

## **IX. STEELHEAD MITIGATION MEASURES**

The Findings for Certification of the Water Allocation Program Final EIR (Findings Nos. 388-A through D) identified mitigation measures to reduce impacts to the Carmel River steelhead population, including: (a) expansion of the program to capture and transport smolts during spring, (b) prevent stranding of early fall and winter migrants, (c) rescue juveniles downstream of Robles del Rio during summer, and (d) implement an experimental smolt transport program at Los Padres Dam. Monitoring of adult returns and juvenile populations provides an indication of the overall success of the steelhead mitigation measures. The following sections briefly describe the purpose of each mitigation measure and activities during the reporting period. For reporting purposes, the steelhead “rescue season” generally begins in May and runs through September. Accordingly, results from the 2007 rescue season are included in this report and the results for the 2008 rescue season, i.e., May through September 2008, will be included in next year’s report.

### **A. Capture and Transport Emigrating Smolts in Spring**

#### Description and Purpose

The goal of this program is to reduce disruption of the steelhead life cycle due to streamflow diversions. During spring months, when steelhead smolts are actively emigrating from fresh water to the ocean, the diversion of surface and groundwater from the river often interferes, and in some cases, blocks migration into the ocean. This threatens individual fish, reduces the number of smolts that successfully reach the ocean, and indirectly affects the number of adults that eventually return to freshwater. When streamflow is too low for natural emigration, or when smolts are at risk of being stranded, the District monitors streamflow, captures emigrating smolts, and transports them to the lagoon or ocean.

#### Implementation and Activities During 2007-2008

Between March and mid-June 2008, mean daily streamflow in the Carmel River at the Highway 1 Bridge dropped from 276 to 0 cubic feet per second (cfs). Streamflow was less than 20 cfs by late April and less than 5 cfs by mid May (**Figure IX-1**). These flows allowed for only a slightly shortened late smolt migration period, and provided fair to good conditions for the emigration of smolts from the lower Carmel River and the Lagoon into the ocean, therefore, no trapping of smolts was completed in 2008 (**Figure IX-2**).

### **B. Prevent Stranding of Fall/Winter Juvenile Migrants**

#### Description and Purpose

As in other central California streams, juvenile steelhead in the Carmel River move downstream into lower reaches of the river well ahead of the peak emigration of smolts. Depending on river conditions and diversions during the previous dry season, there is some risk that pre-smolts and other juvenile steelhead will be stranded following early fall and winter storms, which increase flows and stimulate the fish to move downstream into habitats that are subsequently dewatered after the storm peak passes. This risk occurs primarily from October through February, although during severe droughts, the risk period may extend into March. The District mitigates this problem by

capturing and transporting juveniles during the high-risk period from October through February. Currently, juveniles trapped during fall/winter months are transported upstream to viable habitats above the Narrows or held at the District's Sleepy Hollow Steelhead Rearing Facility (SHSRF).

### Implementation and Activities During 2007-2008

District staff monitored river conditions during the fall and winter months of the 2007-08 reporting year (RY 2008). Mean daily streamflow below San Clemente Dam remained very low; between about 3 and 5 cfs from October 2007 to early January 2008 (**Figure II-4**). An early January storm raised the daily flow to about 600 cfs. Continuous seasonal streamflow returned to the MPWMD gaging station at Highway 1 on January 5, 2008 (**Figure IX-1**). The highest average daily discharge at the Highway 1 gage was 2,030 cfs, reached in late January. As a result of these flows there was little risk of fish stranding, although conditions were carefully monitored throughout the fall and winter, and no rescues of juvenile fish were needed.

## **C. Rescue Juveniles Downstream of Robles del Rio in Summer**

### Description and Purpose

About 1.5 miles of habitat between Boronda Road and Robles del Rio and up to nine miles of habitat below the Narrows are seasonally subject to dewatering, depending on the magnitude of streamflow releases at San Clemente Dam, seasonal air temperatures and water demand. Beginning as early as April or May of each dry season, the District rescues juvenile steelhead from the habitat in these reaches. The goal of this program is to help maintain a viable steelhead population by transplanting juveniles to permanent river habitats downstream of San Clemente Dam (if it is available), and/or rearing juvenile steelhead at the SHSRF, located just downstream of San Clemente Dam, if habitat is not available.

### Implementation and Activities during 2007-2008

- **MPWMD Annual Rescue Totals** – The surface flow of the Carmel River dropped to 10 cfs at the Highway 1 Bridge by May 1, 2007. In response to the decline in surface flow, District staff began rescues on May 7, 2007 and these efforts continued through September 6, 2007. During these months, staff conducted 42 rescue operations, yielding a total of 12,185 fish including 11,722 young-of-the-year (YOY), 308 older juveniles, 17 adults and 138 mortalities (**Table IX-1**). Compared to previous rescue seasons, rescue totals in the 2007 dry season were below the average number of steelhead rescued from 1989 through 2007 (**Figure IX-3**).
- **2007 Dry Season, MPWMD Transplant Location** – During the 2007 dry season, juvenile steelhead rescued by MPWMD were transported and released into the District's SHSRF (11,191), Carmel River at Garland Park (386), Carmel River at West Garzas Well (448), Carmel River at Old Carmel Dam (6), the SHSRF tail works pool (2), and Carmel Bay at Stewart Cove (14). Adult steelhead in good condition were acclimated to salt water and released at Stewart Cove. The mortality of rescued and transported fish was 1.13% (138), which is above the 1991-2007 average mortality of 0.64%. This was due to two seining incidents in which 68 of the total 138 mortalities were recorded. These two seining events were in isolated pools that had severely diminished water quality conditions.

- **CRSA Annual Rescue Totals** – During the 2007 dry season, May through July, a total of 6,468 steelhead were rescued from the Carmel River watershed by the Carmel River Steelhead Association (CRSA), including 5,887 fish from the mainstem, 253 from the lagoon and 328 from the tributaries. The total rescued included 5,900 YOY, 244 older juveniles, 124 smolts, 123 adults and 77 mortalities. All the smolts, and 122 of the adults were rescued from the lagoon.
- **2007 Dry Season, CRSA Transplant Location** – During the 2007 dry season, juvenile steelhead rescued in the mainstem by CRSA, were transported and released into in the District's SHSRF (811), Boronda Road (754), Garland Park (463), or the Carmel River Lagoon (3,306). One transplant location was not reported. At this unknown location, 485 fish were released. Juvenile steelhead rescued in the tributaries were released in the mainstem at the confluence of that tributary (328). Only smolts and adults were rescued in the Carmel River Lagoon and these fish were released into Carmel Bay (246). The mortality of rescued and transported fish was 1.19% (77).
- **Sleepy Hollow Steelhead Rearing Facility (SHSRF)** - The District's Water Allocation Mitigation Program includes construction and operation of a facility for rearing juvenile steelhead through the dry season. In early 1997, the District completed construction of the SHSRF, which includes: (1) a diversion and pump station, (2) two large circular tanks, (3) an 800-foot long rearing channel, (4) electrical, water, pressurized air and drainage systems, (5) an office/shop/lab building and (6) miscellaneous equipment.

Significant additional upgrades and modifications were made to the Facility between 2000 and 2003. These included: (a) a cooling tower, (b) large emergency generator, (c) upgraded impellers on the existing pumps, (d) purchases of an additional backup pump and a mobile emergency pump, and (e) installation of a centrifugal separator to reduce the buildup of coarse sediment in the cooling tower and rearing channel. In 2005 and 2006, new wooden weir boards were installed and waterproofed in the rearing channel to prevent fish movement between bays and add an additional backup mechanism. If the river pumps were to fail, the channel would hold more water for a longer period, giving staff more time to correct the problem without fish loss. In 2007, eight, 250-gallon, insulated rearing troughs were installed. These rectangular, flow-through troughs replaced a defunct 22-foot diameter tank. These tanks can be used to rear small rescued fish, for additional quarantine treatments, or for growth and survival experiments.

Facility Modifications in Reporting Year 2007-08 – Filters, chillers, and UV sterilizer equipment were purchased for the rearing troughs to make them capable of operating in a closed, recirculation mode. Additional sizes of fish graders were purchased to enable staff to more effectively separate incoming fish by size before stocking in the rearing channel. The additional sized graders now allow fish to be separated into as many as six sizes, rather than no more than three sizes using the previous equipment.

