5.5.1.2 DELINEATE POTENTIAL REARING HABITAT AND POPULATION SURVEYS FOR JUVENILE STEELHEAD

The purpose of this section is to 1) review and update the existing data on juvenile steelhead habitat, 2) provide a quantitative assessment of the quantity and quality of juvenile habitat in several streams, including the main stem from the Narrows upstream to the upper boundary of steelhead migration, Cachagua Creek, and San Clemente Creek, 3) review and update data on juvenile populations in the Carmel River, and 4) provide estimates of the carrying capacity of young-of-the-year steelhead in key reaches of the mainstem.

POTENTIAL REARING HABITAT – REVIEW AND UPDATE

Early Habitat Surveys – The CDFG surveyed the mainstem of the Carmel River in 1957 as part of an effort to evaluate the feasibility of passing fish over Los Padres Dam (Elwell, 1957). Though not as quantitative as later efforts beginning in the 1970's, this information provides an important insight into the nature of juvenile steelhead populations in the basin and CDFG management of the river, ten years after the construction of Los Padres Dam (**Appendix 5.5.1.2**). Regarding the habitat quality and productive capacity of the river, the CDFG report found,

> "*The productive capacity of this river* [upstream of Los Padres Dam], *as evidenced by the very small game fish population present, appears to be limited. RT* [rainbow trout] *2" to 6" were fairly common, but certainly not as abundant as they should be in a river of this size. Fish of the year were conspicuously absent along the margins of the main river and tributaries."* The report continued, *"It is not felt that this scarcity of trout can be attributed to fishing pressure alone, which is fairly light in this section* [upstream of Los Padres], *or other forms of predation. Moreover, all other conditions for successful natural propagation appear to be favorable in this section with two known exceptions – limited spawning areas and a pronounced scarcity of bottom food ... it seems reasonable to assume that the same limiting factors would also affect an anadromous population in the same manner.*"

Based on the results of this habitat study the author opined,

> "*there would be little or no benefits derived from attempting to re-establish a steelhead run in the Carmel River* [upstream of Los Padres] *by transporting adult steelhead over the Los Padres Dam."* This rationale, while ultimately flawed, guided CDFG policy and management on the river for another 15 years, until renewed interest in restoration of the population emerged as follow ups to the California Fish and Wildlife Plan of (CDFG 1965) and to Cal-Am's project to drill additional wells in lower Carmel Valley.

Habitat Surveys in the 1970's – During the 1973-75 period, the CDFG surveyed juvenile rearing habitat in selected portions of the Carmel River Basin as part of its mandate to inventory, protect and restore the habitat for anadromous fish stocks throughout California (Snider, 1983). [1] This work was the first to provide a quantitative description of the juvenile steelhead habitat in the Carmel River. At the time of this survey, fall 1975, juvenile rearing habitat totaled 48 acres in just over 34 miles of stream channel (**Table 5.5.1.2-A**). Approximately, 90 percent of the viable rearing habitats were distributed in the upper drainage basin above San Clemente Dam, as this was prior to any provision for streamflow releases at the base of the dam. This pattern was noted by Snider[2], "*Nursery habitat in the lower drainage, below Tularcitos Creek, was lacking both in quality and quantity. Following the termination of releases from San Clemente Dam in June 1975, flow receded rapidly leaving only 1 mile of perennial flowing river in the lower drainage (RM 15 to RM 14). The stream in this [*flowing*] section was generally less than 6 inches deep, the result of 1-2 cfs spreading across a wide, low gradient streambed*."

Table 5.5.1.2-A[3]

TABLE 7. Steelhead Habitat Available in the Carmel River Basin during Low Flow Period (July - October).1/

Study Area	Flow at time of measurement (cfs)	Stream miles	Surface area (acres)	Riffle area (acres	Pool area	Spawning2/ habitat (acres)	Nursery habitat (acres)
Danish Creek	1-2	0.75	0.36	0.36	0.14	0.22	0.36
Carmel River, upstream of Los Padres Dam	5-10	14.00	17.57	15.26	10.19	7.66	17.57
Cachauga Creek	1	2.0	1.21	0.73	0.48	0.36	1.21
Pine Creek	1-2	5.50	4.00	2.00	2.00	2.00	4.00
San Clemente Creek	2-3	4.50	2.73	1.37	1.37	1.37	2.73
Carmel River, between San Clemente and Los Padres dams	10-20	5.50	16.67	8.34	8.34	4.25	16.67
Carmel River, downstream of San Clemente Dam							
Flowing section	1-2	1.25	3.03	1.82	1.21	--	3.03
Non-flowing section	0	0.75	2.27	0	2.27	--	2.27

1/Measured July-October 1975.

2/Area estimated to meet spawning criteria during January-April spawning period.

[1] The complete Snider (1983) Anadromous Fish Branch Report is provided in Appendix 5.5.1.2. The forward of the Snider (1983) report set the stage for future restoration efforts by the CDFG, "*The California Fish and Game Commission recognizes steelhead as a valuable resource with strict environmental requirements. It is the Commission's policy to provide a vigorous, healthy steelhead resource by maintaining an adequate breeding stock and suitable spawning area and by providing for natural rearing of young fish to migratory size. The policy emphasizes management programs, which inventory and protect and wherever possible, restore or improve the habitat of natural steelhead stocks. It mandates the CDFG to develop and implement such programs by measuring and wherever possible, increasing steelhead abundance. Protection is to be provided by assessing habitat status and adverse impacts and by alleviating those aspects of projects, developments, or activities which would or already do adversely impact steelhead habitat or steelhead populations*." Although stated over twenty years ago, this preamble to Snider's report still guides the efforts of the CDFG in managing and restoring steelhead populations, even as many are listed as threatened or endangered under the Federal Endangered Species Act.

[2] Snider (1983), page 22

[3] Source: Snider (1983), page 21.

Habitat Surveys by D. W. Kelley and Associates 1980 to 1989 – The Monterey Peninsula Water Management District (MPWMD) hired D. W. Kelley and Associates (DWKA) to conduct surveys of steelhead habitat, first as part of the planning efforts for New San Clemente Dam and later for New Los Padres Dam. The goal of this work was to delineate habitat in key reaches of the mainstem between major tributaries and to develop means for predicting juvenile populations with and without new dams in place. While the efforts to construct and operate new reservoirs have now been essentially abandoned, the underlying work in delineating habitat and assessing the quality and quantity of rearing habitats is still valid, given an understanding of how streamflow and streambed conditions may change in the future. This work, summarized in Dettman and Kelley (1986), and modified to reflect current conditions indicates that viable rearing habitats are currently distributed over approximately 53 miles of stream channel (**Table 5.5.1.2-B**). This is a substantial increase compared to the 34.5 miles of available habitat that was measured by Snider in 1975 and represents over 80 percent of the channel available to adult steelhead for spawning. The increase is a direct result of efforts over the last 20 years to increase available rearing habitat by making releases from the base of San Clemente Dam beginning in 1983 and changing the order of pumping from wells in Carmel Valley beginning in 1993.[4] [5]

<u>The Quality and Quantity of Juvenile Rearing Habitat in the Carmel River Basin</u> – While the length of stream channel with juvenile rearing habitats is a valuable index, it does not allow comparisons amongst tributaries and the mainstem within the Carmel River Basin or with other coastal steelhead streams of differing sizes. In the 1980's, DWKA developed a method for assessing the rearing habitats for young of the year and yearling steelhead that results in a Rearing Index (RI) of the quality and quantity of habitats.[6] DWKA and subsequently MPWMD applied this method to the mainstem from the Narrows to San Clemente Dam, from San Clemente Reservoir to Los Padres Dam and upstream of Los Padres Reservoir. In addition, rearing habitats were assessed in San Clemente and Cachagua Creeks. Following are short descriptions of habitats and RIs in these streams.[7]

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[4] Beginning in 1983 the California Department of Fish and Game initiated an annual Memorandum of Agreement (MOA) governing California-American Water's schedule of operations at Los Padres and San Clemente Dams. Over time, the operation has changed to restrict direct diversions and increase the release requirements at San Clemente Dam. In addition, in 2001 Cal-Am operations were further restrained under terms of a Conservation Agreement with NOAA Fisheries to preclude any direct diversion during the low-flow season, defined as periods when streamflow at the MPWMD gaging station at Don Juan Bridge is less than 20 cfs for five consecutive days.

[5] As a result of recommendation from the CDFG, the SWRCB ordered Cal-Am Water to change the sequence of pumping subsurface flow from their lower Carmel Valley Wells. Beginning in 1993 under a testing program, and continuing from 1995-on under Water Rights Order 95-10 and 98-04, the SWRCB ordered, " *To the maximum extent feasible without inducing sea water intrusion or unreasonably affecting the operation of other wells, Cal-Am shall satisfy the water demands of its customers by extracting water from ins most downstream wells*".

