

Rainbow trout/steelhead occur throughout the Santa Ynez River basin and its tributaries where conditions are favorable for their persistence. A description of the steelhead habitat conditions in the mainstem Santa Ynez River and Hilton Creek, a tributary to the river, is provided below. Hilton Creek is the only tributary included in this discussion because it is the only creek that will be enhanced by releases. Hilton Creek is situated immediately downstream of Bradbury Dam and therefore provided a unique opportunity for flow-related enhancement.

2.1 MAINSTEM

2.1.1 PHYSICAL HABITAT

Anadromous steelhead are currently limited to the mainstem Santa Ynez River and the accessible portion of its tributaries below Bradbury Dam (Figure 2-1). Historically, the reach of the Santa Ynez River downstream of Bradbury Dam either dried up in the summer or supported very low streamflow levels (Shapovalov 1944). Young steelhead remain in freshwater for a year or more, and summer habitat in warm climates is often in short supply. Steelhead also require cool water temperatures. Summer conditions in Santa Ynez valley can warmwater temperatures above levels suitable for young steelhead.

Prior to 1953, when the dam was constructed, steelhead likely used the mainstem below Bradbury Dam primarily for passage to more favorable spawning and rearing areas that now lie above Bradbury Dam (but below Gibraltar Dam, which was the upstream limit of migration beginning in the 1920's, when it was constructed) (Shapovalov 1944). The area below the current location of Bradbury Dam, except for a spring-fed segment near Solvang, typically went dry in the summer and therefore was not suitable spawning or rearing habitat (Shapovalov 1944). Shapovalov (1944) reports rescuing rainbow trout/steelhead from the area of the mainstem above the current location of Bradbury Dam.

Since 1953, steelhead have been restricted to the mainstem Santa Ynez River and its tributaries below Bradbury Dam. This 48-mile reach of river is characterized by a longitudinal gradient of differing habitat types. Several reaches have been delineated based on geomorphology, as well as opportunities for management (Table 2-1). The primary characteristics describing each reach include channel structure, substrate, cover and water temperature conditions. A description of the mainstem reaches follows, discussing the attributes of these reaches and their suitability for rainbow trout and steelhead.