Summary of 2007-2008 SHSRF Fish Stocking and Releases - Steelhead rescues began in May 2007. Between May 14 and September 6, 2007, staff received approximately 10,846 rescued fish at the Facility (**Table IX-2**). This year, because most of the incoming fish were very small (i.e., approximately one-inch total length), batches of fish were placed directly into the eight new rearing troughs for quarantine treatment and rearing. Throughout the summer and fall months,

fish were graded and restocked by size into different rearing troughs and several 8-foot rearing tanks. Approximately 9,247 YOY fish were reared in the troughs and 1,362 larger YOY were reared in 8-foot holding tanks, along with 237 medium to large sized yearling fish.

During the eight month holding period, 60% of the Facility's fish died as a result of disease, stress, or general poor health. In addition to their small size, many of the 2007 fish were rescued from drying and stagnant pools with poor water quality and water temperatures frequently above 70 degrees Fahrenheit (F), as the lower Carmel River dried up very quickly early in the season. Primarily due to the regular re-grading of fish in the troughs, thus keeping the larger, more aggressive fish from preying on the small fish, there were only 14% unaccounted-for mortalities. This compares to 2006 when there was 36% disease mortality and 20% unaccounted-for fish.

Due to a large, early season storm in January 2008, staff was concerned with the amount of stress the fish were exhibiting in the tanks while being held in near-zero visibility water, and the possibility of pump failure at the Facility due to high river turbidity. A total of 2,780 fish needed to be quickly released back into the Carmel River in three general locations (**Table IX-3**). Small, non-smolting fish were released above River Mile (RM) 15.5, primarily in the reach around the Facility and at the Stonepine Resort. Twenty-seven percent of the fish were large or smolting, and were released in the lagoon. Most fish were in excellent physical condition, and ranged in size from approximately 3 to 12 inches.

The overall survival rate of fish held at the Facility in 2007 was 26%, far below the Facility's 12-year average of 41%. This low survival rate was likely due to the extremely small size of the fish upon arrival at the Facility and the poor river conditions from which they were rescued, either of which might have increased the probability of contracting a bacterial infection or other disease. Despite being fed antibiotic feed and given repeated salt and antibiotic baths to fight outbreaks, many fish did not survive through June.

#### **D. Monitoring of Steelhead Population**

##### Description and Purpose

The District uses three primary techniques to monitor the health of the steelhead population: (1) counts of adult steelhead passing San Clemente Dam, (2) surveys of winter steelhead redds, and (3) surveys of the juvenile steelhead population in freshwater at the end of the dry season in October.

- **Winter Steelhead Adult Run** - The fish counter and video monitoring equipment were reinstalled at San Clemente Dam on December 20, 2007 and operated continuously from that date until May 11, 2008. As of May 11, 2008, a total of 412 fish passed by the counter, including 28 in January, 221 in February, 154 in March and 9 in April (**Figure IX-4**). The 2008 run was slightly below the average of 467 fish for the 1994-2008 period and less than half of the recent peak runs of 861 fish in 1998 and 804 fish in 2001. However, the 2008 run is the highest count at SCD since the 2003 run of 483 fish and nearly double the low 2007 count of 222 fish (**Figure IX-5**).

- **Winter Steelhead Redd Surveys** – Since 1994, the District has periodically conducted winter steelhead redd (nest) surveys downstream of Los Padres Dam. Originally, these surveys

were part of the District's spawning habitat restoration project to track how many adult fish actually spawned in the injected gravel between the dams and to record the downstream movement of the gravel itself. In 2001, the survey area was enlarged to include the Stonepine Resort area and several tributaries. In 2003 and 2004, complete mainstem surveys were conducted from Via Mallorca Road Bridge (RM 3.2) to Los Padres Dam (RM 24.8). No redd surveys were conducted in the mainstem in 2005 and 2006 due to high river flows throughout most of the winter that precluded wading most river reaches and large late storms that effectively "erased" existing redds.

Summary of 2008 Redd Survey: In early April 2008, staff walked the Carmel River from the Highway 1 Bridge (River Mile 1.1) to San Clemente Dam (SCD) (River Mile 18.6). The survey's goals were to: (a) quantify the number of spawning redds (nests) and adult fish (including spawning pairs, singles, kelts, and carcasses) in the mainstem river below SCD, and compare those numbers to the fish passage counts at SCD in order to make a better estimate of the river's total steelhead run size this year; (b) assess locations where adult steelhead may become stranded and need to be rescued as flows decrease; and (c) assess the relative numbers of steelhead smolts that may be remaining in the river.

Between the Highway 1 Bridge and SCD, 135 redds, 30 adults (including one spawning pair, two "fresh" single fish, seven kelts, and 19 carcasses), zero smolts, zero small juveniles, and numerous fry were observed. Of these totals, 36 redds and four live adults were counted downstream of Robinson Canyon Bridge (RM 8.5). At 45 cfs, the reach between the Highway 1 Bridge and Valley Greens Drive Bridge had a couple shallow glides and riffles that could potentially impact upstream and downstream migration of adults and smolts. The lack of smolts might have been due to the relatively early timing of the survey and the very low abundance of juvenile steelhead in the river the previous fall. The abundance of fry was consistent with the January 2008 lagoon opening and excellent spawning conditions in the lower river.

- **Juvenile Population Surveys** - Since Fall 1990, the District has surveyed the juvenile steelhead population in the Carmel River below Los Padres Dam. This information is crucial to assess the success of adult reproduction and to determine whether or not freshwater habitats are adequately seeded with juveniles.

In October 2007, the population was surveyed at ten stations in a 16.0-mile reach between the Scarlett Narrows area in mid-Carmel Valley and Los Padres Dam, including two sites in the San Clemente Reservoir (SCR) inundation zone. The Red Rock survey station was dry. In 2007, the juvenile steelhead population density averaged 0.36 fish-per-foot (fpf) of stream and ranged from 0.06 at the DeDampierre Station (RM 13.7) to 0.77 fpf at the Boronda Station (RM 12.7) (**Table IX-4**). The low abundance in the DeDampierre reach was not unexpected, as the downstream section of this reach had dried and re-wetted a few days before the survey.

The 2007 juvenile steelhead population density was by far the lowest overall since 1990, near the end of the 1987-1991 drought period (**Figure IX-6**), and was considerably below the long-term (1990 - 2007) average density of 0.84 fpf. Low winter and spring river flows, and the associated adult migration problems and poor fry survival, warm water temperatures, and poor food availability all contributed to the low overall fall abundance of juvenile fish in the Carmel River.

- **Constraints to Cal-Am Diversions from the Lower Aquifer** - During the 1992 SWRCB hearings on complaints against Cal-Am's diversions from the Carmel River, testimony was presented that outlined the potential benefits of a modified way of managing the sequence of pumping from Cal-Am wells in the Carmel Valley Alluvial Aquifer. Pursuant to Condition No. 5 of SWRCB Order WR 95-10, Cal-Am is required to operate its Carmel Valley production wells beginning with the most downstream well, and moving upstream to other wells as needed to meet demand. The goal of this order is to maximize the length of viable stream and aquatic habitats in the lower Carmel Valley.

During the 2007 dry season, this mode of operation and flow releases from San Clemente Reservoir resulted in approximately 0.7 miles of additional viable aquatic habitat. Based on estimated population density at the Scarlett Narrows site (see **Table IX-4**), this habitat produced about 554 additional juveniles, representing approximately 2.9% of the total juvenile population downstream of San Clemente Dam (**Figure IX-7**).

#### **F. Other Activities Related to the Steelhead Resource**

The District carried out several activities in RY 2008 that were not required as part of the original Allocation EIR Mitigation Program, but will improve habitat conditions, help restore the steelhead resource, or provide additional key data on the steelhead resource. These include: (a) rescue and transportation of kelts, (b) spawning habitat monitoring, and (c) assessment of the benthic macroinvertebrate (BMI) communities.

"Kelts" are adult steelhead that have already spawned, typically from January through April, and begin to migrate back to the ocean in late spring and early summer. Under existing conditions, these fish are threatened by receding flows in most years, especially when the upstream migration of adults is delayed due to late-season storms. District staff rescue and transport these fish to more stable waters, when needed.