[6] Dettman, D.H. 2001. A method for Assessing Critical Habitats for Juvenile Steelhead in Coastal Streams. MPWMD Files, Memorandum dated January 9, 2001 from D. H. Dettman to L. Hampson. Memorandum summarizes the D W Kelley method for assessing rearing habitat and developing Rearing Indexes for young-of-the-year and juvenile steelhead. The January 9 2001 Memorandum is provided in Appendix 5.5.1.2

[7] For a more complete description of habitats, see Chapter IV of Dettman and Kelley (1986), which is included in Appendix 5.5.1.2

Upstream of Los Padres Reservoir – The principle streams available for rearing steelhead are 7.0 miles of the mainstem, 5.7 miles of Miller Fork, and 1.7 miles of Danish Creek. The rearing habitats within the upper watershed are of exceptionally high quality and quantity with over 400,000 sq. ft. of good-excellent habitat for young-of-the-year, representing over 97 percent of the total stream area. (**Table 5.5.1.2-C**) In 1982, the average young-of-the-year RIs in these streams ranged from 2 to 5 times as high as RI's measured in other coastal streams at similar flows.[8] The upper watershed is almost entirely within the confines of the Ventana Wilderness Area, so the rearing habitats will probably remain in good-excellent condition for the foreseeable future and beyond.

Los Padres Dam to San Clemente Reservoir – During the last 55 years, the Carmel River between Los Padres Dam has been used to convey water released from Los Padres Reservoir and diverted at San Clemente Dam. The minimum streamflow release at Los Padres Dam is 5 cfs, as required by the SWRCB.[9] Due to variation in natural accretion, the augmented dry season flows in this reach vary from about 5 cfs to 15 cfs in wet years. Bedrock outcrops and boulders control the river configuration in this reach (**Figure 5.5.1.2-A**). The substrate is a large cobble boulder mixture. Gravels are scarce above Cachagua Creek, due to entrapment by Los Padres Dam, but more prevalent below there. At times, the substrate below Cachagua Creek is embedded with sand that originates from development and roads in the Cachagua Creek basin, but most often the physical habitat is of good to excellent quality, due to an ample supply of large substrate and augmented flow.

Rearing habitat quality ratings are lower in this reach, as compared to above Los Padres, but because the stream is wider and flows are augmented, the RIs tend to be higher than in the upper Carmel River Basin (**Table 5.5.1.2-D**). In the reach between Syndicate Camp and Cachagua Creek, the rearing habitat is more constrained by higher degrees of cobble embeddedness. Nonetheless, the rearing habitat for young-of-the-year totals 763,000 sq. ft. in the reach between the dams, which is about 60% of the amount upstream of Los Padres and 23% of the total habitat area in the mainstem, upstream of the Narrows (**Figure 5.5.1.2-D**).

During late summer and early fall months of below median flow years, the release of epilimnetic water from Los Padres Reservoir can result in stream temperatures above the optimum level for steelhead. For example, in 1997 the reservoir was drawn down to 50% of maximum storage by September and this resulted in very warm releases of water during August and September 1997 (**Figure 5.5.1.2-D**). In contrast, during wet years when the reservoir stays fuller over the dry season, the temperature of the release is cooler (**Figure 5.5.1.2-E**). In future years, the pattern of temperature releases will tend to earlier, warmer releases of water, as Los Padres Reservoir continues to fill with sediment. Maintenance of the current pattern of cooler temperatures may require additional

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[8] Dettman, and Kelley (1986)

[9] SWRCB on July 7, 1948, in the Matter of Application 11674, issued Decision 582 established minimum streamflow requirement of 5 cfs in the Carmel River directly below the outlet structure of the Los Padres Dam at all times during which water is being stored, subject to temporary reductions for operating purposes and emergencies.

measures such as dredging to restore storage capacity or installation of a cooling tower to keep water within an acceptable range for juvenile steelhead.

Figure 5.5.1.2-A. Stream habitat in the mainstem of the Carmel River between San Clemente Reservoir and Cachagua Creek, April 19, 2004. Streamflow was approximately 30 cfs at the time of the survey.

The Narrows to San Clemente Dam – Large numbers of adult steelhead successfully spawn in the 14-mile reach of the river between San Clemente Dam and Via Mallorca Bridge. In winter and early spring, water quality and substrate conditions are usually adequate to ensure reasonably good hatches and fry emergence, so that the reach begins most springs well seeded with young steelhead.

Currently, summer streamflow is maintained in the 11.4-mile reach below San Clemente Dam downstream to the vicinity of Schulte Road at RM 6.7. Historically, flows throughout most of this reach were reduced to critical levels each summer as Cal-Am diverted all surface inflow to San Clemente Reservoir at the dam and through the Carmel Valley Filter Plant. Since 1983, diversions at San Clemente Dam have been gradually constrained by loss of surface storage and agreements with NOAA-Fisheries, CDFG, MPWMD, and the California Department of Water Resources. Currently, all surface inflow to San Clemente Reservoir is released into the river channel, once the flow declines to 20 cfs as measured at the MPWMD gaging station at Don Juan Bridge (RM 10.8).

In 1982, DWK measured the quantity and quality of rearing habitat in five representative sections of the river between San Clemente Dam and the Narrows, at flows ranging from ~ 6 to 53 cfs (**Table 5.5.1.2-E**).[10] At the time, the habitat below the Narrows was not assessed due to the sandy substrate and lack of surface flow in most years.[11] Discounting habitats in the stream below the Narrows, the total rearing habitat area at the low end of the flow range (~6 cfs) was 1.3 million square feet (msf), with quality ratings ranging from 2.0 to 2.5 and the RI averaging 65.9 units. Accounting for a reasonable adjustment to improved habitat downstream of the Narrows since 1994 raises the total area to 1.6 msf for young-of-the-year and 1.0 msf for yearlings at flows ranging from 3 to 6 cfs (**Table 5.5.1.2-E).**

As long as current water storage in Los Padres Reservoir is maintained and Cal-Am operates its wells according to the approved sequence in Lower Carmel Valley, an average minimum streamflow of about 5 cfs can be maintained below San Clemente Dam, for the foreseeable future. With these conditions, it is reasonable to expect that flow can persist downstream through the Lower Carmel River to about Schulte Road, where Cal-Am pumping removes most of the surface and subsurface flow. With a 5 cfs release at San Clemente Dam, the quality and quantity of rearing habitat is substantial in the reach above Schulte Bridge, totaling 1.3 msf and 3.3 million Rearing Index units (mRIU) (**Table 5.5.1.2-F**).[12] These totals represent about 37% of the habitat area for young-of-the-year and 24% of the total Rearing Index Units in the basin upstream of Schulte Road (**Figure 5.5.1.2-B**).[13]

Cachagua Creek – Near the intersection of Tassajara Road and Cachagua Road, James Creek, Finch Creek and Conejo Creek join together to form Cachagua Creek, which drains a large watershed (46 sq mi). The unit runoff is low compared to the remainder of the upper Carmel River watershed. Gaging records by MPWMD and the USGS since 1992 show that average annual runoff from Cachagua Creek is only 6.5% of the average runoff at Robles del Rio, although the Cachagua Basin represents 24% (46 sq mi /193 sq

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[10] Dettman and Kelley (1986), pages 71-83.

[11] Since 1983, and especially since 1993 when the SWRCB required Cal-Am to pump their wells from a downstream to upstream sequence and curtail most pumping above the Narrows, the viable summer rearing habitats have extended downstream, ranging from near Highway One Bridge (RM 1.1) in 1998 to Robinson Canyon (RM 8.5) in 1994. No systematic measurements have been made of rearing habitats in this reach, but the quantity and quality of habitats in the extended reach is probably similar to habitat in the reach from the MPWMD gaging station at the Narrows to the Eucalyptus Grove at the lower end of Garland Park.

[12] Table 5.5.1.2-F provides summary of totals in major reaches of the mainstem and in selected tributaries. See **Appendix 5.5.1.2-D** for a detailed accounting of habitat quality and quantity, rearing indexes and capacity to rear young-of-the-year in specific reaches of each stream.

[13] The totals in **Table 5.5.1.2-F** and **Figure 5.5.1.2-D** do not include assessments of habitat in Pine Creek, Tularcitos, Hitchcock Canyon and Garzas Creek, which have not been surveyed since 1974. Habitats in Pine and Garzas creeks are similar to San Clemente Creek and habitat in Tularcitos Creek is similar to Cachagua Creek. Habitat quality and quantity is severely constrained in Tularcitos and Garzas Creeks by lack of surface flow during summer months. Pine Creek is relatively pristine in character with only minor diversions of surface flow and few landform disturbances.

mi) of the drainage area. Summer flows are correspondingly low, with annual minimums frequently declining to zero by early summer in the lowermost reach of the creek. Along the lower portions of the creek, the canyon and riparian corridor are relatively open; but there are patches of alder, live oak, and sycamore that provide shade in the narrow canyon reach immediately downstream of Tassajara Road. Similar habitat exists upstream of Tassajara Road, along Finch Creek and James Creek. Streamflow in these canyon reaches can persist in some years, providing limited amounts of rearing habitat. In 1982, DWKA surveyed rearing habitat in three reaches of Cachagua Creek at two flows. By summer's end, juvenile rearing habitat was poor and the quality was higher upstream than downstream, reflecting more persistent flow and lower levels of embeddedness in the upper reaches. In comparison to other portions and tributaries draining the Santa Lucia Range, the quantity and quality of habitat for young-of-the-year is limited in Cachagua Creek, totaling only 110,000 sq. ft. and 218,000 RIUs (**Table 5.5.1.2-F**). These indexes represent about 2-3% of the rearing habitat in the basin (**Figure 5.5.1.2-B**).