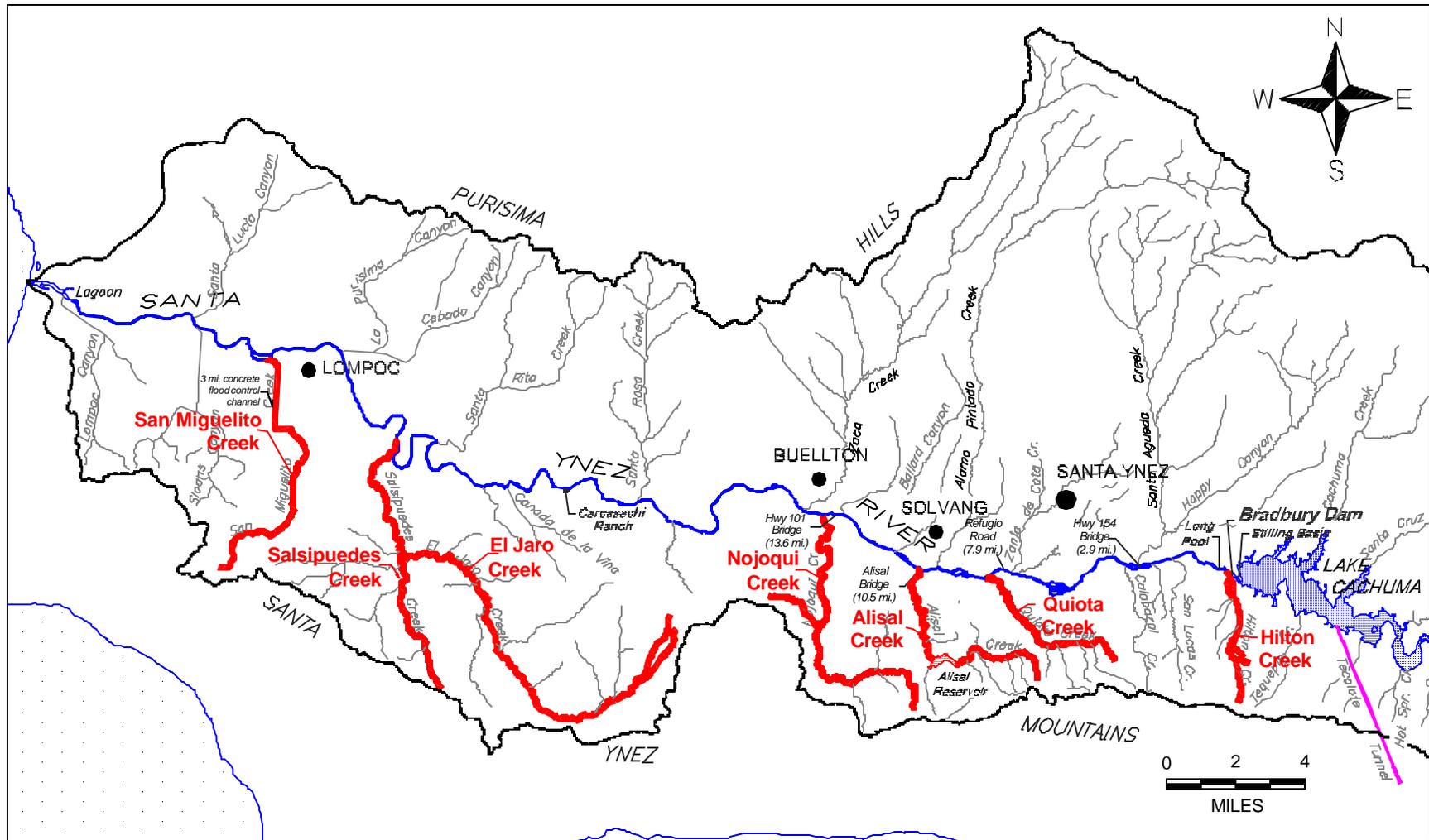


Figure 2-1 Santa Ynez River Basin Downstream of Lake Cachuma

Table 2-1 Reaches in the Lower Mainstem Santa Ynez River

Reach Name	Landmarks	Reach Length (miles)	Miles below Bradbury Dam
Highway 154	Bradbury Dam down to Highway 154 Bridge	2.9	0 - 2.9
Refugio	Highway 154 Bridge down to Refugio Road	5.0	2.9 - 7.9
Alisal	Refugio Road down to Alisal Bridge in Solvang	2.6	7.9 - 10.5
Avenue of the Flags	Alisal Bridge in Solvang down to Avenue of the Flags Bridge in Buellton	3.1	10.5 - 13.6
Buellton to Lompoc	Buellton to Highway 1 Bridge in Lompoc (includes Weister and Cargasachi study sites)	23.9	13.6 - 37.5
Below Lompoc	Highway 1 Bridge in Lompoc to lagoon	8.3	37.5 - 45.8
Lagoon	Above old 35 th Street Bridge to mouth of river	2.5	45.8 - 48.3

2.1.2 REACH DESCRIPTIONS

2.1.2.1 Highway 154

The Highway 154 Reach extends 2.9 miles from Bradbury Dam to the Highway 154 Bridge. The Highway 154 Reach has a more confined channel than reaches further downstream, as well as better riparian cover in general. Property access issues have limited studies in this reach to Reclamation property, which extends approximately a ¼ mile between the Stilling Basin just below Bradbury Dam to the Reclamation property boundary. Habitat mapping in March 1994 showed that this reach was dominated by pool habitat (75% by length) (Table 2-2). Most of the pools in this reach (76% of total pool length) had a maximum depth of less than 3 feet. Runs accounted for 19% of the total length, and riffles and dry channel made up 3% each. Several large and deep perennial pools are present on Reclamation property, including the Stilling Basin and the Long Pool.