In November 2000, the District began a bioassessment program using BMI as an indicator of water and habitat quality at four locations between Los Padres Dam and the Red Rock steelhead population survey site. In 2004, a new site above Los Padres Reservoir was added. The above Los Padres location can be used as a reference site to compare "pristine" habitat to habitat below the dams, and that of the lower, developed valley. Results from the BMI analysis can be used as an indicator of water quality and food quantity and quality for juvenile steelhead, both between the sites and over time. Low BMI abundance may be attributable to: (a) poor substrate quality [little available gravel or filled-in interstitial spaces (embeddedness)], (b) high levels of suspended particulates/turbidity, (c) poor oxygen concentration, or (d) high water temperature. Following CDFG's California Stream Bioassessment Procedure (CSBP), BMI samples are collected from each site in the fall and sent to a laboratory for analysis. A three-year summary report on the District's bioassessment program was completed in June 2005.

In addition to the bioassessment program, the District also began detailed monitoring of substrate conditions at its juvenile steelhead population survey sites in 2000. Substrate-size distribution and embeddedness are analyzed and compared over time and space at each location. Substrate size and embeddedness affect both steelhead spawning and rearing success, as well as the presence and abundance of BMI that fish feed on.

### Implementation and Activities in 2007-2008

- **Rescue and Transportation of Kelts** - Seventeen kelts were rescued and transported by District staff during the reporting period. Of the 17 total kelts rescued, 14 were acclimated to saltwater and released in the Pacific Ocean at Stewarts Cove, Carmel Bay. The remaining three kelts were in poor condition and staff were concerned that the fish were too stressed to successfully survive a forced acclimatization. These three fish were released in the river downstream of San Clemente Dam.
- **California Stream Bioassessment Procedure** - During RY 2008, District staff collected BMI samples in Fall 2007 from five locations between above Los Padres Dam and CAW's Begonia Treatment Plant at mid-Carmel Valley. The four sites below LPR match District steelhead population survey stations. The above LPR site is near a CDFG steelhead population survey site.

Of the five composite site samples, 2,518 BMIs were processed, comprising 52 taxa. *Simulium* (black fly larvae) were particularly abundant in 2007 and dominated all five sites, ranging from 25% to 58% of the samples. Black flies are fairly tolerant of poor water quality and are not a preferred food for salmonids. *Baetis* mayflies were the second most dominant species at all sites but the lowest one at Scarlett Well, where Ostracoda were the second most dominant BMI.

Results from 2007 showed moderate abundance of BMI at the four sites above mid-valley, and very high abundance at the Scarlett Well site (ranging from 228 – 789 BMIs/ft<sup>2</sup>), but again, black fly larvae were particularly plentiful (**Table IX-5**). As in the previous two years, the Above Los Padres site had the greatest taxonomic richness, but this year had a very low percentage of intolerant organisms (those that are highly intolerant to water and/or habitat-quality impairment), and the lowest abundance. The Scarlett Well site had the highest BMI abundance and the greatest biovolume, as well as the highest percentage of EPT taxa (*Ephemeroptera*, *Plecoptera*, *Tricoptera* which are the primary steelhead food BMI) and both intolerant and tolerant organisms.

- **Carmel Lagoon Water Quality-Monitoring** – The District continued to monitor lagoon water quality (dissolved oxygen, temperature, and salinity) by taking vertical depth profiles of the lagoon at five sites on a monthly basis in 2007-2008. The raw data and associated graphs have been shared with the Carmel River Lagoon Technical Advisory Committee.
- **Development of a Rescue and Rearing Management Plan for the SHSRF** – The District has had a Section 10 Permit application on file with NOAA Fisheries for a number of years. In RY 2007-2008, the District continued to develop the “Rescue & Rearing Management Plan” (RRMP) needed to receive a Section 10 Permit for the District's rescue operations and the SHSRF, as required by NOAA for any fish-rearing facility. District staff continued to meet with representatives of NOAA Fisheries, the California Department of Fish and Game, aquaculturist Dave Streig of the Monterey Bay Salmon & Trout Project's Big Creek Hatchery, and Mr. Bob Zampatti of the CRSA, to develop initial drafts of the plan. The final draft of the RRMP is scheduled to be submitted to NOAA for public review and comment in 2009.

## **OBSERVED TRENDS, CONCLUSIONS AND/OR RECOMMENDATIONS:**

Monitoring conducted by the District shows that the Carmel River steelhead population has recovered from remnant levels that prevailed as a result of the last drought and past water-supply practices. Since 1992, the spawning population had recovered from a handful of fish to levels approaching 900 adults per year, as counted at San Clemente Dam, before a six-year downward trend from 804 fish in 2001 to 222 fish in 2007. In 2008, the population rebounded somewhat to 412 adults at SCD. Redd surveys below SCD confirm that many adults are spawning in the lower river reaches, and not migrating upstream into the upper watershed, possibly contributing to the low counts at the ladder. This trend substantiates the fact that the habitat in the lower river continues to improve and now has both excellent spawning gravel and food production (BMI abundance) in many of these reaches. River-bank stabilization and restoration projects by the District have matured and now provide both improved rearing habitat and shade for juvenile steelhead in the lower reaches. In addition, the juvenile steelhead that are rescued by the District from the lower river and that survive to adulthood, are likely to return to the lower river to spawn.

Monitoring of the juvenile population at several sites along the mainstem Carmel River below Los Padres Dam shows that, in general, the population is recovering from low densities during the 1989-91 drought period (ranging below 0.50 fish per foot [fpf] of stream) to levels frequently ranging above 1.00 fpf, values that are typical of well-stocked steelhead streams. But in the 2007-2008 reporting period, the average population density was significantly below the long-term average for the Carmel River, primarily due to the low adult returns in 2007, the late opening of the lagoon, and the poor fry survival due to the critically-dry river conditions. District staff believes the recovery and fluctuation of steelhead in the Carmel River Basin is directly related to the following factors:

- Improvements in streamflow patterns, due to favorable natural fluctuations, exemplified by relatively high base-flow conditions since 1995;
- The District's and the SWRCB rules to actively manage the rate and distribution of groundwater extractions and direct surface diversions within the basin;
- Changes to Cal-Am's operations at San Clemente and Los Padres Dams, providing increased streamflow below San Clemente Dam;
- Improved conditions for fish passage at Los Padres and San Clemente Dams due to physical improvements;
- Recovery of riparian habitats, tree cover along the streambanks, and increases in woody debris, especially in the reaches upstream of Robinson Canyon and in the lower valley;
- Extensive rescues by MPWMD of juvenile steelhead over the last 19 years, now totaling 262,482 fish through 2007; and
- Rearing and releases of rescued fish from the SHSRF of over 55,000 juveniles and smolts back into the river and lagoon over the past 12 years.



Though overall fish populations have improved since the inception of the Mitigation Program in 1990, District staff has noticed a period of decline in the adult run above SCD from 2001 to 2006. In 2007, the adult run size nearly doubled from that of 2006, but was still far below recent highs. At present, the reasons for this period of decline in adult returns are not obvious, but may be related to a combination of controlling and limiting factors including:

- Better spawning conditions in the lower Carmel River (i.e., fish spawn before they reach the counter at the dam);
- Lagoon conditions including chronic poor water quality that can cause annual fish die-offs, and high predation by birds and recently by striped bass, especially in low-flow years, thus resulting in fewer returning adults;
- Low numbers of juvenile fish in 1999, 2001, and 2004 affecting subsequent adult populations;
- Migration barriers such as the Old Carmel River and San Clemente Dams;
- Chronic, and occasionally acute, fall temperature and hydrogen sulfide levels below LPD, and the increase in suspended sediment from the SCD summer draw-down;
- Potential for enhanced predation on smolts and YOY migrating through the sediment fields of LPD and SCD;
- Poor ocean conditions; and
- Ongoing but limited impacts of fishing (i.e., approximately 1.5% incidental mortality associated with catch-and-release fishing for adults in the winter season, and catch-and-release fishing for juvenile steelhead in the upper watershed during the Spring/Summer trout season may slightly reduce the number of fish that reach the ocean).

A recent challenge that may remain for some years is the potential effects of substantive physical and operational changes to San Clemente Dam (SCD) required by DWR/DSOD, including possible removal of the dam. The most significant issue is the effect of released sediment from the reservoir on downstream river habitat, proper functioning of MPWMD's SHSRF, and downstream property owners (flood elevations). Major changes include:

- Lowering of the San Clemente reservoir water level to address seismic safety concerns;
- Significant changes in the sediment regime in the Carmel River downstream of San Clemente as the dam fills with sediment; and
- Loss of reservoir storage, which, in the past, has helped maintain adequate river flows and cooler water in the Carmel River below SCD.

