LAURENS H. SILVER (SBN 55339)
CALIFORNIA ENVIRONMENTAL LAW PROJECT
P.O. Box 667
Mill Valley, California 94942
Telephone: (415) 383-5688
Facsimile: (415) 383-7995
Attorney for SIERRA CLUB

BEFORE THE CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

In the Matter of Draft Cease and Desist Order No. 2008-00XX-DWR Against California American Water Company

TESTIMONY OF SIERRA CLUB WITNESS JOHN G. WILLIAMS

My name is John G. Williams. I have previously testified in this matter, and I incorporate by reference my curriculum vitae, which was presented with my statement in Phase I.

Qualifications:

I have a long-standing familiarity with the Carmel River. I was born about two miles north of the Carmel River, and grew up about two miles south of it. My grammar school was less than a mile from the river mouth. My school chums and I used to play along the river and catch crayfish in its pools. In 1958, when I was in high school, I helped pile sandbags along Highway 1 and the levee downstream when the Carmel River was in flood.

In 1976, I was appointed to the Zone 11 Advisory Committee to the Monterey County Flood Control and Water Conservation District by then-Supervisor Sam Farr. Two years later, about the time I completed my Ph.D. in Geography, I was elected to the Board of Directors of Monterey Peninsula Water Management District (MPWMD), and served there from 1978 to 1981, and from 1983 to 1987. While on the Board, I helped develop ordinances that regulated the allocation of the available water supply and required Cal-Am to release water from San Clemente Dam for re-diversion downstream.

During most of the period from 1981 to 1983 when I was not on the Board, I worked on the MPWMD staff. I helped create a special zone along the Carmel River for bank stabilization and riparian restoration projects, and I wrote a draft Carmel River Watershed Management Plan. In a working paper for that plan, circulated in 1983, I presented analysis and hydrogeological information showing that Cal-Am was diverting water from the subterranean flow of the Carmel River (Williams 1983a, Exhibit RWC-SC-3 (92)) [1]. From my academic training (see my curriculum vitae), I was familiar with the science pertaining to the effects of Cal-Am's diversions on riparian vegetation along the Carmel River, and I promoted and participated in research that demonstrated adverse effects on riparian vegetation caused by Cal-Am's diversions. During my service on the MPWMD board and staff, I started to become familiar with the science pertaining to fluvial geomorphology and the biology and the habitat needs of steelhead. I helped organize several scientific meetings regarding the Carmel River and spoke about the river at others. I have published scientific papers regarding the river and its public trust resources. I co-authored a paper on the effects of bank storage and well pumping on base flow in the Carmel River. As a consultant, I developed a restoration plan for the Carmel River lagoon, including an historical study of the lagoon (Williams 1989).

I have represented the Ventana Chapter of the Sierra Club and sometimes the Carmel River Steelhead Association and the Residents Water Committee in various proceedings before the SWRCB, including the hearings leading to D-1632 and Orders WR 95-10, 1998-04, and 2002-02, and assisted in the preparation of three of the four complaints that resulted in Order WR 95-10. I helped negotiate the "Interim Relief Plan" (Exhibit MPWMD 53 (92)) that required the MPWMD to hire a staff biologist, and participated in the settlement of *Sierra Club and CRSA v. SWRCB*, that resulted in Order WR 1998-

[1] When an exhibit is identified as RWC-SC # (92), this denotes an exhibit for the July 1992 hearing, when I represented both the Residents Water Committee and the Ventana Chapter of the Sierra Club. I also include a citation, here Williams 1983a, so that the document can be identified in the list of citations at the end of the testimony. References to other exhibits in the July 1992 hearing will also include "(92)," for example Exhibit MPWMD 116 (92).

04. I also wrote detailed critiques of consulting studies prepared for Cal-Am in response to Order WR 98-04, regarding the feasibility of moving more of Cal-Am's diversions downstream. I also represented the Ventana Chapter of the Sierra Club in various PUC proceedings, including the "Plan B" process, for which I developed a proposal by which Cal-Am might terminate its illegal diversions.