Substrate consisted primarily of cobble near Bradbury Dam with increasing proportions of sand and gravel downstream. This is typical of stream reaches just below dams because sediment-starved water from the reservoir picks up small substrate and carries it downstream. Habitat mapping surveys in 1994 noted that spawning-sized gravels were of extremely limited availability within the wetted channel between Refugio Road and Bradbury Dam (ENTRIX 1995a). High-flow events in 1995 and 1998 have since resulted in additional gravels being moved into the system from Hilton Creek and other tributaries (SYRTAC data).

Table 2-2 Habitat Mapping of the Lower Mainstem Santa Ynez River

		Highway 154 Reach ¹		Refugio Reach ²		Alisal Reach ²	
		Length	%	Length	%	Length	%
Habitat Type	Pool	12,481	75	2,937	33	1,346	9
	Run	468	19	2,800	32	4,184	29
	Glide	*	*	1,494	17	3,859	27
	Riffle	3,088	3	1,543	18	4,991	35
	Dry Channel	554	3	*	*	*	*
	Total Length	16,591		8,774		14,380	
Survey Date		March 25, 1994		July 28, 1997		July 23, 1997	
Release from Cachuma		0 cfs ³		92 cfs		93 cfs	
Flow		42 cfs at Solvang		86 cfs at site		72 cfs at site	

¹ ENTRIX 1995a

² SYRTAC 1999a

³ Estimated flow below Hilton Creek was 4 to 6 cfs.

* Not designated. Glides are grouped with runs.

From a fisheries perspective, riparian vegetation in most areas of the lower Santa Ynez River is not well developed, and does not provide significant shading for aquatic habitats. The Highway 154 Reach has moderate canopy coverage, better than canopy cover in reaches further downstream.

Instream aquatic vegetation, mainly algae, forms in the Highway 154 Reach typically in pools. Large amounts of aquatic algae have been observed growing up from the bottom in all years since 1994. During the early part of the summer this reach appears to have less algal growth than more downstream reaches. However, by the late summer, algae becomes abundant.

Temperature monitoring and modeling results indicate that this reach of the mainstem Santa Ynez River is the only portion of the river where water temperatures remain within the tolerance limits of steelhead. Monitoring over several years reveals that generally there are only a few days in July and August where mean daily water temperatures exceed 22°C and maximum daily water temperatures exceed 25°C (Table 2-3). Several localized areas of upwelling cool water were noted in the Long Pool, which may help account for these cool water temperatures and which may also provide temperature refugia when water temperatures reach stressful levels.

2.1.2.2 Refugio Reach

The Refugio Reach is 5 miles long, extending from the Highway 154 Bridge (about 2.9 miles downstream from Bradbury) down to the Refugio Bridge (about 7.9 miles downstream from

Table 2-3 Frequency Analysis of Water Temperature Exceedances in the Long Pool at Surface

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
<i>1995</i>						
June	15	0	N/A	0	17.3	63.1
July	31	11	N/A	0	22.3	72.1
August	31	10	N/A	0	21.6	70.9
September	30	0	N/A	0	20.8	69.4
October	31	0	N/A	0	18.5	65.3
<i>1996</i>						
April	28	4	0	0	22.5	72.5
May	31	N/A	0	N/A	--	
June	30	N/A	1	N/A	--	
July	31	18	17	1	25.1	77.2
August	31	0	0	0	18.1	64.6
September	30	0	0	0	17.6	63.7
October	31	0	0	0	19.4	66.9
<i>1997</i>						
April	30	0	0	0	19.3	66.7
May	31	10	0	0	23.4	74.1
June	30	13	0	0	23.2	73.8
July	21	10	0	0	23.2	73.8
August	31	0	0	0	17.5	63.5
September	30	0	0	0	17.5	63.5
October	31	0	0	0	18	64.4

Bold/Italics: 25-74% of the monitored days exceeded criterion

Bold: 75% or more of the monitored days exceeded criterion

N/A: Unavailable

Source: SYRTAC 1997, 1998, and other SYRTAC data

Bradbury). Flows in this area often become intermittent or non-existent during the summer. Based on a large subsample of this reach, the habitat composition (percent of total length) was 33% pools, 32% runs, 17% glides, and 18% riffles (SYRTAC 1999a) (Table 2-2).