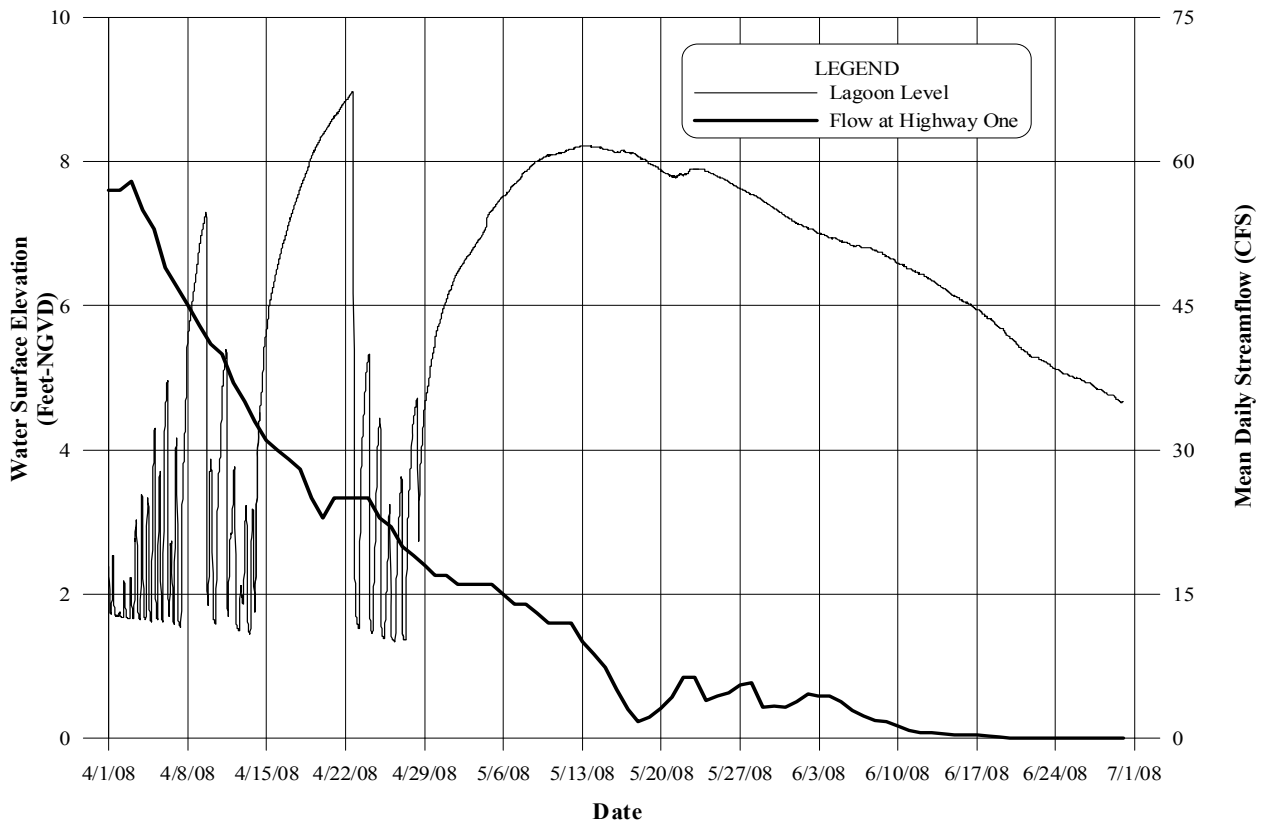
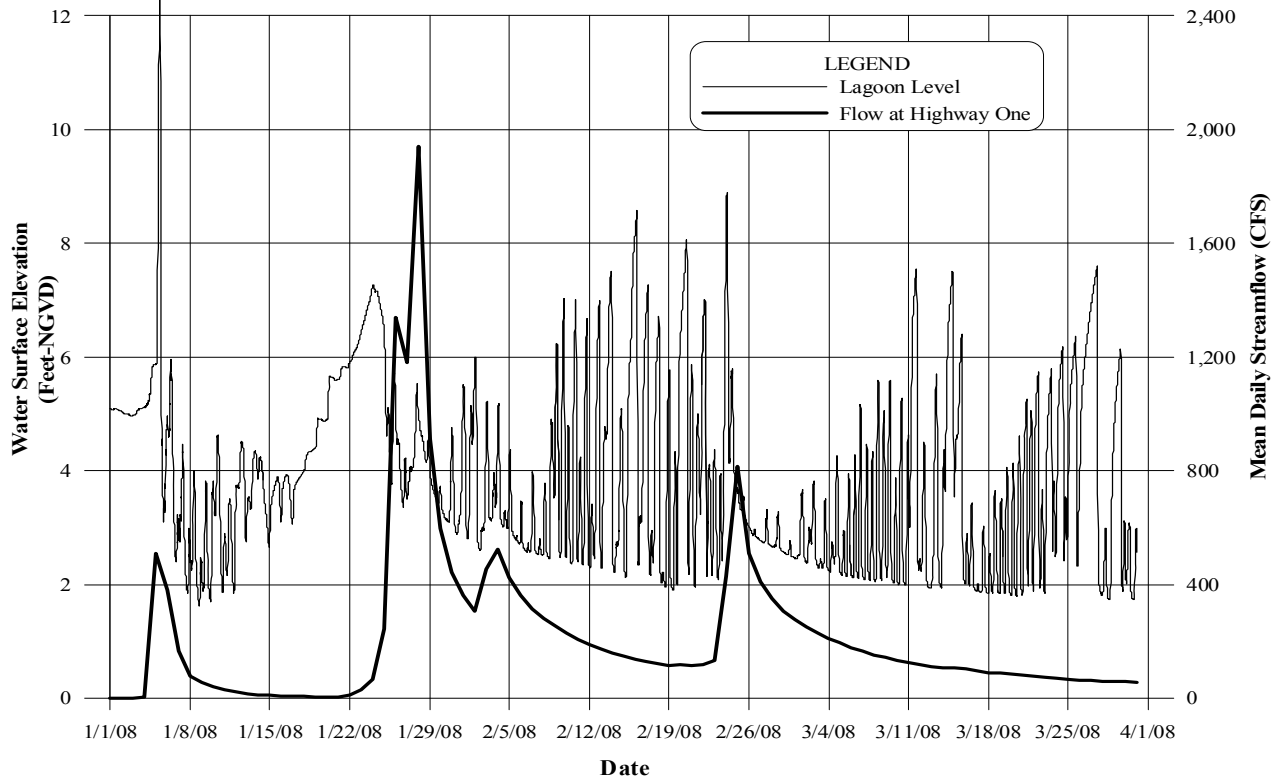
However, improvements in State and Federal permit conditions have extended by two weeks, until at least May 1 of each year, the time that the reservoir will remain full and that the fish ladder can operate to pass adult steelhead upstream. This improvement over past standards may

result in allowing an additional dozen or more adult steelhead each year to pass SCD under the new draw-down regimen.

