to note streams supporting only *O. mykiss* of hatchery origin. As a result, some streams may be designated DF that no longer support *O. mykiss* derived from anadromous stocks of the Central California Coast Evolutionarily Significant Unit.

Eighty-three of our study streams (30 percent) appear to have no run or population currently. In 25 instances (nine percent), sufficient uncertainty existed regarding the potential of the stream to support *O. mykiss* that we used the UNK value. We hope that new information can be developed to complete the current status designations and to update our designations as necessary. As described below, we believe that creating a "clearinghouse" for monitoring information will assist in effectively managing steelhead resources in the future.

Of the 277 streams we analyze in our study, 152 (55 percent) currently are incapable of supporting an anadromous *O. mykiss* life cycle, either because no population is present in the stream or because known total passage barriers exist downstream from suitable spawning and rearing habitat. We estimate that the number of streams capable of supporting the anadromous *O. mykiss* life cycle has decreased from 196 streams (*i.e.*, the number of historical DF streams) to 83 streams. In other words, 58 percent of the known historical steelhead streams in the Bay Area no longer support steelhead populations.

A substantial number of our study streams are current DF status but do not support anadromy. The resident populations in these streams may or may not produce smolts. We recommend additional study to characterize potential smolt production from resident *O. mykiss* populations in the Bay Area.

Our research indicates that very few abundance estimates are available for *O. mykiss* populations in San Francisco Estuary streams. Where we found reliable evidence of population decline, we cited references in the description for the stream experiencing the decline and used a "Y" (for "yes") designation in the county summary table. We applied the Y value to 158 streams, or about 57 percent of the streams in our study area. It is beyond the scope of this investigation to attribute specific causes of population decline to specific streams.

Persistence factors and management considerations

The most commonly-cited factors in decreased *O. mykiss* abundance in San Francisco Estuary streams were (in unranked order): construction of passage barriers including dams, drop structures, road crossings, weirs, concrete channels, and other structures; increased sedimentation through hydrologic modification, land use changes, or other processes; habitat degradation through channel modification, cattle grazing, deforestation, pollution, or water diversion; and over fishing. We do not attempt to rank these factors or otherwise quantify their impact on distribution and abundance of *O. mykiss* here. However, the potent effects of passage barriers and habitat degradation through water diversion implied in the materials we reviewed for this report merit some discussion.

Several known historical Bay Area steelhead runs have been lost entirely to lower watershed passage barriers. A partial list of regionally important extirpated runs includes: Walnut and San Pablo creeks in Contra Costa County; San Leandro, San Lorenzo, and Alameda creeks in Alameda County; and Arroyo Corte Madera del Presidio and Corte Madera Creek in Marin County. A larger number of streams have experienced habitat restriction and decreased *O. mykiss* abundance through placement of partial or total passage barriers. Important examples of this phenomenon include: Los Gatos Creek (Vasona Reservoir) and Stevens Creek (Stevens Creek Reservoir) in Santa Clara County; San Francisquito Creek tributaries (Searsville Lake) and San Mateo Creek (Crystal Springs Reservoir) in San Mateo County; and Conn Creek (Lake Hennessey) in Napa County. Construction of several larger Bay Area reservoirs appear to have land-locked native *O. mykiss* populations, several of which continue to reproduce in reservoir tributaries. These adfluvial populations may constitute an important genetic resource to be used in recovering the regional steelhead resource.

Barrier studies and modifications are on-going throughout Bay Area watersheds, and may lead to re-opening of substantial habitat areas. Re-design of the lower Walnut Creek flood control channel, dam removals and modifications in Alameda Creek and the Guadalupe River, and fish passage studies in eastern Marin County streams are particularly encouraging indications that conditions for steelhead in-migration may improve in the near term. Continued attention to the "fish friendly" design of flood control projects, road crossings and other channel modifications is necessary to ensure that new impediments are not created in migration corridors.

Water diversion may comprise both the most important factor in reducing *O. mykiss* abundance in Estuary streams over time and the most difficult to correlate with this effect. Where Bay Area dams impound most of the local runoff from the watersheds in which they occur, and are operated without provision for fish flows, downstream effects on steelhead resources are relatively clear (and can be noted in at least four East Bay streams). More commonly, however, steelhead habitat appears to be reduced in quality and quantity by the cumulative effects of multiple smaller diversions, combined with groundwater withdrawals. Establishing "cause and effect" relationships between diversion and habitat characteristics for particular watersheds typically involves complex data collection and modeling efforts. We did not encounter such analyses in our research. Rather, we noted multiple reports by DFG staff and others of agricultural and other diversions leading to decreases in the extent and duration of wetted channel (particularly pools) in the dry season.

We suggest that the historical and current practice of ascribing low value to the use of water for fish habitat is incompatible with steelhead restoration in streams of the San Francisco Estuary. Amongst the anadromous salmonids, *O. mykiss* is uniquely adapted to succeed within the climatic constraints encountered in the region. In particular, the species' abilities to spawn repeatedly (*i.e.*, iteropary), to maintain both resident and anadromous forms within a population, and to persist in isolated pools throughout the dry season make its extirpation from the region unlikely. Nevertheless, we believe that water development has severely impacted steelhead resources by reducing available habitat, and that additional studies and resulting dedicated minimum "fish flows" will be necessary for recovery of the Bay Area *O. mykiss* population.