The substrate is a mix of small cobble, gravel, and fine sediment. The 1994 habitat surveys noted that spawning-sized gravels were of extremely limited availability within the wetted channel between Refugio Road and Bradbury Dam. High-flow events in 1995 and 1998 have resulted in additional gravel recruitment to this area's tributary streams. Instream cover is moderate in pools. Riparian vegetation is not well developed, and canopy coverage is low. This reach has the most extensive growths of algae compared with the other mainstem reaches.

Temperatures often exceeded 20°C daily average in summer 1995 and August 1996, but rarely exceeded a 22°C daily average (Table 2-4). A daily maximum temperature of 25°C was generally exceeded on a few days in 1995 and 1996, but was not exceeded in 1997. Temperature modeling studies suggest that temperatures in this reach could likely not be

maintained on a reliable basis during most years even at flows of up to 20 cfs. In relatively cool, wet years, it may be possible to maintain suitable temperatures in some or all of this reach. Upwelling of cool groundwater, which occurs in a few habitat units, can provide a thermal refuge for fish in the summer (SYRTAC 1997, 1998, 2000).

Table 2-4 Frequency Analysis of Water Temperature Exceedances in the Refugio Reach (3.4 miles Downstream of Bradbury Dam) at Surface

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
<i>1995</i>						
June	16	4	0	0	23.9	75.0
July	31	26	5	6	26.4	79.5
August	31	29	9	9	26.5	79.7
September	30	25	0	1	25.0	77.0
October	31	1	0	0	24.1	75.4
<i>1996</i>						
July	12	2	0	1	24.7	76.5
August	31	23	2	8	27.2	81.0
September	30	9	0	9	26.6	79.9
October	31	8	0	6	25.4	77.7
<i>1997</i>						
April	30	0	N/A	0		
May	0	0	N/A	0	Dry	
June	0	0	0	0	Dry	
July	14	0	0	0	23.0	73.4
August	15	6	0	0	24.9	76.8
September	30	7	0	0	23.8	74.8
October	31	0	0	0	22.2	72.0

Bold/Italics: 25-74% of the monitored days exceeded criterion

Bold: 75% or more of the monitored days exceeded criterion

N/A: Data not available

Source: SYRTAC 1997, 1998, and other SYRTAC data

2.1.2.3 Alisal Reach

The Alisal Reach extends about 2.6 miles from the Refugio Road Bridge (7.9 miles downstream from Bradbury) to the Alisal Road Bridge in Solvang (approximately 10.5 miles downstream from Bradbury). Quiota and Alisal creeks join the mainstem Santa Ynez River in this reach. Flows generally become non-existent during the summer and fall months except in very wet years. The habitat composition of this reach (percent of total length) is 35% riffles, 29% runs, 27% glides, and only 9% pools (Table 2-2) (SYRTAC 1999).

The substrate is small cobble, gravel, and fine sediments. As with the Refugio Reach, riparian vegetation is not well developed, and canopy coverage is poor. Floating mats of algae can be extensive in the summer. In July 1995, algal mats covered an average of 60% of the aquatic

habitat surface area in Alisal Reach. Although algal mats declined or disappeared during the winter of 1995 to 1996, they were again extensive by early summer 1996. In August 1996, following initiation of downstream water rights releases from Bradbury Dam, algae were not observed in any of the habitats where snorkel surveys were conducted. In June 1997, algal mats were again prevalent in monitored pools (25% to 70% cover).

The Alisal Reach is the downstream most extent to which steelhead have been observed on a regular basis in the mainstem. Generally a few adults may be found in the thermal refugia in this portion of the river, but numbers are typically sparse.