San Clemente Creek – San Clemente Creek flows through a steep, narrow, well-shaded canyon. Its relatively small watershed of 15.6 sq. mi. contributes 13% of the average annual runoff in the Carmel River at Robles del Rio (James, 2003). Summer flows are regulated by releases from San Clemente Creek Trout Pond, 1.6 miles above San Clemente Reservoir and set at 1 cfs, or the natural flow, whichever is less. The dry-season low flows typically decline to less than 0.3 cfs at the MPWMD gaging station, above San Clemente Reservoir, but only rarely does the streamflow cease. Based on surveys in 1990, it appears that steelhead utilize all of the San Clemente Creek and its tributaries, except the south fork of Black Rock Creek, where a waterfall blocks adult migration. In 1982, DWKA surveyed steelhead habitat in four sections of the creek at flows ranging from 0.6 to 3.9 cfs. The amount of suitable young-of-the-year habitat decreased from 74,000 sqft at 2.7 cfs to 47,000 sq ft at 0.6 cfs, but the quality of the remaining habitat declined only slightly from 3.4 to 2.9 units.[14] Because of this, the RI for San Clemente Creek is maintained at a relatively high level, as the low flows persist during the dry season. Based on 1982 information, the habitat area for young-of-the-year totals about 204,000 sq ft in the basin and RIUs total 760,000, representing 6 % of the total habitat and RIUs in the Carmel River Basin (**Table 5.5.1.2-F and Figure 5.5.1.2-B**).

JUVENILE STEELHEAD POPULATION SURVEYS – REVIEW AND UPDATE EXISTING INFORMATION

In coastal streams, conducting surveys of the juvenile steelhead population is an effective way to assess whether freshwater systems are providing for a healthy, self-reproducing steelhead resource. Surveys provide basic information on the numbers of fish, sizes of individual fish and population density, which are crucial to assessing the success of adult reproduction and to determine whether freshwater habitats are adequately seeded with juveniles. Traditionally, surveys have been conducted in coastal streams during the end of the low-flow season, usually in October, prior to the onset of fall and winter storms, which displace or cause individual fish to

[14] Dettman and Kelley (1986), pages 64-67.

move downstream. Numerous surveys have been conducted in the Carmel River Basin. Following is a brief account of existing information from the surveys.

CDFG Population Surveys in the 1970's and 1980's –The CDFG surveyed juvenile steelhead in the reaches upstream and downstream of Los Padres in 1973 and 1974.[15] Mean population density in these sections ranged from 1,371 fish/mile in the reach upstream of Los Padres to ~5,120 fish/per mile in the short flowing section below San Clemente Dam (**Table 5.5.1.2-G**). In the reach upstream of Los Padres Reservoir, the population included resident steelhead, which affected the age distribution and shifted the age structure to include 13-15% age 1+ and older fish (**Table 5.5.1.2-H**). CDFG continued population surveys below San Clemente Dam in 1983 and 1985-87.[16] For areas downstream of Los Padres Dam, lineal density for the period prior to the 1987-1991 drought averaged 6,032 fish per mile and ranged from a low of 3,648 fish/mi in 1974 to 9,307 fish/mi in 1986 (**Table 5.5.1.2-I**)

DWKA Surveys in 1982 – DWKA (1986) measured juvenile steelhead abundance and size in two reaches of the Carmel River during summer/fall 1982. Upstream of Los Padres Reservoir, where the population was comprised of a mixed resident/anadromous population of steelhead, the population was estimated at 45,630 fish, including 29,079 young-of-the-year and 16,551 older juvenile and resident fish. Density of the combined population in 1982 averaged 3,179 fish per mile, approximately twice the levels measured by CDFG in 1973 and 1974.

Population Surveys since 1990 – Since Fall 1990, the MPWMD has surveyed the juvenile steelhead population in the Carmel River below Los Padres Dam. The extent of sampling within the 25-mile long reach below Los Padres Dam has been expanded from four stations in 1990 to eleven in 2002. (**Tables 5.5.1.2-J and 5.5.1.2-K**) Over the last fourteen years, the lineal density of the juvenile population at these stations averaged 4,367 fish per mile (fpm) of stream, ranging from a low of 2,083 fpm at the Lower River Sites to a high of 8,139 fpm at the Cachagua Site, and density progressively increased from lower elevation to higher elevation sites, with the highest density usually at the Cachagua site, about 0.5 mile below Los Padres Dam. (**Figure 5.5.1.2-C**) The pattern of areal density was similar to lineal density with the overall station density averaging 0.036 fish per square foot ($fpft^2$) and ranging from 0.016-0.017 $fpft^2$ at lower river sites and lower San Clemente inundation zone to 0.067 $fpft^2$ at the Cachagua site below Los Padres Dam.

The trend from lower density at low elevation stations to higher density at upper elevations is probably due to a combination of more favorable water temperatures and substrate conditions in the upper reaches. Two exceptions to this trend occur in the vicinity of San Clemente Dam, where population density is consistently low, just downstream of San Clemente Dam (Sleepy Hollow Station) and within the inundation zone at the SCR Delta Lower Station. Population density at the Sleepy Hollow Station is often the lowest of the annual survey series, which is most likely due to the combination of high water temperatures released from San Clemente Dam and the low production of aquatic invertebrates. Although the substrate at this site is ideal for juvenile steelhead, the narrow stream channel combined with almost a century of scour has

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[15] Snider (1983), Appendix 5.5.1.2-B, pages 25-26

[16] Snider (1983, included as Appendix 5.5.1.2-B) and CDFG Office files in Monterey, CA.

reduced the habitat to a series of long, deep pools separated by short riffles. Invertebrate production in this reach may be low due to the preponderance of boulder/pool habitat and the short nature of riffles, resulting from 80 years of sediment trapping in the reservoir. Population density within the inundation zone of San Clemente Reservoir ranges from very low levels at the lowermost station to above average levels at the uppermost site. Since 1997, when the flashboards were no longer raised at San Dam, the inundation zone has been transitioning from a shallow reservoir back to stream environment.

CAPACITY TO REAR JUVENILE STEELHEAD IN THE CARMEL RIVER BASIN

The information summarized in the preceding sections on habitat surveys and juvenile population density can be used to develop estimates of the carrying capacity of young-of-the-year steelhead in the Carmel River and selected tributaries.

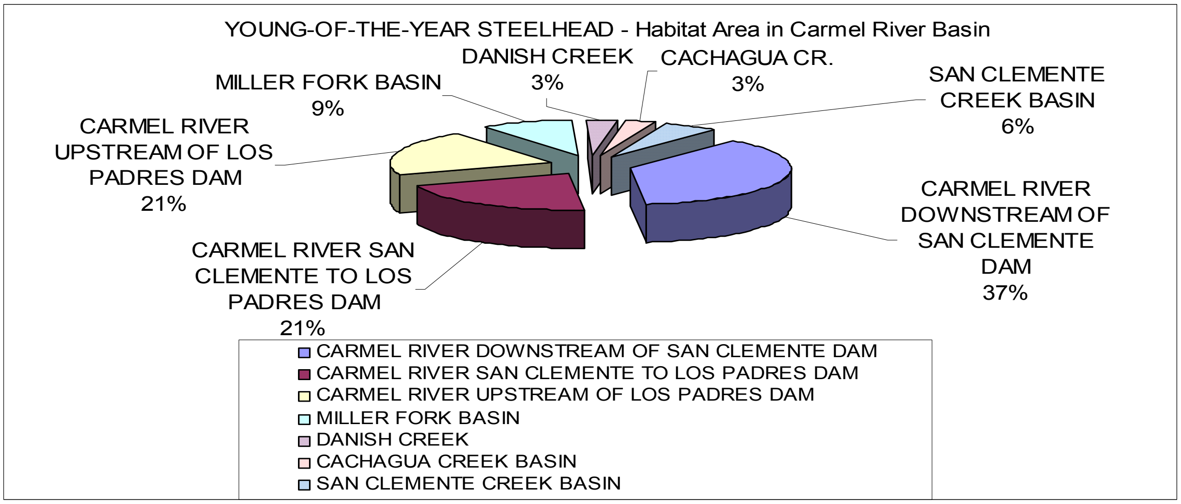
Estimated Carrying Capacity Based on Habitat Surveys – Dettman, Kelley and Reuter (1987) developed estimates of the juvenile steelhead carrying capacity in the mainstem of the Carmel River and selected tributaries, based on 1982 survey information. Their estimates have been updated for this watershed assessment by including potential habitat in the reach from Schulte Bridge to the Narrows and by modifying the 1987 estimates with information from 1989 surveys at 35 sites in the reach between San Clemente Reservoir and Los Padres Dam.[17] Using this approach the ~3.6 million square feet of rearing habitat in the Carmel Basin yields a total potential population of ~245,000 young-of-the-year steelhead (**Table 5.5.1.2-F**). Of this total, approximately 25% is downstream of San Clemente Dam, 33% is between San Clemente and Los Padres Dam, and 42% is upstream of Los Padres Dam (**Figure 5.5.1.2-B**). In terms of the mainstem only, the total capacity is 174,600 fish, including 60,200 fish downstream of San Clemente, 52,000 fish between the dams, and 62,400 fish upstream of Los Padres Reservoir (**Table 5.5.1.2-F**).