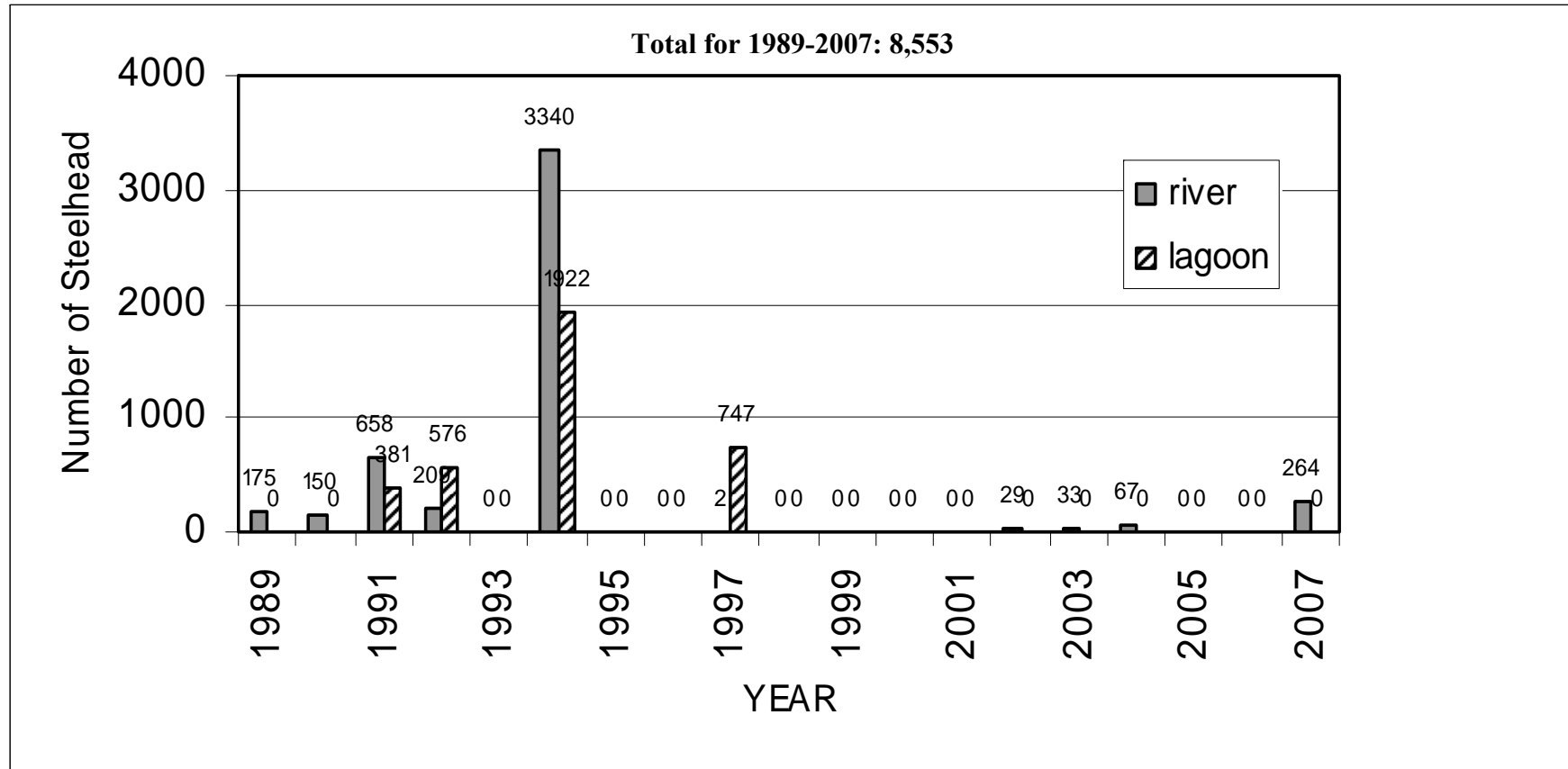
District staff continues to provide technical expertise and scientific data to CAW engineers and environmental consultants, DWR/DSOD, CDFG, NMFS, U.S. Fish and Wildlife Service, and others involved in addressing the resource-management issues associated with seismic retrofit of SCD. District staff also continues to provide technical expertise and scientific data to CDPR, Monterey County Water Resources Agency, Monterey County Public Works Department, California Coastal Commission, U. S. Army Corps of Engineers, and Carmel Area Wastewater District, other regulatory agencies and stakeholders involved in the management of the Carmel River Lagoon and barrier beach.

**Figure IX-1**

Water Surface Elevation in the Carmel River Lagoon and Highway One Bridge, January-July, 2008



**Figure IX-2**  
**Number of Steelhead Smolts Rescued by MPWMD in the Carmel River Basin from 1989 to 2008**



NOTE: No trapping was completed in 2008. Rescue data will be reported in the next annual report

Figure IX-3

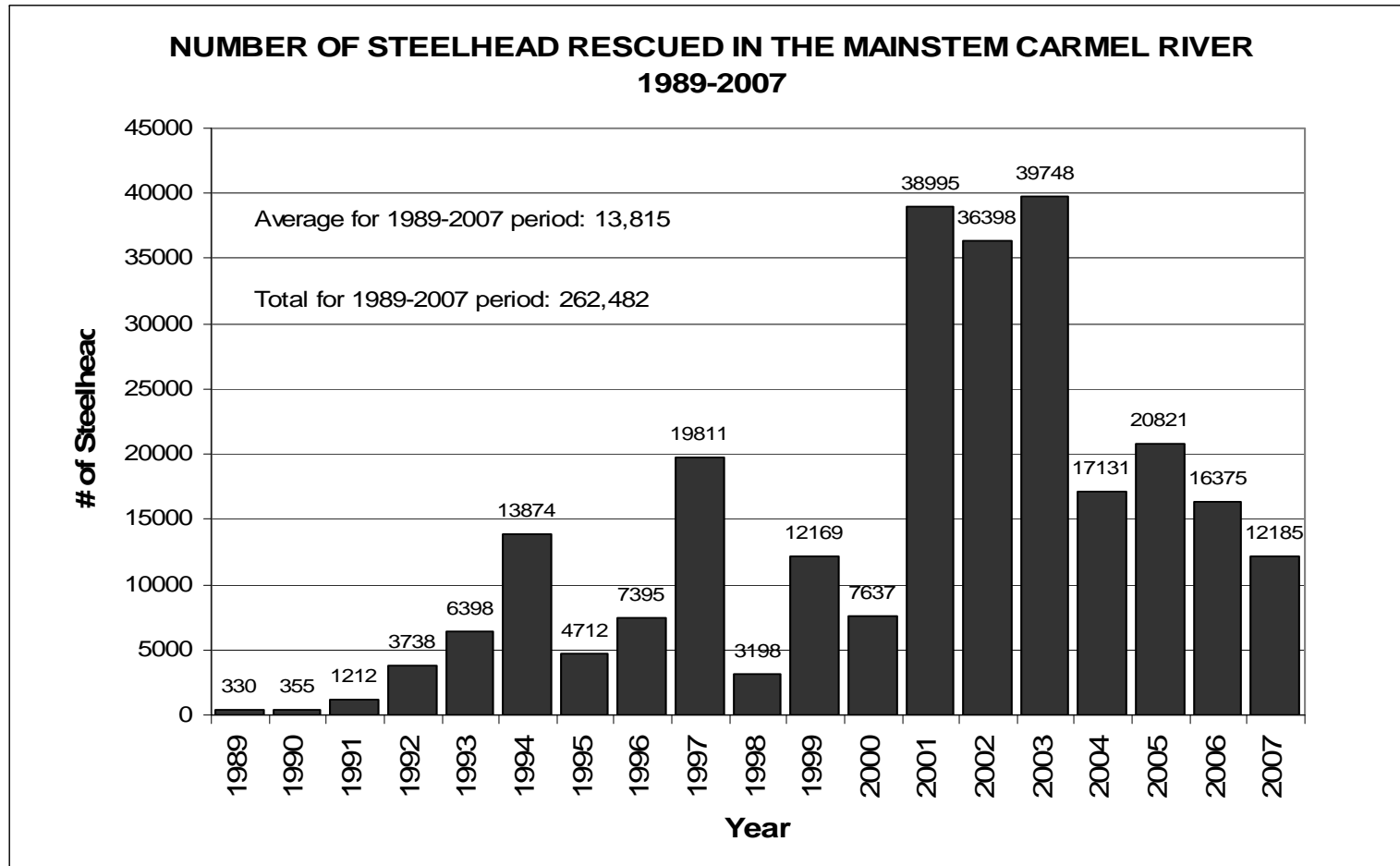
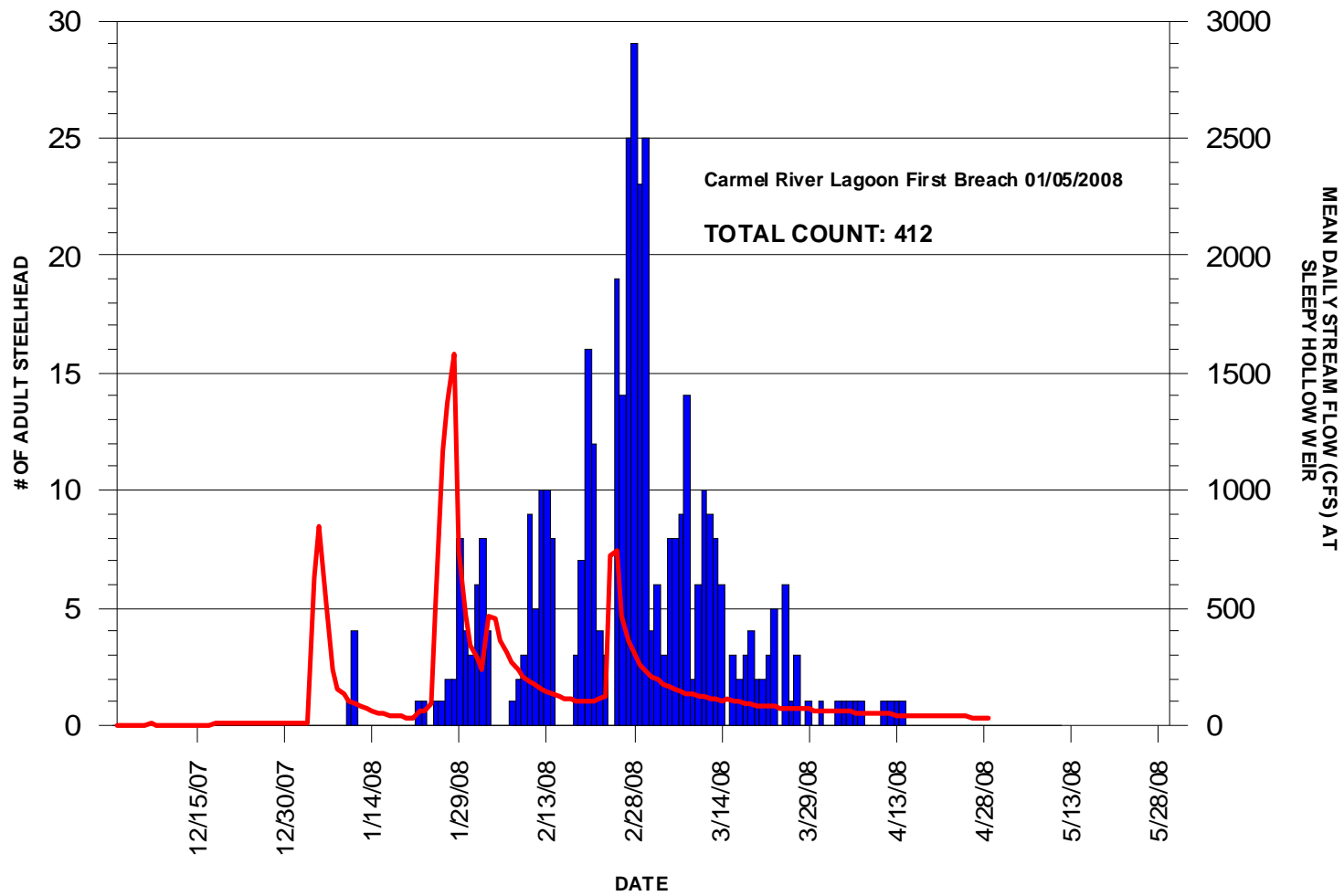