Temperature monitoring in 1995 through 1997 shows that mean daily temperatures in this reach generally exceeded 20°C in all years from June through September and often exceeded 22°C in July or August (Table 2-5). Maximum daily temperatures exceeded 25°C in more than 75% of days in August in 1996 and 1997. Temperature modeling results indicate that temperatures suitable for steelhead cannot be maintained in this portion of the river on a reliable basis, even with flow releases of up to 20 cfs (Woodward-Clyde Consultants *et al.*, 1995, SYRTAC 1997). Upwelling of cool groundwater, which occurs in a few habitat units, can provide a thermal refuge for fish in the summer (SYRTAC 1997).

Table 2-5 Frequency Analysis of Water Temperature Exceedances at the Alisal Bridge (9.5 miles Downstream of Bradbury Dam) at Surface

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
<i>1995</i>						
July	7	7	6	7	26.4	79.5
August	31	31	7	7	26.3	79.3
September	30	9	0	0	22.8	73.0
October	31	5	0	0	22.0	71.6
<i>1996</i>						
May	28	7	0	2	25.6	78.1
June	30	28	2	17	28.0	82.4
July	31	31	23	30	28.2	82.8
August	31	30	11	30	28.0	82.4
September	30	30	7	22	27.5	81.5
October	31	15	0	9	26.3	79.3
<i>1997</i>						
April	30	3	0	2	25.1	77.2
May	6	2	5	2	25.8	78.4
June	30	19	7	8	26.6	79.9
July	31	30	8	16	26.5	79.7
August	31	31	27	27	27.9	82.2
September	30	30	9	15	27.7	81.9
October	31	6	N/A	2	25.8	78.4

Bold/Italics 25-74% of the monitored days exceeded criterion

Bold 75% or more of the monitored days exceeded criterion

N/A: Not available

Source: SYRTAC 1997, 1998, and other SYRTAC data

2.1.2.4 Avenue of the Flags

The Avenue of the Flags Reach extends 3.1 miles, from Alisal Road Bridge down to the Avenue of the Flags Bridge in Buellton (about 13.6 miles downstream from Bradbury). The habitat is almost exclusively run. Substrate here is typically sand and gravel. This reach is essentially devoid of canopy cover (SYRTAC 1998). Water temperatures at Buellton are potentially adverse or lethal for steelhead, with nearly all summer days exceeding 20°C, many days exceeding 22°C average daily in July through September, and a significant proportion of days exceeding 25°C daily maximum in July and August (Table 2-6).

Table 2-6 Frequency Analysis of Water Temperature Exceedances at Buellton (13.6 Miles Downstream of Bradbury Dam) at Bottom

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
<i>1995</i>						
May	28	0	0	0	24.1	75.4
June	30	16	6	10	27.3	81.1
July	31	31	10	14	26.4	79.5
August	31	16	2	1	25.0	77.0
September	30	0	0	0	21.6	70.9
October	31	0	0	0	22.4	72.3
<i>1996</i>						
April	30	5	N/A	0	24.8	76.6
May	27	0	0	0	20.6	69.1
June	30	23	0	0	22.6	72.7
July	31	30	14	10	27.6	81.7
August	31	30	16	29	28.1	82.6
September	30	30	5	2	25.0	77.0
October	31	14	0	0	22.4	72.3
<i>1997</i>						
May	24	0	0	0	22.3	72.1
June	30	24	0	0	22.6	72.7
July	31	28	7	0	24.3	75.7
August	31	31	26	12	26.6	79.9
September	30	30	15	0	24.8	76.6
October	31	6	0	0	22.9	73.2

Bold/Italics 25-74% of the monitored days exceeded criterion

Bold 75% or more of the monitored days exceeded criterion

N/A Data not available

Source: SYRTAC 1997, 1998, and other SYRTAC data

2.1.2.5 Buellton to Lompoc

The mainstem between Buellton and Lompoc (about 37.5 miles downstream from Bradbury at the Highway 1 Bridge) extends 23.9 miles and includes the Weister Reach (about 16 miles downstream from Bradbury) and the Cargasachi Reach (a 1.5-mile reach about 24 miles

downstream from Bradbury). Upstream of Lompoc, near the confluence with Salsipuedes Creek (about 30 miles downstream from the dam), the channel is broad and braided, with little shading. In the 1995 survey, runs are the dominant habitat type, with some riffles and few pools (SYRTAC 1997). Substrate is mainly sand and small gravel. Canopy cover and instream cover is minimal. Coverage from algal mats in July 1995 was lower compared to the Refugio and Alisal reaches. In early summer 1996, algal mats were extensive in the Cargasachi Reach, but were absent in August following initiation of downstream water rights releases.