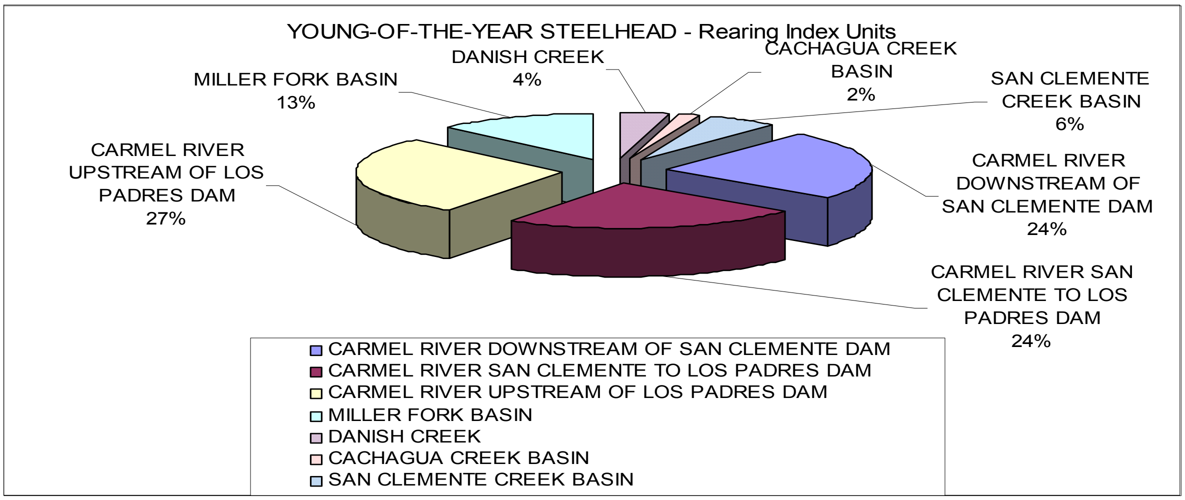
Estimated Carrying Capacity Based on Population Surveys – Another way to estimate carrying capacity is to expand estimated population densities in specific reaches, represented by sampling stations.[18] **Table 5.5.1.2-L** is a compilation and expansion of population densities in seventeen reaches of the mainstem Carmel River. Using this approach the estimated capacity of the mainstem ranges from 89,000 to 94,000 fish, substantially lower than the estimated capacity of 174,500 fish, based on habitat indexes. While the differences between the habitat-based and actual densities are substantial, this is to be expected given that the returning adult population was substantially reduced during and following the 1987-91 drought.

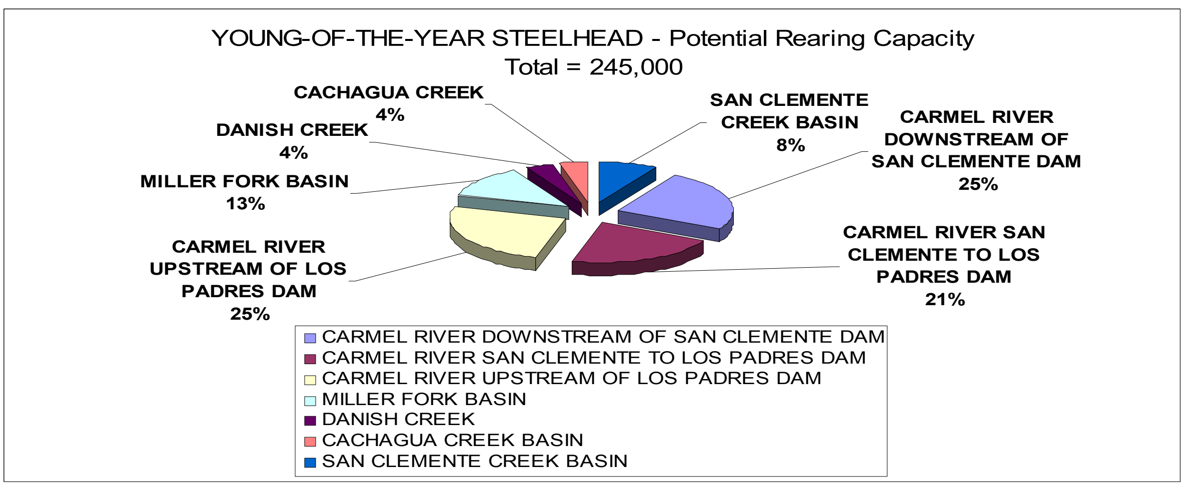
[17] See Dettman, Kelley and Rueter (1986) and Dettman and Kelley (1986) for a detailed discussion of the method used to estimate carrying capacity, based on a calibration of rearing indexes with the density of juvenile steelhead populations in central California coastal streams.

[18] This method for estimating carrying capacity has an advantage in streams where a long time series of population density data is available, but tends to underestimate carrying capacity in streams where the habitat is under seeded with swim-up fry due to insufficient number of spawning adults or to poor survival during larval incubation and emergence of alevins.