In 1990, I was appointed Special Master (reporting to Judge Hodge) in *EDF v. EBMUD* (Alameda County Superior Court, No. 425955). The largest part of this task was to supervise studies regarding Chinook, steelhead and other public trust resources in the American River, and the flows needed to protect them. In the course of my duties as Special Master I became familiar with the scientific literature on Chinook and steelhead in rivers. I have continued to learn about salmon and steelhead, and, under contract to CALFED, I prepared a 400 page monograph on Chinook and steelhead in the Central Valley that was published in 2006 (Williams 2006). I was recruited by NMFS to serve on the Central Valley Technical Recovery Team. I was selected by CALFED to serve on a panel that reviewed the 2005 NMFS Biological Opinion on the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (OCAP BO). Other work done under contract to CALFED involved geomorphic assessments of Butte, Mill and Clear creeks, and an assessment of the probable geomorphic response of the Sacramento River to diversions to Sykes Reservoir.

I have published papers and attended scientific meetings on adaptive management. I have also published papers and given talks at scientific meetings regarding methods for instream flow assessment, and served as an expert witness for the New Zealand Department of Conservation for litigation regarding instream flows in the Tongariro River, one of that nation's premier trout streams. I co-taught a course on instream flow assessment with Peter Moyle at UC Davis, and with him and Matt Kondolf, I prepared a review for the SWRCB on fish bypass flows for coastal watersheds.

Details on these and other aspects of my scientific qualifications are provided in Exhibit SC-2.

Should the proposed CDO be modified, and if so, why?

The key issue that I will address is: should the proposed CDO be modified, and if so, why? This is not a simple question, however; and answering it requires that a number of other issues be addressed as well.

Sierra Club believes that a CDO is necessary to motivate Cal-Am to comply with Order WR 95-10 and amendments, and with its obligations to protect steelhead arising under state and federal law. Sierra Club believes that the proposed CDO should be modified to provide a better balance between the protection and restoration of public trust resources on the one hand and the inconvenience and expense for Cal-Am's customers on the other. This can be done by maximizing the reductions in diversions during periods when flows in the river are low, and incremental increases in flow will provide greater benefit to the River's steelhead. Because practical necessity requires that the illegal diversions not cease immediately, the CDO should include measures to mitigate for the effects of the continuing diversions. Because existing scientific information does not provide clear answers regarding the most effective mitigation, the CDO should incorporate adaptive management and require that, while illegal diversions continue, Cal-Am fund basic studies into the biology and habitat needs of south-central California coast steelhead. We provide specific recommendations for modifying the draft CDO below, and explain how new scientific information can guide management and mitigation, but first we provide background information on the history of the Carmel River and its public trust resources, which provides context for our recommendations.

Brief description of the Carmel River and its steelhead habitat:

Flow in the Carmel River is highly variable within and between years, but the unimpaired flow at the mouth averages about 100,000 acre feet. The river was perennial until diversions began at the old Carmel Dam at about river mile (rm) 18 in 1882. A larger but still small concrete arch dam, San Clemente, was built in 1921 at rm 18.6, approximately in the middle of the watershed, and a somewhat larger earth-fill dam, Los Padres, was built in 1948 at rm 23.5. The initial storage capacities of the dams were 1,300 acre feet (af) at San Clemente, and 3,200 af at Los Padres, but sediments now fill almost all of the San Clemente reservoir and about half of the Los Padres reservoir. Water stored at Los Padres is released into the river, and rediverted for use at San Clemente. Diversions from the dam have been augmented by diversions from wells in Carmel Valley. Initially, the wells were located in the upper Carmel Valley, where the quality of the groundwater was better. Beginning in the late 1960s wells were developed progressively farther downstream. Diversions by Cal-Am are now approximately 11,000 acre feet, down from about 14,000 acre feet. Other diversions are approximately 2,000 af. Because flow is so highly variable, in some years all is diverted, so that the river does not reach the ocean. This happened for three years in a row in 1988-90.