2.1.2.6 Below Lompoc

This reach extends about 8.3 miles from the Highway 1 Bridge in Lompoc (37.5 miles downstream of Bradbury Dam) down to the lagoon. Habitat surveys in March 1994 of the two miles below the Lompoc Wastewater Treatment Facility found the reach dominated by deep pools formed by numerous beaver ponds (50% of length) (ENTRIX 1995a). Runs were also extensive, accounting for 37% of the reach, while shallow pools (maximum depth less than 3 feet deep) and riffles accounted for 12% and 1%, respectively.

Downstream of Bailey Avenue in Lompoc, progressively greater concentrations of riparian vegetation occur, including extensive growths of willows, both along the sides and within the river channel. The growth of willows and other vegetation in this area is supported by freshwater (treated effluent) releases to the channel from the Lompoc Wastewater Treatment Facility. Substrate in the area is typically sand and fine silt.

2.1.2.7 Lagoon

The lagoon is located at the mouth of the Santa Ynez River, about 9 miles west-northwest of the town of Lompoc, California. The lagoon typically forms as flows decline after the winter runoff period when the mouth of the river is filled with sand deposited by both the river and by the strong longitudinal drift of sand from north to south along the shoreline. High winter river flows are capable of opening an outlet. Low summer flows are typically insufficient to keep the outlet open, although inflow from the Lompoc treatment facility and wave action can breach this barrier (Engblom, pers. comm.).

The lagoon is about 13,000 feet long, with an average width of about 300 feet. Near the beach, it is substantially wider than at the upstream end. The average water depth is about 4 feet, and the water surface elevation during the July 1994 sampling period, with the mouth closed, was almost 5 feet MSL. The volume of water stored in the closed lagoon is approximately 300 AF. The lagoon supports the growth of emergent aquatic vegetation along the margins, but the majority of the lagoon is open water. Substrate in the lagoon typically consists of sand and silt.

The lagoon represents a unique habitat characterized by saltwater/freshwater mixing. Water quality within the lagoon, particularly salinity, has a major influence on the distribution of fish and macroinvertebrates inhabiting this area of the system. Vertical gradients in water temperature, dissolved oxygen, and salinity were observed within deeper areas of the lagoon during periods when the lagoon mouth was closed. Vertical stratification in water quality parameters varied

substantially between locations and survey periods. Dissolved oxygen concentrations were generally greater than 5 mg/l in the upper three quarters of the water column during months when stratification within the lagoon had developed. The lower one quarter of the water column had dissolved oxygen levels less than 4 mg/l, with concentrations less than 1 mg/l within 1 foot of the bottom at most locations.

Average daily and maximum daily water temperatures within the lagoon during the summer were usually lower than water temperatures measured at upstream monitoring locations, with the exception of locations immediately downstream of Bradbury Dam (SYRTAC 1997). Surface and bottom temperatures frequently exceeded 20°C average daily but never exceeded 25°C from May to September (SYRTAC 1997).

Salinity levels within the lagoon followed a consistent longitudinal pattern, with salinity near brackish/full strength seawater at Ocean Park, decreasing to freshwater at the upstream location. Salinity level varied at each site between months, reflecting seasonal variation in the balance between freshwater inflow and tidal influence. Higher salinity concentrations were observed at high tide at all three sites monitored, particularly when the Lagoon mouth was open.