Figure 5.5.1.2-B

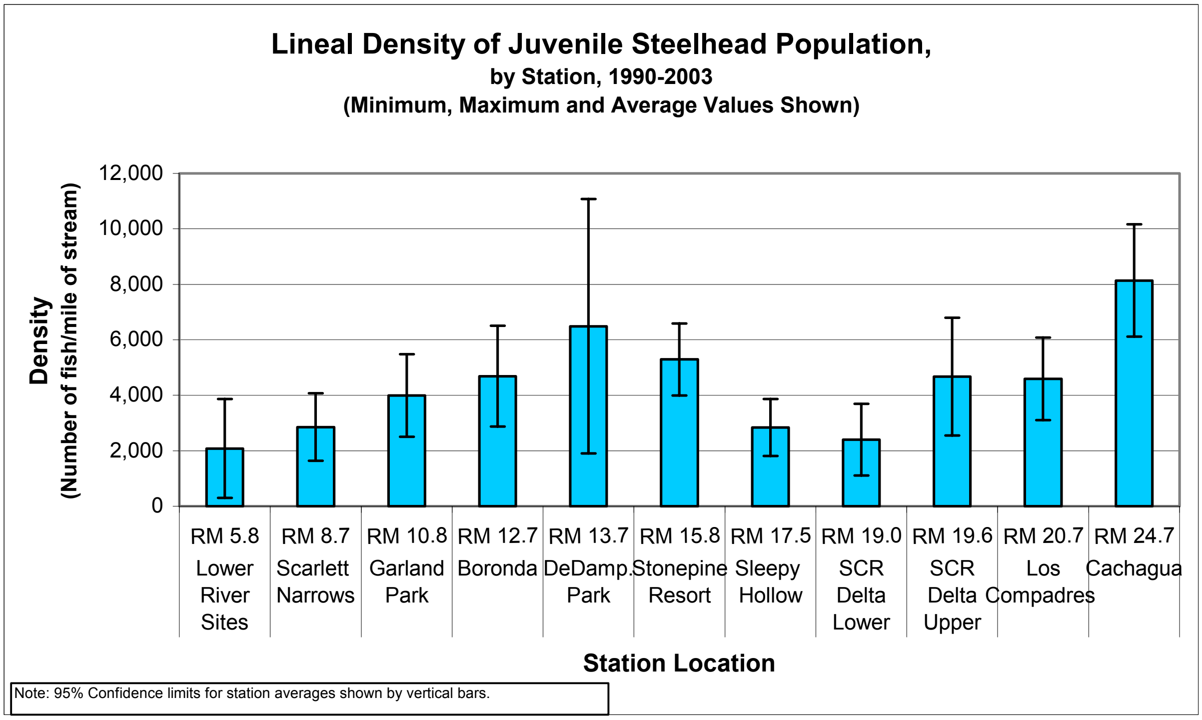


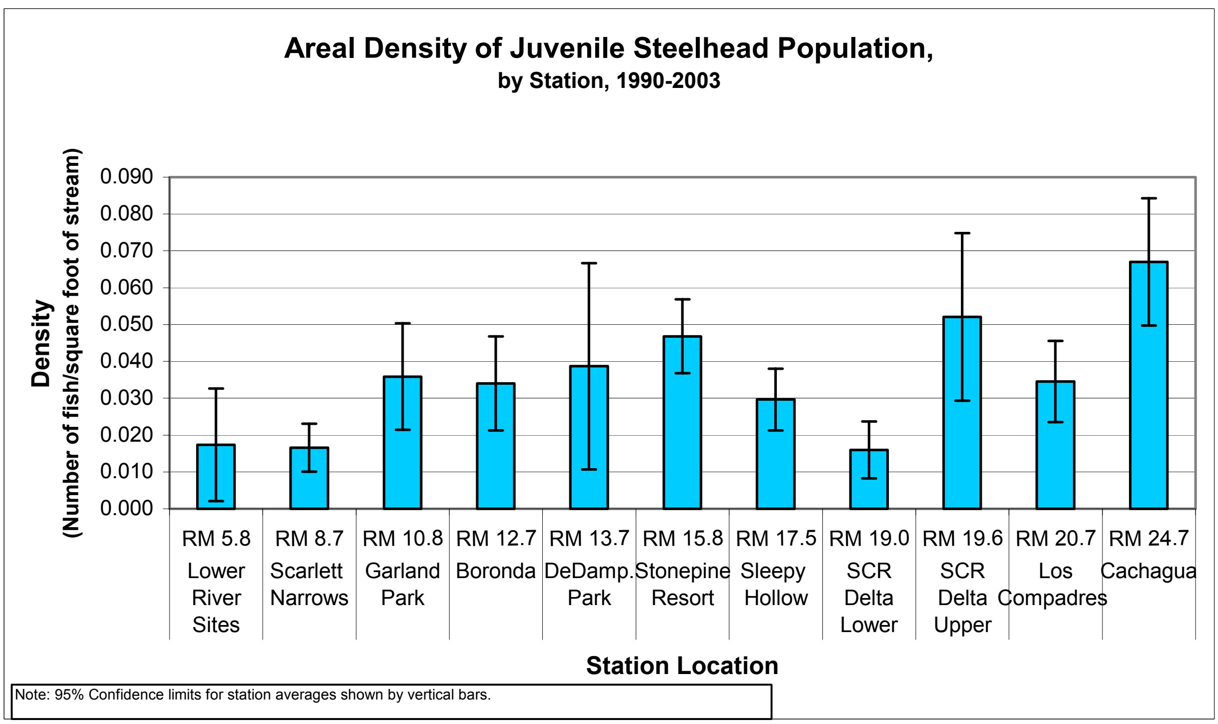




Rearing Habitat Area (upper chart), Rearing Habitat Index Units (middle chart), and Potential Rearing Capacity (lower chart) for young-of-the-year steelhead in the mainstem Carmel River and selected tributaries upstream of Tularcitos Creek (see chart).

Figure 5.5.1.2-C





Average Lineal Density (upper graph) and Areal Density (lower graph) of the juvenile steelhead population in monitoring stations on the Carmel River between Los Padres Dam and the annual wetted front of the lower river. Note: Based on surveys completed in October 1990-2003 and on repetitive 3-pass removal method using an electrofisher. Not all stations were sampled each year. See Tables 5.5.1.2-J and 5.5.1.2-K for detailed accounting of sampled stations and annual data.

Table 5.5.1.2-B Estimates of the linear extent of rearing habitat in the Carmel River Basin.

PORTION OF BASIN, - Stream	Length Accessible to Adult Steelhead [2]		Length w/Flow Suitable for Rearing[1]	
	(ft)	(miles)	(ft)	(miles)
DOWNSTREAM OF SAN CLEMENTE DAM				
- Carmel River mainstem [3]	95,568	18.1	62,832	11.9
-- Lagoon	2,640	0.5	1,320	0.3
-- Robinson Canyon Cr.	5,850	1.1	2,500	0.5
-- Las Gazas Creek [4]	13,150	2.5	6,600	1.3
-- Tularcitos Cr.	22,750	4.3	15,000	2.8
BETWEEN SAN CLEMENTE RES & LOS PADRES DAM				
- Carmel River mainstem	28,550	5.4	28,550	5.4
-- San Clemente Creek	22,200	4.2	22,200	4.2
--- Black Rock Cr.	15,800	3.0	13,800	2.6
-- Pine Creek	29,050	5.5	29,050	5.5
-- Cachagua Creek	25,250	4.8	10,560	2.0
--- Finch Cr.	10,900	2.1	5,000	0.9
--- James Cr.	5,600	1.1	5,600	1.1
UPSTREAM OF LOS PADRES RES.				
- Carmel River mainstem	35,800	6.8	35,800	6.8
-- Miller Fork	31,000	5.9	31,000	5.9
-- Danish Creek	9,000	1.7	9,000	1.7
SUBTOTALS				
- Carmel River mainstem	162,558	30.8	128,502	24.3
-- Primary Tributaries	158,250	30.0	125,910	23.8
--- Secondary Tribs.	32,300	6.1	24,400	4.6
TOTAL IN CARMEL RIVER BASIN	**353,108**	**66.9**	**278,812**	**52.8**

[1] Estimated portion with perennial flows based on field surveys during summers of 1974 & 1975 (CF&G report by Snider,1983); 1982 &1989 (D.W. Kelley & Associates, 1986 and MPWMD Tech Memo 1990-03); and 1994-2003 (MPWMD, files).

[2] Based on field reconnaisssance of migration barriers in mainstem Carmel River and San Clemente Creek (see Table 5.5.1.1, this report).

[3] Annual portion of the mainstem with perennial flow and viable habitat ranges from 10.5 to 12.8 miles, depending on diversions of subsurface streamflow and releases at San Clemente Dam.

[4] Annual portion of Garzas Creek with perennial flow and viable habitat ranges from zero to 2.5 miles, depending in part on natural accretion, releases from Moore's Lake Dam and possibly diversions of subsurface inflow in the Garzas Creek Basin. Releases at the dam are set according to an agreement and protocol between NOAA Fisheries, California Department of Fish and Game, and the Santa Lucia Preserve. The protocol allows for no minimum release of water from the dam when measured surface inflow to the reservoir declines to zero.

Table 5.5.1.2-C

Quantity and quality of juvenile rearing habitat in twelve reaches of the Carmel River upstream of Los Padres Reservoir[1]

STREAM	REACH	REACH LENGTH (ft)	FLOW (cfs)	PORTION MEASURED (ft)	MEASURED SURFACE AREA (sqft)	ESTIMATED TOTAL SURFACE AREA (sqft)	YOUNG-OF-THE-YEAR STEELHEAD: Measured Habitat Area (sqft)	YOUNG-OF-THE-YEAR STEELHEAD: Estimated Total Habitat Area (sqft)	YOUNG-OF-THE-YEAR STEELHEAD: Mean Habitat Quality (0-8)	YOUNG-OF-THE-YEAR STEELHEAD: Rearing Index
Carmel River, Main Fork	Danish Creek to Bluff Camp	8,078	~10	3,009	67,600	181,480	65,365	175,480	4.9	106.9
	Bluff Camp to Bruce Fork	5,174	~10	1,785	40,959	118,724	39,543	114,619	5.1	112.0
	Bruce Fork to Trib. u.s. of Sulphur Sprgs	3,960	~7	1,828	41,288	89,442	38,315	83,002	5.1	107.3
	Trib u.s. of Sulphur Sprgs. to trib. d.s. of Buckskin Camp	6,178	~6	2,733	56,575	127,889	56,175	126,985	4.5	93.0
	Tributary d.s. of Buckskin Camp to rb trib. u.s. of Buckskin Camp	4,541	~5	1,811	41,506	104,074	39,672	99,476	5.8	126.1
	Right bank trib u.s. of Buckskin Camp to trib d.s. BM1743	4,752	~4	3,234	68,293	100,349	67,525	99,220	5.2	109.4
	Trib d.s. BM 1743 to Barrier u.s. Ventana Mesa Creek	4,171	~4	489	8,621	73,534	8,148	69,500	5.4	90.5
	SUBTOTALS	36,854		14,889	324,842	795,492	314,743	768,281		
Miller Fork	Confluence with Carmel River to meadow ~1 mi upstream	5,280	~2-3	1,117	14,773	69,831	13,705	64,783	4.1	50.8
	Meadow to Clover Basin Camp	5,544		1,908	20,824	60,507	19,368	56,277	4.4	44.7
	Clover Basin Camp to Miller Cyn Camp	3,168	~2-3	1,503	20,098	42,362	20,063	42,288	6.2	82.4
	Miller Canyon Camp to barrier d.s. China Camp	16,104	~1	1,201	12,585	168,750	12,151	162,931	5.4	54.2
	SUBTOTALS	30,096		5,729	68,280	341,451	65,287	326,279		
Danish Creek	Confluence with Carmel River to u.s. barrier	8,976	~2	2,442	30,010	110,307	29,275	107,605	4.7	57.0
	OVERALL TOTALS	75,926		23,060	423,132	1,247,250	409,305	1,202,166		