Steelhead habitat in the Carmel River has been studied by Snider (1983) and by Dettman and Kelley (1986, Exhibit SWRCB 36 (92)). Rearing habitat for steelhead in the Carmel River extends from migration barriers on the upper river and its tributaries to the seasonally dry reach of channel in the Carmel Valley. It also includes the lagoon. Snider (1983) reported that about half the available spawning habitat was above Los Padres Dam. Dettman and Kelley (1986) estimated that there are 14.38 miles (or ~423,000 square feet) of good to excellent rearing habitat there. As they noted (p. 44):

> Most of the steelhead habitat in the Carmel River above Los Padres is within the confines of the Ventana Wilderness Area. The river's flow is unregulated, roads have not caused erosion, and the physical steelhead habitat probably looks much like it did before the arrival of European man. The river's configuration is controlled by its steep gradient (320 ft/mile), numerous rock outcrops, and large boulders that have lodged in the channel. Deep pools, separated by short, shallow glides and long, cobble/boulder riffles and runs are numerous throughout the upper Carmel River. The stream is heavily shaded by a dense canopy of riparian trees, including white alder, sycamore, big leaf maple, California bay laurel, canyon live oak, and sometimes by steep canyon walls.

However, Dettman and Kelley found that most of the *O. mykiss* present above Los Padres were nonanadromous, and that the total population was less than half of what they had found in comparable habitat in other coastal streams.

What is known about the historical population size of Carmel River steelhead?

The Carmel River once had a substantial steelhead population. Estimating numbers is speculative, and presumably the population varied a good deal from year to year, but probably the average was in the tens of thousands. I base this estimate on information I have gathered over the years, mainly when I was working on the Carmel River Watershed Management Plan (Williams 1983b, RWC-SC Exhibit 1) and the Carmel River Lagoon Restoration Plan (Williams 1989, MPWMD Exhibit 185 (92)).

There are a few 19th Century references to Carmel River steelhead. According to a newspaper called the Pacific Tourist, undated, but ~1880: "… [T]he disciples of Isaac Walton will … follow up the Carmel River, and he will find some fine trout fishing. At the mouth of the Carmel River in the Fall of the year, there are lots of salmon of good size that can be taken. The San Clemente, Garsus, and other creeks have an abundance of trout." Similarly, the Monterey Cypress, 22 Feb. 1890, reported that "There were some salmon speared in the Carmel River last week, but the rise of the river has spoiled salmon fishing for the present."

In Williams (1983b:22-23, Exhibit RWC-SC 1), based on the information I had available, I wrote that:

> In historical times the Carmel River supported a spectacular run of steelhead, then known as salmon. Bob Norton of Carmel, who came to the area in 1903 as a small child, still has a lucid mind and an excellent memory of the early part of the Century. He remembers as a teenager seeing steelhead "too thick to count" in the lagoon, and also seeing wagon loads of fish that were caught by hand in the surf, hauled up to town, and given away. Most fishing at the time was done at night with torches and spears, or with snag hooks; it was not for sport. He recalls that a Chinese family living in the Rancho Canada area dried large quantities. Leonard Williams, whose wife's family owned a ranch at the mouth of the river [now the Mission Ranch], remembers hearing from his father-in-law that it used to be a night's work to spear a wagonload.

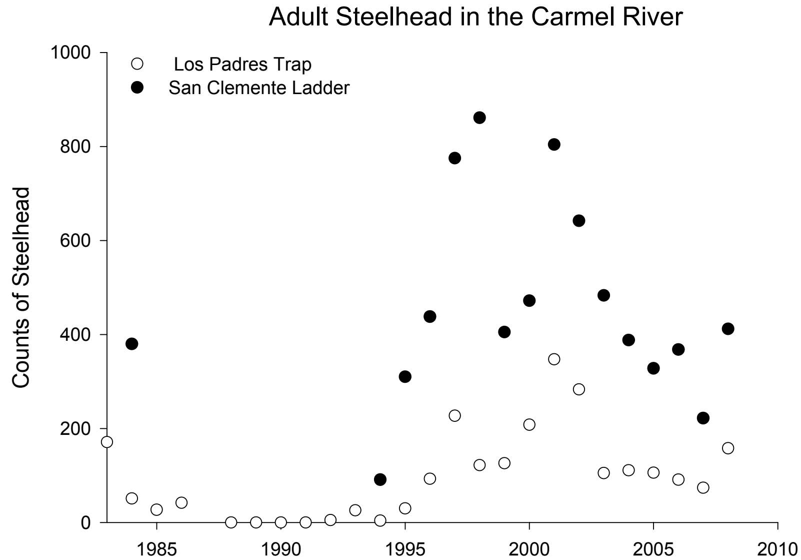
These memories are supported by the transcript of testimony from a trial in 1931 (*Otey v. CSD,* 219 Cal. 310; SC Exhibit 5) concerning a disputed title to the beach north of the river mouth, that I obtained while working on Williams (1989). Carmel Martin, who grew up in what is now called the Mission Ranch, adjacent to the Carmel River lagoon, testified that “All of our family, when we were young folks, we used to spear steelhead trout or salmon, as we called them then, in the mouth of this river all winter long, … We would fish for steelhead and spear them, and, in order to spear them, you had to get right into the stream. … we were in the water, all the way from our ankles up, until the law went into effect, prohibiting the spearing of steelhead, which was 15 or 20 years ago, I believe.” His half-brother, Williams Stewart, testified that “I will state that I lived near the mouth of the river for 36 years continuously (1874-1912). … in winter time us boys were spearing those steelheads night and day. We would go down at low tide, and we would wait for them at night so we were pretty well familiar with that part of the county.”