2.1.3 DISSOLVED OXYGEN MONITORING

Dissolved oxygen concentrations are an important component of habitat for steelhead and rainbow trout. Among the most profound influences on dissolved oxygen concentrations are algal concentrations and mixing. Algal concentrations have been observed to be high in all reaches of the mainstem from late spring to early fall. Large diel fluctuations in dissolved oxygen concentrations have been linked to high algal concentrations in studies conducted by the SYRTAC (1997, 1998). In these studies, dissolved oxygen concentrations were monitored in mainstem pools at times when algae was and was not present (SYRTAC 1997, 1998). Dissolved oxygen levels were good during the day (>5 mg/l), regardless of algal cover. Pre-dawn surveys found that concentrations were acceptable when algae was not present (usually about 6 to 9 mg/l); however, when algae was present, dissolved oxygen concentrations in some pools dropped to as low as 1 to 3 mg/l. Dissolved oxygen concentrations this low would be expected to result in stress and possible mortality to steelhead. Steelhead are likely to respond by seeking out microhabitats having more oxygen, such as a riffle, where the water is better aerated. Observations indicate that large accumulations of algae are removed from pools when WR 89-18 releases are made. These releases flush the algae out of the pools, resulting in better dissolved oxygen concentrations.

2.1.4 STEELHEAD USE OF THE MAINSTEM

SYRTAC studies conducted from 1993 to 2000 have documented rainbow trout/steelhead in the mainstem Santa Ynez River downstream of Lake Cachuma (Table 2-7). These studies have occurred during wet and average periods, therefore, results probably do not reflect distribution and relative abundance in dry years.

Table 2-7 Relative Abundance of Rainbow Trout/Steelhead in the Lower Santa Ynez River Basin

Mainstem Reach	Miles below Bradbury	Young-of-the-year				
		1995 Wet	1996 Average	1997 Average	1998 Wet	1999 Average
Highway 154 Reach	0-0.5	3-36	0	0	239	5
Refugio Reach	3.4-7.9	0	0	0	686	0
Alisal Reach	8-10.5	0	0	0	244	0
Avenue of the Flags Reach	14	0	0	0	0	0
Weister Ranch Reach	16	0	0	0	0	0
Santa Rosa Park Reach	20	0	0	0	0	0
Cargasaschi Reach	24	0	0	0	0	0

Mainstem Reach	Miles below Bradbury	Juveniles				
		1995 Wet	1996 Average	1997 Average	1998 Wet	1999 Average
Highway 154 Reach	0-0.5	10-31	3	23	5	6
Refugio Reach	3.4-7.9	1-8	0	0	5	8
Alisal Reach	8-10.5	1-14	0	0	0	48
Avenue of the Flags Reach	14	0	0	0	0	0
Weister Ranch Reach	16	0	0	0	0	0
Santa Rosa Park Reach	20	0	0	0	0	0
Cargasaschi Reach	24	0	0	0	0	0

Mainstem Reach	Miles below Bradbury	Adults				
		1995 Wet	1996 Average	1997 Average	1998 Wet	1999 Average
Highway 154 Reach	0-0.5	52-84	23	5	48	44
Refugio Reach	3.4-7.9	4-43	1-15	0	29	1
Alisal Reach	8-10.5	20-38	8-42	1	24	6
Avenue of the Flags Reach	14	1	0	0	0	NS
Weister Ranch Reach	16		0	0	0	NS
Santa Rosa Park Reach	20	0	0	0	15	NS
Cargasaschi Reach	24	0	0	0	0	NS

WY Water Year (October 1-September 30)

NS Not sampled

P Not sampled by snorkeling survey, but presence observed from bank.

Hyphenated values represent the range of fish numbers observed when multiple surveys were conducted.

Data are not standardized to a particular unit (e.g. length of stream) although the methods for data collection are.

Data from snorkel surveys in summer and fall, 1995-1999 (SYRTAC 1997, 1998, 2000; Engblom pers. comm.).

Spawning activity has been observed in the mainstem directly downstream of Bradbury Dam in nearly every year of the SYRTAC studies (SYRTAC 1997, 1998, 2000), but no redds were reported in 1997 (SYRTAC 1998). While no spawning has been observed downstream of the Highway 154 Reach, redds have been observed in the Refugio Reach in 1999 and in the Alisal Reach in 2000 (SYRTAC 2000, other data). In addition, young-of-the-year have been documented in the Refugio and Alisal reaches in 1995 and 1998, both very wet years.