San Francisco Estuary streams steelhead recovery

Recovering steelhead in San Francisco Estuary streams will require coordinated actions to mitigate the substantial loss of habitat that has resulted from human activities of the last 150 years. We support an approach of first identifying and protecting relatively healthy watershed areas throughout the Bay Area. Next, a program to determine a set of priority streams for restoration is recommended. Restoration related studies, planning and project implementation already are occurring in several watersheds likely to be designated as "priority." However, we believe that a comprehensive approach to restoration using established methods must form the basis of a regional *O. mykiss* recovery strategy.

We suggest evaluating Estuary watersheds for steelhead restoration potential so that decision-makers and the public can direct financial and staff resources most efficiently. We have not included such a list here, since evaluation criteria have not been established and applied to the range of Bay Area watersheds. This step is necessary to minimize disagreement among stakeholders regarding disposition of resources. Several streams clearly will be important to regional *O. mykiss* recovery, however, including Alameda Creek in Alameda County, Coyote Creek in Santa Clara County, San Francisquito Creek in San Mateo County, Sonoma Creek in Sonoma County and the Napa River system (particularly Dry Creek) in Napa County.

For each of these (and the other priority) watersheds, available information should be collected and analyzed to form the basis of a watershed assessment. (This process is well advanced in most Bay Area watersheds.) Completed assessments identify limiting factors to steelhead production in the watersheds, often including passage barriers, sedimentation, stream flow, and water quality. Enhancement plans for each priority watershed should be prepared to respond to the limiting factors cited in the assessment. The plans list barrier modifications, land use changes, in-stream flow and water quality considerations, and re-vegetation and other projects necessary to meet restoration goals. Costs, responsibilities, and schedule should be assigned to the various elements of the enhancement plans.

Near-historical steelhead abundance levels are unlikely to be regained, even through an aggressive recovery program. However, we believe the priority watershed approach offers the highest chance of success in re-establishing a viable regional population. Our emphasis on priority watersheds should not be construed, however, as a lack of support for salmonid restoration projects in smaller watersheds, as such creek systems appear to have contributed substantially to overall numbers of steelhead using San Francisco Estuary tributaries. Increasing the number of Bay Area watersheds supporting regular steelhead runs will increase the resistance of the population to stresses caused by stochastic events.

Our study revealed a paucity of data regarding *O. mykiss* distribution in many San Francisco Estuary tributaries, with about 100 instances (33 percent) of two or fewer surveys for specific streams. A total of 139 streams (46 percent) had no quantitative information available that could be used to characterize *O. mykiss* population features such as relative abundance, reproduction, anadromy, and others. As part of a program to recover steelhead in the Bay Area, we recommend creating a monitoring data clearinghouse through which *O. mykiss* distribution and abundance information is collected, stored, and analyzed. At a minimum, *O. mykiss* presence/absence surveys should be conducted every ten years in Bay Area streams. Various agencies including EBMUD, EBRPD, SFPUC, and SCVWD regularly collect such information for areas under their jurisdiction and appear willing to contribute to a regional data collection effort. However, large portions of the Bay Area are surveyed only when adequate funding becomes available to private organizations, or not at all. For "priority" streams, we suggest bi-annual monitoring to allow for trend analysis, for measuring the success of restoration activities, and for an adequate basis from which to perform adaptive management. The process of analysis and documentation recommended here will help ensure that costly or politically challenging restoration efforts are implemented along with smaller-scale projects.

We cite biological, cultural, and political bases for optimism regarding the recovery of Bay Area steelhead. First, the presence of remnant *O. mykiss* populations throughout San Francisco Estuary streams reflects the species' vigor, particularly in terms of swimming ability and temperature tolerance, as well as the effectiveness of maintaining individuals with different life history traits and a range of migratory behaviors within a population. While cultural processes have led to highly-altered lower watershed areas in most San Francisco Estuary streams, the use of large portions of Bay Area headwaters for water supply, parks, and agricultural purposes has led to a relatively high degree of protection that favors steelhead restoration. Finally, the existence of several steelhead restoration processes involving multi-million dollar packages of projects (*e.g.*, in Walnut, Alameda, Coyote, Stevens creeks, the Guadalupe River, and others) indicates a political climate favorable to recovery of the species. We note, however, that obtaining water supply for habitat purposes likely will constitute the greatest obstacle to long-term steelhead recovery in the region.

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ABBREVIATIONS AND ACRONYMS

The following abbreviations and acronyms appear in this report:

ACCWP	Alameda County Clean Water Program
ACDD	Alameda Creek Diversion Dam
ACFCWCD	Alameda County Flood Control and Water Conservation District
ACFRW	Alameda Creek Fisheries Restoration Workgroup
CDFG	California Department of Fish and Game
cm	centimeters
Corps	U.S. Army Corps of Engineers
DCE	Design, Community, and Environment
DFG	Department of Fish and Game
d/s	downstream (from)
EBMUD	East Bay Municipal Utilities District
EBRPD	East Bay Regional Park District
FL	Fork Length
FONR	Friends of the Napa River
HES	Hagar Environmental Science
HRG	Habitat Restoration Group
HSA	Harvey and Stanley Associates
Hwy. / I.	Highway / Interstate
LLNL	Lawrence Livermore National Laboratory
m	meters
mi.	miles
mm	millimeters
Mt.	Mount
NMFS	National Marine Fisheries Service
pers. comm.	personal communication
pp.	pages
Rd.	Road
RM	River Mile
SCVWD	Santa Clara Valley Water District
SFEI	San Francisco Estuary Institute
SFPUC	San Francisco Public Utilities Commission
SL	Standard Length
St.	Street
TL	Total Length
u/s	upstream (from)
USFWS	U.S. Fish and Wildlife Service
YOY	young of the year