[1] Source: Dettman, D. H. 1990. The Quantity of Steelhead Rearing Habitat Inundated or Blocked by Alternative Water Supply Projects in the Carmel River Basin. Technical Memorandun
Distirict. 21 pp. Based on measurements of rearing habitat using method developed by Dettman and Kelley (1986) in twelve stations upstream of Los Padres Reservoir, October 18-26, '

Table 5.5.1.2-D

Quantity and quality of juvenile rearing habitat in four reaches of the Carmel River between San Clemente Reservoir and Los Padres Dam[1]

REACH	REACH LENGTH (ft)	FLOW (cfs)	PORTION MEASURED (ft)	MEASURED SURFACE AREA (sqft)	ESTIMATED TOTAL SURFACE AREA (sqft)	YOUNG-OF-THE-YEAR STEELHEAD Measured Habitat Area (sqft)	Estimated Total Habitat Area (sqft)	Mean Habitat Quality (0-8)	Rearing Index	YEARLING & OLDER STEELHEAD Measured Habitat Area (sqft)	Estimated Total Habitat Area (sqft)	Mean Habitat Quality (0-8)	Rearing Index
San Clemente Reservoir to Pine Creek	10,600	~5-16	600	17,958	311,902	16,035	276,347	4.5	108.7	12,851	215,260	1.3	27.0
Pine Creek to Syndicate Camp	5,350	~5-16	753	22,640	160,422	19,332	137,759	5.6	108.7	14,835	111,084	1.8	30.6
Syndicate Camp to Cachagua Creek	6,300	~5-16	753	22,640	233,212	19,332	209,369	4.5	108.7	14,835	136,338	1.4	27.8
Cachagua Creek to Los Padres Reservoir	6,300	~5-16	636	18,280	163,273	16,149	139,346	6.7	108.7	14,738	127,871	2.0	38.5
OVERALL TOTALS	28,550		2,742	81,518	868,809	70,848	762,821	5.3	108.7	57,259	590,553	1.6	31.0

[1] Source: Dettman, D. H. 1990. The Quantity of Steelhead Rearing Habitat Inundated or Blocked by Alternative Water Supply Projects in the Carmel River Basin. Technical Memorandum, 90-03. Monterey Peninsula Water Management Distirict. 21 pp. Based on measurements of rearing habitat using method developed by Dettman and Kelley (1986) in 35 stations in the reach between San Clemente Reservoir and Los Padres Dam, April 17 - June 5, 1989.

Table 5.5.1.2-E

REACH	REACH LENGTH (ft)	FLOW (cfs)	PORTION MEASURED (ft)	SURFACE AREA (sqft)	TOTAL SURFACE AREA (sqft)	YOUNG-OF-THE-YEAR STEELHEAD Habitat Area (sqft)	YOUNG-OF-THE-YEAR STEELHEAD Total Habitat Area (sqft)	YOUNG-OF-THE-YEAR STEELHEAD Mean Habitat Quality (0-8)	YOUNG-OF-THE-YEAR STEELHEAD Rearing Index	YEARLING & OLDER STEELHEAD Habitat Area (sqft)	YEARLING & OLDER STEELHEAD Total Habitat Area (sqft)	YEARLING & OLDER STEELHEAD Mean Habitat Quality (0-8)	YEARLING & OLDER STEELHEAD Rearing Index
Narrows to Bedrock	11,128	46	4,606	208,524	503,790	201,664	487,216	4.1	181.4	129,992	314,058	3.8	107.6
Pools u.s. of		40	3,245	165,018	565,892	140,400	481,470	3.7	159.1	77,533	265,882	3.5	83.4
Garland Park		18	3,299	168,185	567,312	160,235	540,496	3.4	168.4	118,256	398,894	2.7	99.7
		8.5	3,589	131,487	407,687	117,026	362,849	2.0	64.6	57,988	179,797	1.3	21.5
Bedrock Pools u.s.	4,122	46	4,361	207,041	195,694	201,119	190,097	6.4	297.1	175,375	165,764	4.2	167.5
of Garland Park		40	4,456	204,799	189,448	194,871	180,264	5.5	242.4	159,869	147,886	4.2	152.0
to Garzas Creek		16	3,859	157,801	168,556	156,426	167,087	3.8	153.1	114,527	122,332	2.5	73.6
		5.6	3,812	139,059	150,368	130,656	141,281	2.3	78.0	95,931	103,732	1.7	42.0
Garzas Creek to	10,380	49	3,058	144,576	490,745	144,156	489,320	5.8	275.0	126,977	431,008	3.7	153.0
Rosies Bridge		38	2,844	145,038	529,358	138,310	504,802	5.3	259.3	117,325	428,211	3.7	151.0
(Esquiline Road)		19	3,011	150,107	517,473	110,181	379,834	3.6	130.8	25,694	88,576	2.8	23.6
		6.6	2,763	90,247	339,039	85,214	320,131	2.1	71.6	64,179	241,107	1.3	32.3
Rosies Bridge to	7,040	53	3,664	148,057	284,476	148,057	284,476	5.1	207.5	142,539	273,874	4.8	186.7
Stonepine Bridge		38	3,512	135,645	271,908	130,937	262,471	4.6	171.8	104,460	209,396	4.1	120.6
(Tularcitos Creek)		18	3,476	122,105	247,301	109,895	222,572	3.2	110.7	57,558	116,573	2.8	46.7
		8.5	3,478	112,378	227,470	91,304	184,813	2.8	73.6	51,837	104,926	2.3	34.0
Stonepine Bridge to	14,940	53	3,153	115,061	545,199	109,042	516,679	5.2	178.2	91,440	433,274	4.7	153.8
San Clemente Dam		38	2,214	65,376	441,155	65,376	441,155	5.9	174.1	82,687	557,969	5.3	155.7
		18.5	2,942	86,251	437,998	57,059	289,756	3.5	67.8	39,362	199,887	2.5	35.3
		5.6	2,933	67,004	341,302	66,154	336,973	2.5	55.8	55,909	284,787	0.8	15.9
Schulte Bridge to the Narrows [2]	15,300	*~3.5*			*220,000*		*206,000*	*0.9*	*40*		*124,000*	*0.6*	*20*
1982 TOTALS	47,610	49			2,019,904		1,967,787		214.7		1,617,978		148.9
		39			1,997,762		1,870,163		194.7		1,609,345		132.3
		18			1,938,640		1,599,744		118.8		926,264		52.8
		7			1,465,865		1,346,047		65.9		914,349		25.7
EXISTING TOTALS	62,910	*~3.5-7*			1,685,865		1,552,047		59.6		1,038,349		24.3

[1] Source: Dettman and Kelley (1986), Table IV-11, pp 72-73. Based on measurements of rearing habitat using method developed by Dettman and Kelley (1986) in five stations in the reach between the Narrows and San Clemente Dam, June 15 - July 30, 1982. Measurements in 1982 did not include habitats downstream of the Narrows.

[2] For reach from Schulte Bridge to Narrows, habitat area, habitat quality, and rearing indexes for young-of-the-year and yearlings based on values for reach from the Narrows to Bedrock Pools upstream of Garland Park, projected to lower flow of ~3.5 cfs.

Table 5.5.1.2-F

Summary of estimated total habitat area and rearing index units for young-of-the-year and yearling steelhead and capacity to rear young-of-the-year steelhead in the Carmel River upstream of Schulte Road Bridge and in selected tributaries upstream of Tularcitos Creek [1]

STREAM & REACH [2]	REACH LENGTH			YOUNG-OF-THE-YEAR STEELHEAD				YEARLING AND OLDER STEELHEAD			
			TOTAL SURFACE AREA	Total Habitat Area	Total Rearing Index Units	Projected Populaton Density	Potential Rearing Capacity	Total Habitat Area	Total Rearing Index Units	Projected Populaton Density	Potential Rearing Capacity
	(ft)	(mi)	(ft)	(sqft)	(RI units)	(no/ft)	(nos.)	(sqft)	(RI units)	(no/ft)	(nos.)
CARMEL RIVER DOWNSTREAM OF SAN CLEMENTE DAM	56,550	10.7	1,461,147	1,339,860	3,288,080	1.06	60,171	878,540	1,319,130	NA	NA
CARMEL RIVER SAN CLEMENTE TO LOS PADRES DAM	28,550	5.4	868,809	762,821	3,204,260	1.82	51,997	590,553	867,600	NA	NA
CARMEL RIVER UPSTREAM OF LOS PADRES DAM	35,900	6.8	775,104	748,391	3,817,320	1.74	62,417	611,067	2,512,140	NA	NA
MILLER FORK BASIN	31,050	5.9	350,261	334,631	1,691,145	1.01	31,439	240,242	953,570	NA	NA
DANISH CREEK	9,000	1.7	110,602	107,893	513,000	1.05	9,432	86,314	304,200	NA	NA
CACHAGUA CREEK BASIN	27,060	5.1	162,871	109,605	217,551	0.36	9,811	42,056	33,843	NA	NA
SAN CLEMENTE CREEK BASIN	38,000	7.2	361,098	203,600	760,495	0.53	20,147	138,365	167,030	NA	NA
TOTAL CARMEL RIVER BASIN	226,110	43	4,089,892	3,606,801	13,491,851		245,413	2,587,137	6,157,513		

[1] Table 5.5.1.2-F provides summary of totals in major reaches of the mainstem and in selected tributaries. See **Appendix 5.5.1.2-D** for a detailed accounting of habitat quality and quantity, rearing indexes and capacity to rear young-of-the-year in specific reaches of each stream.