2.2 HILTON CREEK

Hilton Creek is a small, intermittent stream located immediately downstream of Bradbury Dam. In general, steelhead are known to migrate to the uppermost accessible reaches in a river seeking spawning habitat. Adults migrating up the Santa Ynez River are blocked by Bradbury Dam and must find spawning habitat downstream of the dam. Hilton Creek currently provides the most upstream, tributary spawning habitat available to anadromous fish in the lower Santa Ynez basin. It is included here because proposed flow-related enhancement releases will be discharged into Hilton Creek through the supplemental watering system. Please refer to *Appendix C, Tributaries of the Santa Ynez River below Bradbury Dam* and *Appendix D, Hilton Creek Enhancement* for a more detailed description of Hilton Creek and the supplemental facility.

2.2.1 PHYSICAL HABITAT

The watershed of Hilton Creek is estimated at approximately 4 square miles, and approximately 2,980 feet of the creek is on Reclamation property, including the confluence with the Santa Ynez River. The lower reach of Hilton Creek (downstream of the Highway 154 crossing) is high gradient and well confined. The channel is shaded by riparian vegetation and the walls of the incised channel. Habitat mapping in 1998 classified the stream below the chute pool (located approximately 1,380 feet upstream of the confluence) as 58% run, 27% riffle/cascade, and 15% pool (SYRTAC 2000). Surveys upstream of the chute pool to the Reclamation property boundary (1,553 feet total) documented 34% run, 61% riffle/cascade, and 5% pool (SYRTAC 2000). Most pools had suitable spawning habitat at their tails.

Thermograph data, coupled with observations throughout the year, indicate that water temperatures are generally suitable for over-summering steelhead, although temperatures may occasionally reach stressful levels for a few days in some years. Water temperatures are lowest at the upper Reclamation property boundary, with gradual warming occurring towards the mouth of the creek. Dissolved oxygen concentrations are suitable for rainbow trout/steelhead (>5 mg/l) when water is flowing in the creek. Channel disturbance and water quality problems appear to be minimal. Hilton Creek clears quickly even after several days of rain.

2.2.2 STEELHEAD USE OF HILTON CREEK

Hilton Creek is inhabited by rainbow trout/steelhead up to the chute pool (1,380 feet upstream of its confluence with the Santa Ynez River). Prickly sculpin are found to about 800 feet upstream

from the mainstem and no introduced warmwater species, such as bass, bullhead or sunfish, are found in Hilton Creek.

Adult passage to upper Hilton Creek is hampered first by a cascade and bedrock chute (just upstream of the chute pool) and then completely blocked at a culvert at the Highway 154 crossing (about 4,200 feet upstream from the confluence). Spawning is generally more common in the upper sections of the accessible reach. No spawning or young-of-the-year have been observed above the cascade to the Reclamation property boundary (about 2,980 feet upstream from the mainstem). Anecdotal reports indicate that trout were historically present in upper Hilton Creek above the Highway 154 Culvert prior to the Refugio Fire in 1955.

Adult rainbow trout/steelhead have been documented migrating into Hilton Creek in all years that observations have been made, but numbers were low in years with low winter runoff. Production has been especially good during high runoff years such as 1995 and 1998, when many adults enter the creek. Adults migrating into Hilton Creek are often large and could be anadromous steelhead from the ocean (particularly in wet years), rainbow trout that spilled over from Lake Cachuma, or fish that are resident in the river, its tributaries or the lagoon (SYRTAC 1997). Because the stream goes dry during the summer, young-of-the-year cannot complete rearing in lower Hilton Creek under natural conditions (SYRTAC 1997, 1998, 2000). The fish are either stranded or must enter the mainstem where they are exposed to predatory bass and catfish. Fish rescue operations saved over 220 young-of-the-year and 5 adults in 1995 and 831 young-of-the-year (up to 100 mm) and 3 adults in 1998, the two years when rescues have been performed.