Figure IX-4

Adult Steelhead counts at the San Clemente Fish Ladder during RY 2008



\*\* Streamflow measured at MPWMD gaging station at Sleepy Hollow Weir or San Clemente Spillway

Figure IX-5

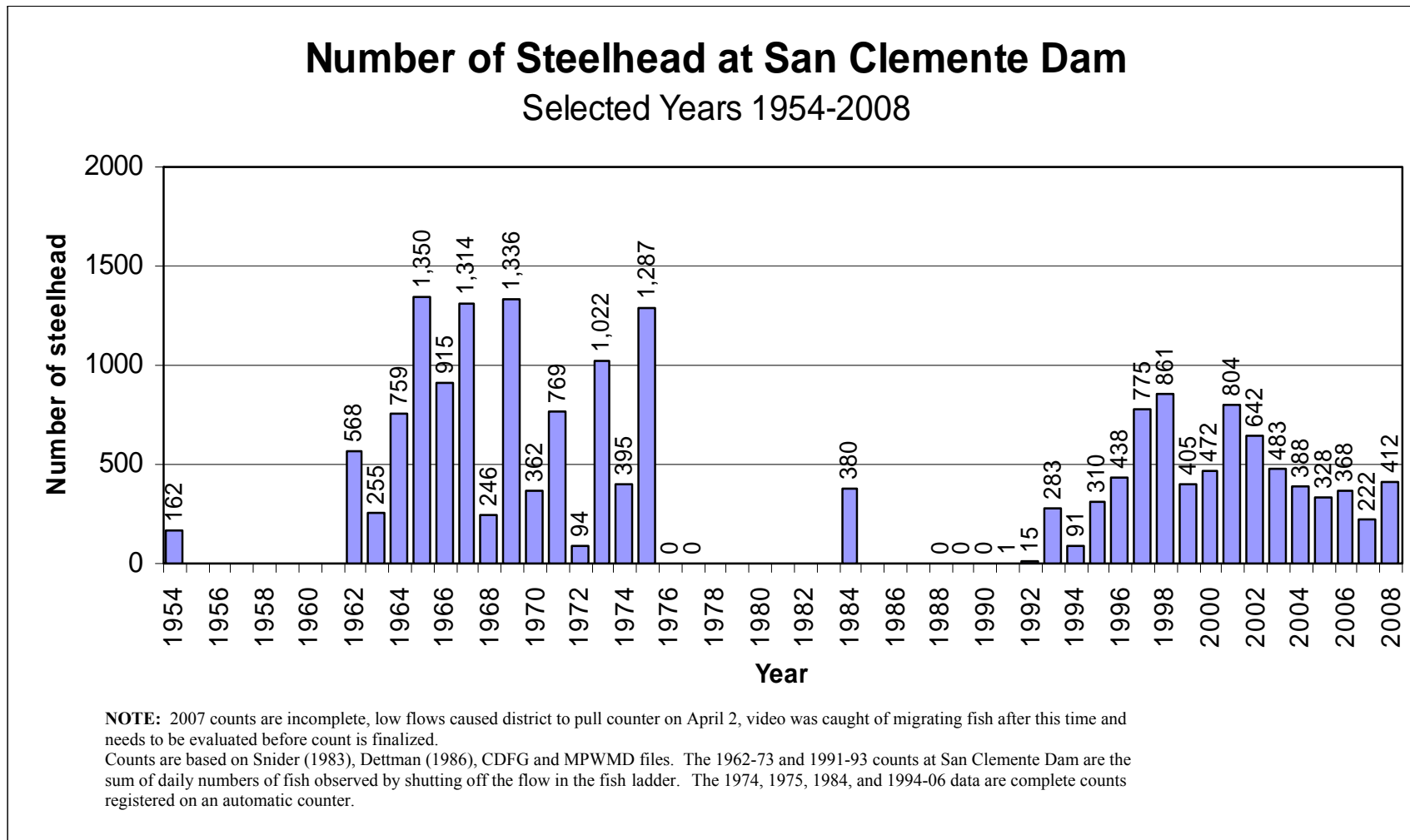


Figure IX-6

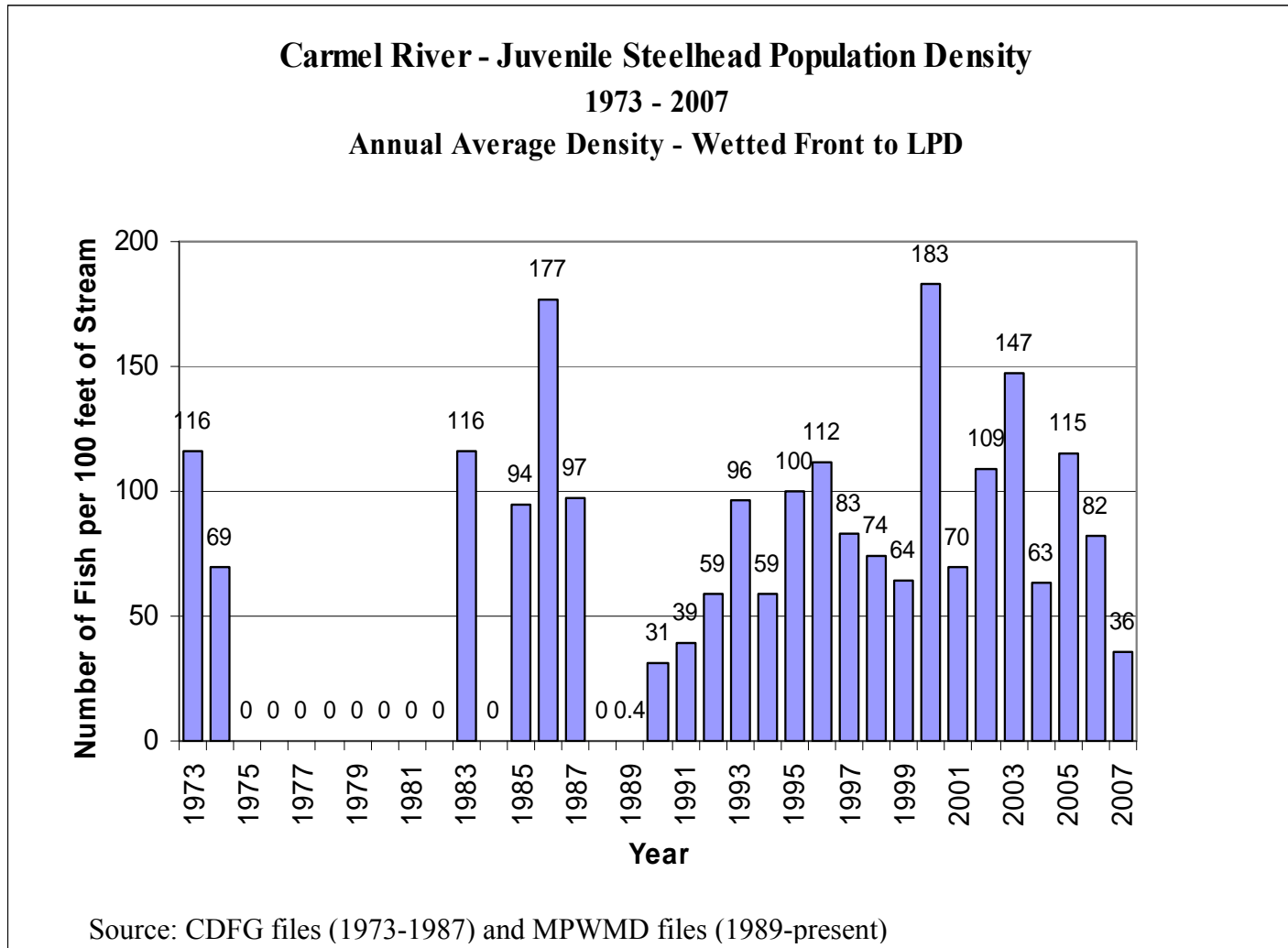
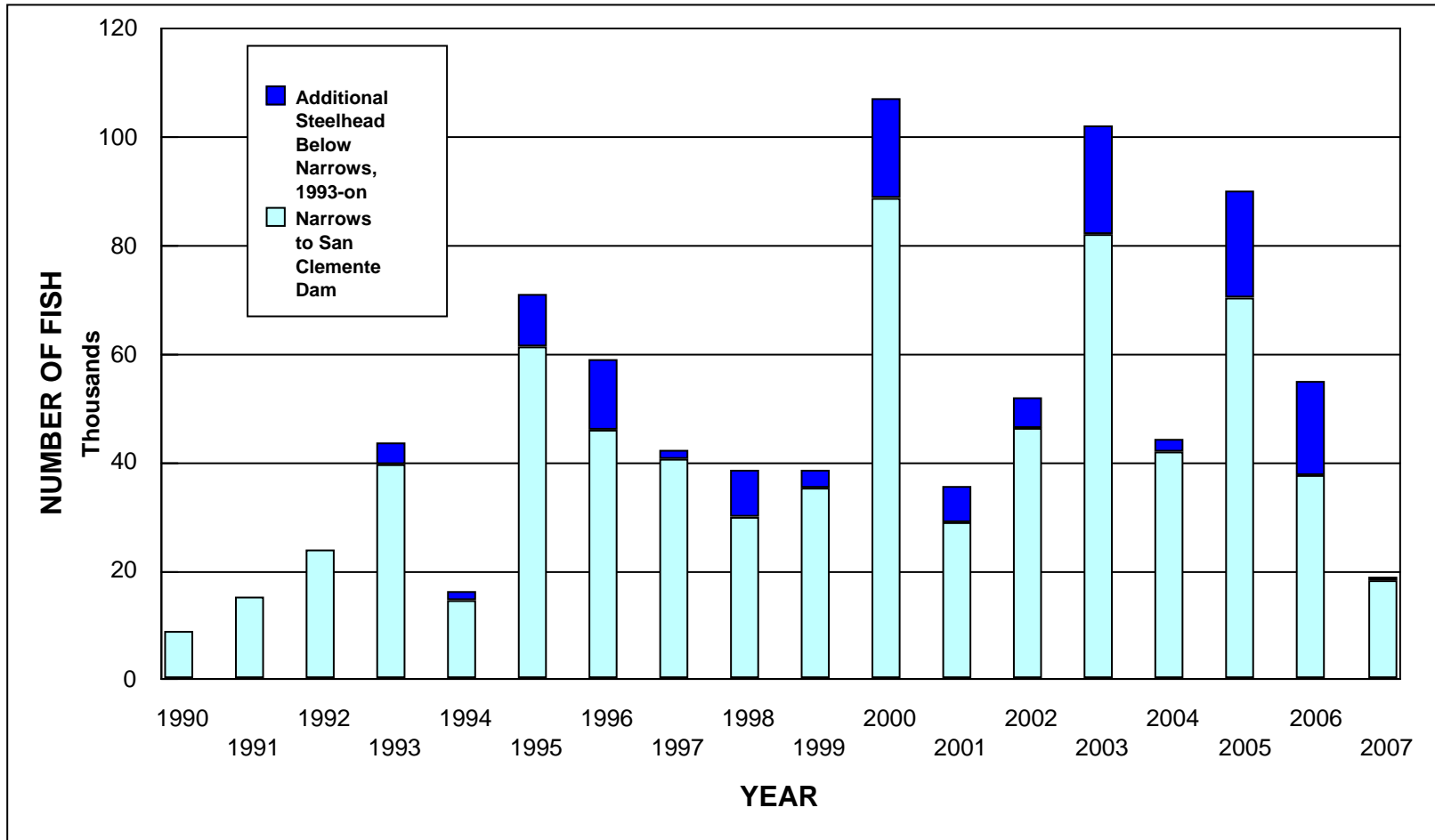




Figure IX-7

Estimated Number of Juvenile Steelhead Reared Below San Clemente Dam, 1990 - 2007



**Table IX-1  
 Number of Juvenile Steelhead Rescued in Mainstem Carmel River,  
 by Age Group and General Location, Rescue Year 2007**

<b>Age Group</b>	<b>General Location</b>	<b>MPWMD May- Sept. 2007</b>	<b>CRSA May-July 2007</b>
Young-of-the-year	Mainstem	11,722	5,781
Age 1+	Mainstem	308	37
Smolts	Lagoon and Lower River	0	124
Adults	Mainstem and Lagoon	17	123
Mortalities	Mainstem	138	75
Totals		12,185	6,140
Percentage Mortality		1.13	1.22

**Table IX-2  
Fish Survival at Sleepy Hollow Facility  
Fish Rearing Summary: May 14, 2007 - January 8, 2008**

Holding Location	# Fish Stocked <sup>(1)</sup>	# Morts (Disease) <sup>(2)</sup>	# Morts (Unaccounted for) <sup>(3)</sup>	Total # Released	% Survival	Ave Condition Factor (K)	# by Release Location <sup>(4)</sup>	Notes
Quarantine Holding Tanks (large 1+ age fish)	237	90	20	127	54%	1.11	127 -- Lagoon 0 -- River	Fish were ~ 2 yrs old at release. Sizes ranged from approx. 6 - 12 inches (FL)
Quarantine Holding Tanks (large YOY fish)	1,362	373	106	883	65%	1.05	387 -- Lagoon 496 -- River	Fast growing YOY fish were moved from the rearing troughs to the 8-foot tanks in early summer. Size range at release ~ 5 - 7 inches (FL)