[2] Table does not include assessment of juvenile rearing habitats or potential rearing capacity for young-of-the-year in Pine Creek, Tularcitos Creek Hitchcock Canyon, Garzas Creek or Potrero Creek. Habitats in Pine and Garzas creeks are similar to San Clemente Creek and habitat in Tularcitos Creek is similar to Cachagua Creek. Habitat quality and quantity is severely constrained in Tularcitos and Garzas Creeks by lack of surface flow during summer months. Pine Creek is relatively pristine in character with only minor diversions of surface flow and few landform disturbances.

Table 5.5.1.2-G

TABLE 9. Juvenile Steelhead and Resident Rainbow Trout Population Estimate in the Carmel River Basin, 1973 and 1974.

Study area	Year	No./mile	No./acre	Total/study area
1. Danish Creek[1/]	1973	2,323	4,840	1.742
	1974	1,637	3,411	1,228
	Mean	1,980	4,136	1,485
2. Carmel River, upstream of Los Padres Dam[1/]	1973	1,475	1,175	20,650
	1974	1,267	1,010	17,738
	Mean	1,371	1,092	19,194
3. Cachauga Creek	1973	Not sampled		
	1974	2,165	3,579	4,330
4. Pine Creek	1973	6,389	8,785	35,140
	1974	4,013	5,518	22,072
	Mean	5,201	7,152	28,606
5. San Clemente Creek	1973	2,633	4,340	11,849
	1974	1,531	2,524	6,890
	Mean	2,082	3,432	9,370
6. Carmel River, between San Clemente and Los Padres dams	1973	6,072	2,003	33,396
	1974	3,590	1,184	19,745
	Mean	4,831	1,594	26,571
Carmel River, downstream of San Clemente Dam				
7. Flowing section	1973	6,336	2,613	7,920
	1974	3,904	1,610	4,880
	Mean	5,120	2,112	6,400
8. Non-flowing section	1973	211	70	158
	1974	581	192	436
	Mean	396	131	297
Entire River	1973	---	----	110,855
	1974	---	----	78,319
	Mean	---	----	94,587

[1/]Rainbow trout found upstream of Los Padres Dam were not considered anadromous.

Source: Snider (1983), page25. See Appendix 5.5.1.2-B, this report.

Table 5.5.1.2-H

TABLE 10. Juvenile Steelhead and Resident Rainbow Trout Age Class Distribution in the Carmel River Basin, 1973 and 1974.

Study area	Year	Age 0+ No.	Age 0+ %	Age 1+ and older No.	Age 1+ and older %
1. Danish Creek 1/	1973	1,724	99	18	1
	1974	1,216	99	12	1
	Mean	1,470	99	15	1
2. Carmel River upstream of Los Padres Dam 1/	1973	17,965	87	2,685	13
	1974	15,077	85	2,661	15
	Mean	16,506	86	2,688	14
3. Pine Creek	1973	34,086	97	1,054	3
	1974	19,644	89	3,428	11
	Mean	26,865	93	1,741	7
4. Cachauga Creek	1973	Not sampled			
	1974	4,287	99	43	1
5. San Clemente Creek	1973	11,731	99	118	1
	1974	6,821	94	69	6
	Mean	9,276	96	94	4
6. Carmel River, between San Clemente and Los Padres dams	1973	33,129	99	267	1
	1974	18,560	92	1,185	8
	Mean	25,845	96	727	4
Carmel River, downstream of San Clemente Dam					
7. Flowing section	1973	7,841	99	79	1
	1974	4,490	92	390	8
	Mean	6,166	96	235	4
8. Non-flowing Section	1973	119	75	39	25
	1974	144	33	292	67
	Mean	132	54	166	46
All areas	1973	106,595	96	4,260	4
	1974	70,239	90	8,080	10
	Mean	88,417	93.5	6,170	6.5

1/ Rainbow trout found upstream of Los Padres Dam were not considered anadromous.

Source: Snider (1983), page 26. See Appendix 5.5.1.2-B, this report.

Table 5.5.1.2-I

	Lineal Density			Carmel River - Areal Density		North Coast Streams - Areal Density
Year	(no/mi)	(no/100ft)	(no/meter)	(no/sqft)	(no/sqm)	(no/sqm)
1973	6,121	116.4	0.355	0.0486	0.523	
1974	3,648	69.4	0.212	0.0290	0.312	
1983	6,116	116.3	0.355	0.0468	0.503	0.430
1984						0.800
1985	4,966	94.4	0.288	0.0544	0.585	0.550
1986	9,307	177.0	0.540	0.1037	1.116	0.930
1987	5,107	97.1	0.296	0.0492	0.529	0.840
1988						0.810
1989	22	0.4	0.001		0.000	0.800
1990	733	13.9	0.042	0.0185	0.199	0.690
1991	1,294	24.5	0.075	0.0148	0.159	0.590
1992	3,098	58.7	0.179	0.0313	0.337	0.630
1993	5,075	96.1	0.293	0.0524	0.564	1.110
1994	2,713	51.4	0.157	0.0291	0.313	0.590
1995	5,281	100.0	0.305	0.0529	0.569	
1996	5,890	111.6	0.340			
1997	4,359	82.6	0.252			
1998	3,901	73.9	0.225			
1999	3,403	64.4	0.196			
2000	9,680	183.3	0.559			
2001	3,716	70.4	0.215			
2002	5,734	108.6	0.331			
2003	7,738	146.5	0.447			
Averages:						
1973, 74, 83, 85-86	6,032	115	0.350	0.0565	0.608	0.678
1987,89,90, 91	1,789	34	0.104	0.0339	0.243	0.785
1995-2003			0.319			
1992-2003	5,049	96	0.292	0.0361	0.388	0.730

[1] Source: CDFG file reports, MPWMD files and Cramer, et al. 1995)

Table 5.5.1.2-J

CARMEL RIVER JUVENILE STEELHEAD ANNUAL POPULATION SURVEY [1]

Lineal Population Density at Survey Stations (numbers per foot of stream) [3, 4]

	Lower River Sites	Scarlett Narrows	Garland Park	Boronda	DeDamp. Park	Stonepine Resort	Sleepy Hollow	SCR Delta Lower Station	SCR Delta Upper Station	Los Compadres	Cachagua	**Overall Annual Average**		**Average [2] 1994-on Comparison**	
YEAR	RM 5.8	RM 8.7	RM 10.8	RM 12.7	RM 13.7	RM 15.8	RM 17.5	RM 19.0	RM 19.6	RM 20.7	RM 24.7	**(nos./ft)**	**(nos./mi)**	**(nos./ft)**	**(nos./mi)**
1990	0	0	0	0	0	0.50	0.27			0.26	0.22	**0.14**	**733**	--	--
1991	0	0	ND	0.12	0	0.74	0.39			0.09	0.62	**0.25**	**1,294**	--	--
1992	ND	ND	0.67	0.36	ND	0.96	0.30			0.40	0.83	**0.59**	**3,098**	--	--
1993	ND	0.62	0.91	0.92	0.82	0.84	0.52			1.22	1.84	**0.96**	**5,075**	**0.96**	**5,075**
1994	ND	0.44	0.23	0.43	0	0.50	0.29			1.51	0.71	**0.51**	**2,713**	**0.51**	**2,713**
1995	0.49	0.65	1.01	1.61	ND	1.42	0.69			0.50	1.63	**1.00**	**5,281**	**1.07**	**5,666**
1996	0.24	1.52	0.82	1.05	2.03	1.22	0.29			0.95	1.92	**1.12**	**5,890**	**1.23**	**6,468**
1997	0.02	0.22	1.02	1.74	1.15	0.5	0.22			1.15	1.41	**0.83**	**4,359**	**0.93**	**4,891**
1998	0.19	0.30	0.67	0.34	1.50	0.27	0.60			0.54	2.24	**0.74**	**3,901**	**0.81**	**4,264**
1999	0.17	0.26	0.50	0.32	0.62	1.67	0.45			0.46	1.35	**0.64**	**3,403**	**0.70**	**3,716**
2000	0.91	1.03	0.64	1.38	5.66	1.71	1.46			1.41	2.3	**1.83**	**9,680**	**1.95**	**10,289**
2001	ND	0.48	0.35	0.63	0.68	1.08	0.32			0.47	1.62	**0.70**	**3,716**	**0.70**	**3,716**
2002	ND	0.68	0.85	1.67	0.83	1.07	0.5	0.33	0.68	1.52	2.73	**1.09**	**5,734**	**1.09**	**5,734**
2003	1.53	0.82	2.16	1.86	1.45	1.55	1.23	0.58	1.09	1.69	2.16	**1.47**	**7,738**	**1.46**	**7,704**
Station Ave (no./ft)	**0.39**	**0.54**	**0.76**	**0.89**	**1.23**	**1.00**	**0.54**	**0.46**	**0.89**	**0.87**	**1.54**	**0.85**	**4,472**	**1.04**	**5,476**
Station Ave (no./mile)	**2,083**	**2,852**	**3,992**	**4,688**	**6,486**	**5,291**	**2,840**	**2,402**	**4,673**	**4,590**	**8,139**				
Overall Station Averages:												**0.83**	**4,367**		

[1] Surveys completed in October and results based on repetitive 3-pass removal method using an electrofisher.

[2] Average 1994-on comparison does not include data for lowest river sites at Meadows Road (1995); Schulte Area (1996), and Red Rock Area (1997-2003).

[3] RM; indicates miles from rivermouth

[4] Data listed as single digit 0; indicates stream was dry at sampling station

Table 5.5.1.2-K

CARMEL RIVER JUVENILE STEELHEAD ANNUAL POPULATION SURVEY [1]

Areal Population Density at Survey Stations (numbers per foot of stream) [3,4]

	Lower River Sites	Scarlett Narrows	Garland Park	Boronda	DeDamp. Park	Stonepine Resort	Sleepy Hollow	SCR Delta Lower Station	SCR Delta Upper Station	Los Compadres	Cachagua	**Overall Annual Average [5]**		**Average [2] 1994-on Comparison**	
YEAR	RM 5.8	RM 8.7	RM 10.8	RM 12.7	RM 13.7	RM 15.8	RM 17.5	RM 19.0	RM 19.6	RM 20.7	RM 24.7	**(nos./ft²)**	**(nos./m²)**	**(nos./ft²)**	**(nos./m²)**
1990	0	0	0	0	0	0.022	0.015			0.009	0.003	**0.005**	**0.059**	**--**	**--**
1991	0	0	ND	0.007	0	0.044	0.030			0.003	0.031	**0.014**	**0.155**	**--**	**--**
1992	ND	ND	0.041	0.023	ND	0.056	0.023			0.017	0.044	**0.034**	**0.366**	**--**	**--**
1993	ND	0.021	0.064	0.055	0.034	0.055	0.038			0.048	0.087	**0.050**	**0.540**	**0.050**	**0.165**
1994	ND	0.017	0.014	0.026	0	0.031	0.023			0.061	0.033	**0.025**	**0.274**	**0.025**	**0.084**
1995	0.030	0.019	0.058	0.069	ND	0.080	0.054			0.024	0.067	**0.050**	**0.539**	**0.053**	**0.174**
1996	0.008	0.044	0.035	0.025	0.065	0.054	0.024			0.041	0.064	**0.040**	**0.430**	**0.044**	**0.144**
1997	0.001	0.006	0.048	0.054	0.005	0.032	0.018			0.053	0.069	**0.031**	**0.338**	**0.035**	**0.116**
1998	0.004	0.011	0.019	0.010	0.037	0.009	0.021			0.019	0.088	**0.024**	**0.260**	**0.027**	**0.087**
1999	0.010	0.012	0.018	0.012	0.020	0.069	0.019			0.018	0.058	**0.026**	**0.282**	**0.028**	**0.092**
2000	0.033	0.031	0.021	0.035	0.178	0.061	0.058			0.053	0.101	**0.063**	**0.682**	**0.067**	**0.220**
2001	ND	0.014	0.014	0.024	0.025	0.040	0.013			0.018	0.068	**0.027**	**0.290**	**0.027**	**0.088**
2002	ND	0.020	0.036	0.072	0.038	0.045	0.022	0.012	0.041	0.057	0.131	**0.047**	**0.508**	**0.047**	**0.155**
2003	0.070	0.022	0.099	0.065	0.063	0.058	0.059	0.020	0.064	0.063	0.096	**0.062**	**0.664**	**0.061**	**0.200**
Station Ave (nos./ft²)	**0.017**	**0.017**	**0.036**	**0.034**	**0.039**	**0.047**	**0.030**	**0.016**	**0.052**	**0.035**	**0.067**	**0.036**	**0.385**	**0.042**	**0.139**
Station Ave (nos./m²)	**0.187**	**0.178**	**0.386**	**0.366**	**0.416**	**0.504**	**0.319**	**0.172**	**0.561**	**0.372**	**0.721**				
Overall Station Averages:												**0.035**	**0.380**		

[1] Surveys completed in October and results based on repetitive 3-pass removal method using an electrofisher.

[2] Average 1994-on comparison does not include data for lowest river sites at Meadows Road (1995); Schulte Area (1996), and Red Rock Area (1997-2003).

[3] RM; indicates miles from rivermouth

[4] Data listed as single digit 0; indicates stream was dry at sampling station

[5] Station and annual averages converted to numbers per square meter by applying conversion factor 10.764 square feet per square meter.

Table 5.5.1.2-L

Estimated Carrying Capacity for Young-of-the-Year Steelhead in the mainstem of the Carmel River

STREAM	REACH	REACH LENGTH (ft)	REACH LENGTH (mi)	Total Habitat Area (sqft)	Juvenile Population Density: Lineal (no/ft)	Juvenile Population Density: Aerial (no/ft2)	Estimated Carrying Capacity, based on: Lineal Density (nos.)	Estimated Carrying Capacity, based on: Aerial Density (nos.)
CARMEL RIVER	Schulte Bridge to the Narrows	15,300	2.9	206,000	0.39	0.017	5,967	3,502
	The Narrows to Bedrock Pools u.s. of Garland Park	11,650	2.2	362,849	0.54	0.017	6,291	6,168
	Bedrock Pools u.s. of Garland Park to Garzas Creek	4,100	0.8	141,281	0.83	0.035	3,383	4,945
	Garzas Creek to Rosies' Bridge (Esquiline Road) [1]	3,500	0.7	107,944	1.06	0.037	3,710	3,940
	Rosies' Bridge to Stonepine Bridge (Tularcitos Creek)	7,050	1.3	184,813	1.00	0.047	7,050	8,686
	Tularcitos Creek to San Clemente Dam	14,950	2.8	336,973	0.54	0.030	8,073	10,109
Subtotal DOWNSTREAM OF SAN CLEMENTE DAM [2]		56,550	10.7	1,339,860			34,474	37,351
	San Clemente Res. to Pine Creek	10,600	2.0	276,347	0.87	0.035	9,222	9,672
	Pine Creek to Syndicate Camp	5,350	1.0	137,759	0.87	0.035	4,655	4,822
	Syndicate Camp to Cachagua Creek	6,300	1.2	209,369	1.21	0.051	7,592	10,678
	Cachagua Creek to Los Padres Dam	6,300	1.2	139,346	1.54	0.067	9,702	9,336
Subtotal SAN CLEMENTE TO LOS PADRES DAM [2]		28,550	5.4	762,821			31,170	34,508
	Danish Creek to Bluff Camp	7,200	1.4	156,407	0.80	0.028	5,782	4,364
	Bluff Camp to Bruce Fork	5,900	1.1	130,702	0.75	0.032	4,407	4,169
	Bruce Fk to trib. above Sulphur Sprgs.	3,850	0.7	80,696	0.69	0.036	2,660	2,897
	Trib. above Sulphur Spr to trib below Buckskin Camp	5,650	1.1	116,132	0.53	0.023	3,017	2,717
	Trib. below Buckskin Camp to rightbank trib. above Buckskin	4,350	0.8	95,292	0.54	0.021	2,349	2,039
	Rightbank trib above Buckskin Camp to trib below Benchmark 1743	4,750	0.9	99,179	0.76	0.049	3,591	4,810
	Tributary below Benchmark 1743 to Barrier above Ventana Mesa Creek	4,200	0.8	69,983	0.46	0.022	1,915	1,554
Subtotal UPSTREAM OF LOS PADRES DAM [3]		35,900	6.8	748,391			23,722	22,551
TOTAL IN MAINSTEM OF CARMEL RIVER							89,365	94,409

[1] Estimates habitat length and area excludes portion of reach which normally drys up by the end of summer.

[2] Estimated densities downstream of Los Padres Dam based on average density in sampling stations, 1990-2003. (See Table 5.5.1.2-I and 5.5.1.2-J)

[3] Estimated densities upstream of Los Padres Dam from Dettman and Kelley (1986), Table IV-3, page 52, based on 1982 samples