Rearing Troughs (smaller YOY fish)	9,247	6,094	1,383	1,770	19%	1.05	244 -- Lagoon 1,526 -- River	Eight, insulated, fiberglass tanks (10 x 2 x 2.5 feet). At release, three tanks had smaller fish (3 - 5 inches), and five tanks had larger fish (4 - 6.5 inches, FL).
<b>Totals</b>	<b>10,846</b>	<b>6,557</b>	<b>1,509</b>	<b>2,780</b>	<b>26%</b>		<b>758 - Lagoon (27%) 2,022 -- River (73%)</b>	
		<b>60%</b>	<b>14%</b>	<b>26%</b>				

Notes:

1. Fish were segregated in separate tanks by size/age at the start of the rearing season. Fish were graded and moved throughout the season as they grew. All older juvenile fish (1+ years) were kept in two separate quarantine tanks. As the YOY fish grew, ~1,000 were moved from the troughs and placed in two different quarantine tanks. No fish were reared in the Facility's rearing channel in 2007.
2. Disease was primarily bacterial infection ( *Flavobacterium columnare* ), but there were several outbreaks of *Ich*.
3. Unaccounted-for-fish [# fish stocked - (# of morts + # released)] were likely due to predation by larger fish, were not discovered as mortalities during the season due to turbid water, or due to enumeration errors.
4. Fish released into the Carmel River Lagoon were greater than 150 mm (FL) and/or were beginning to smolt. All were released in the South Arm (at the discharge pipe). Fish released into the Carmel River at Stonepine and near the SHSRF were <150 mm and non-smolting.

"Morts" refer to mortalities. "FL" refers to fork length - the length of the fish from snout to the fork in its tail.

"Condition Factor" refers to a mathematical formula for determining the physiological state of a fish, including its reproductive capacity. It is calculated by dividing fish weight by length cubed (W/L<sup>3</sup>). The heavier a fish for a given length, the higher its condition factor (K). (x 10<sup>-5</sup>)

**Table IX-3**

**Sleepy Hollow Steelhead Rearing Facility**  
Fish Release Location Summary: January 2008

<b>Release Location</b>	<b>Number of Fish</b>	<b>Percent of Total Release</b>
SHSRF area	1,560	56%
Stonepine Resort	462	17%
Lagoon	758	27%
<b>Total</b>	<b>2,780</b>	<b>100%</b>

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**Table IX-4**  
Carmel River Juvenile Steelhead Annual Population Survey <sup>1</sup>

Lineal Population Density at Survey Stations (numbers per foot of stream) <sup>2,3</sup>												Overall Annual Average	
YEAR	Red Rock (Mid Valley) RM 7.7	Scarlett Narrows RM 8.7	Garland Park RM 10.8	Boronda RM 12.7	DeDamp Park RM 13.7	Stonepine Resort RM 15.8	Sleepy Hollow RM 17.5	SCR Delta Lower Station RM 19.0	SCR Delta Upper Station RM 19.6	Los Compadres RM 20.7	Cachagua RM 24.7	(nos./ft)	(nos./mi)
1990				ND		0.50	0.27			0.26	0.22	0.31	1,650
1991				0.12		0.74	0.39			0.09	0.62	0.39	2,070
1992			0.67	0.36		0.96	0.30			0.40	0.83	0.59	3,098
1993		0.62	0.91	0.92	0.82	0.84	0.52			1.22	1.84	0.96	5,075
1994	ND	0.44	0.23	0.43	ND	0.50	0.29			1.51	0.71	0.59	3,100
1995	0.49	0.65	1.01	1.61	ND	1.42	0.69			0.50	1.63	1.00	5,281
1996	0.24	1.52	0.82	1.05	2.03	1.22	0.29			0.95	1.92	1.12	5,890
1997	0.02	0.22	1.02	1.74	1.15	0.5	0.22			1.15	1.41	0.83	4,359
1998	0.19	0.30	0.67	0.34	1.50	0.27	0.60			0.54	2.24	0.74	3,901
1999	0.17	0.26	0.50	0.32	0.62	1.67	0.45			0.46	1.35	0.64	3,403
2000	0.91	1.03	0.64	1.38	5.66	1.71	1.46			1.41	2.3	1.83	9,680
2001	ND	0.48	0.35	0.63	0.68	1.08	0.32			0.47	1.62	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
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
2004	0.25	0.46	0.78	1.21	0.43	1.24	0.55	0.21	0.41	0.45	0.89	0.63	3,302
2005	1.23	0.60	1.34	1.16	0.91	1.62	1.63	0.21	0.85	0.98	2.10	1.15	6,062
2006	1.13	0.64	0.86	0.87	0.47	0.37	0.95	1.65	0.28	0.82	1.00	0.82	4,339
2007	ND	0.15	0.50	0.77	0.06	0.33	0.16	0.36	0.25	0.49	0.50	0.36	1,885
<b>Station Ave (no./ft)</b>	<b>0.62</b>	<b>0.59</b>	<b>0.83</b>	<b>0.97</b>	<b>1.28</b>	<b>0.98</b>	<b>0.60</b>	<b>0.56</b>	<b>0.59</b>	<b>0.83</b>	<b>1.45</b>	<b>0.84</b>	<b>4460</b>
<b>Station Ave (no./mile)</b>	<b>3,252</b>	<b>3,123</b>	<b>4,392</b>	<b>5,106</b>	<b>6,746</b>	<b>5,160</b>	<b>3,174</b>	<b>2,939</b>	<b>3,133</b>	<b>4,374</b>	<b>7,647</b>		
<b>Overall Station Averages:</b>												<b>0.84</b>	<b>4,459</b>

<sup>1</sup> Surveys completed in October and results based on repetitive 3-pass removal method using an electrofisher.

<sup>2</sup> RM; indicates miles from rivermouth

<sup>3</sup> ND indicates stream was dry at sampling station; NS indicates the site was not sampled that year. Blanks = site not added yet.

**Table IX-5**

<b>Biological Metric Values for Benthic Macroinvertebrate (BMI) Assemblages</b>					
Carmel River, Monterey County - November 2007					
<b>METRICS</b>	<b>CARMEL RIVER SITES</b>				
	<b>RM 26.2</b>	<b>RM 24.4</b>	<b>RM 17.4</b>	<b>RM 15.7</b>	<b>RM 9.0</b>
	<b>Los Padres</b>	<b>Cachagua</b>	<b>Sleepy Hollow</b>	<b>Stonepine</b>	<b>Scarlett Well</b>
Taxonomic Richness	32	21	19	23	25
EPT Taxa <sup>1</sup>	8	5	5	8	7
Ephemeroptera Taxa	1	1	1	2	2
Plecoptera Taxa	3	0	1	1	1
Trichoptera Taxa	4	4	3	5	4
EPT Index (%)	18	18	28	31	34
Sensitive EPT Index (%)	3.1	0.8	0.6	2.6	10
Shannon Diversity	1.7	1.7	1.9	1.6	2.3
Dominant Taxon (%)	58	50	33	53	25
Tolerance Value	5.5	5.8	5.9	5.6	5.4
Intolerant Organisms (%)	3.5	1.0	0.6	2.6	9.6
Tolerant Organisms (%)	4.5	5.9	15	4.0	23
Collector-Gatherers (%)	27	32	54	34	37
Collector-Filterers (%)	58	51	35	56	35
Scrapers (%)	4.7	1.2	2.4	0.8	9.2
Predators (%)	6.7	15	8.0	7.2	8.4
Shredders (%)	1.6	0.0	1.0	0.8	0.2
Other (%)	1.4	1.0	0.0	1.4	9.0
<b>Estimated Abundance</b>					
Composite sample (18 ft <sup>2</sup> )	4100	6960	8040	7030	14200
Site (BMIs/ft <sup>2</sup> )	228	387	447	391	789
Site (BMIs/m <sup>2</sup> )	2452	4163	4809	4205	8494
<b>Estimated Biovolume</b>					
ml/ft <sup>2</sup>	0.40	0.47	0.38	0.37	1.45
ml/m <sup>2</sup>	4.3	5.1	4.1	4.0	16
<b>Central Coast IBI Metrics</b>					
Intolerant Individuals (%)	3.5	1.0	0.6	2.6	9.6
Collector Individuals (%)	44	43	47	43	44
Non-Insect Taxa (%)	16	24	21	22	32
Tolerant Taxa (%)	22	29	16	22	20
Coleoptera Richness	4	0	1	1	1
Predator Richness	11	8	6	8	7
EPT Richness	8	5	5	8	7

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<sup>1</sup>EPT taxa are *Ephemeroptera*, *Plecoptera*, *Tricoptera* which are the primary steelhead food  
 RM = River Mile measured from river mouth at Carmel Bay