A wagonload is not a well defined unit of fish, but evidently there were a considerable number of them to be caught: enough to make it worthwhile to stand in the water at night in the winter, which is not a comfortable experience even with modern wet gear. The only specific number of which I am aware is a report in a self-published book about the Martin Family, cited in Williams (1989 MPWMD Exhibit 185 (92)), that the “boys” at the Martin Ranch speared 1,300 in one winter. Presumably, this was an exceptional year, but if we speculate that the boys speared 1% of the run, which would have been quite a feat, then the run that year would have been 130,000.

What is the current population of steelhead?

The number of mature fish returning from the ocean is not precisely known, because fish are counted when they pass over San Clemente Dam, and some fish spawn in the river downstream from the dam or in tributaries such as Garzas Creek that join the river below the dam. Counts at San Clemente Dam recently have been in the low hundreds, although it was up to 412 this past winter, and was higher in the years around 2000 (Figure 1). My understanding is that MPWMD biologists counted about 100 redds below San Clemente last winter, which suggests a total population of about 600, and presumably somewhat less in the few years before that.

Figure 1. Counts of adult steelhead at the San Clemente ladder and at the Los Padres trap. Los Padres is upstream from San Clemente, so the Los Padres counts are a sub-set of the San Clemente counts. Data from MPWMD.



What is known about the timing of the decline in the Carmel River steelhead population?

While working on Williams (1983b), I talked to several CDFG biologists and wardens, most notably Leo Shapovalov, the senior author of a major study of coho salmon and steelhead on Waddell Creek (Shapovalov and Taft 1954) and an authority on California steelhead, who began dealing with the Carmel River in 1940 and testified for CDFG during the initial SWRCB hearing on Los Padres. According to my notes (Exhibit SC 6), Shapovalov "believes that the run dwindled after Los Padres was built." Unfortunately, I did not know who he was at the time, so I did not interview him as thoroughly as I now wish I had.. Lester Golden, who was a warden from 1954 to 1971, reported that the run varied a lot from year to year, but with a general downward trend. Two other wardens and several old-timers said approximately the same thing.

What accounts for the decline in the run?

A variety of natural and anthropogenic factors have been involved. For example, the population peak around 2000 and subsequent decline corresponds to a similar trend in Central Valley Chinook, so it seems likely that changing ocean conditions were partly responsible for the decline since 2002. In the longer term, diversions and dams, especially Los Padres Dam, are mainly responsible. Diversions reduced dry season flow and habitat downstream from San Clemente Dam, and Los Padres Dam blocked access to upstream habitat. Mismanagement of the Carmel River lagoon probably is also a factor.

<u>Reduced flows in the Carmel River:</u>

Another and obvious factor in the decline of Carmel River steelhead is dewatering of the river by Cal-Am's diversions. The effect of groundwater pumping on surface flows, steelhead, and riparian vegetation is documented in many MPWMD reports, as well as in the scientific literature, for example in Kondolf and Curry (1986, Exhibit SC 7) and Kondolf *et al*. (1987). Regarding steelhead, MPWMD (2008:IX-2, Exhibit SC 8) noted that:

> 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…
>
> About 1.5 miles of habitat between Boronda Road and Robles del Rio and up to nine miles of habitat below the Narrows may dry up, 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 Sleepy Hollow Steelhead Rearing Facility, located just downstream of San Clemente Dam, if habitat is not available.

It is obvious that fish lose habitat when a stream dries up, or nearly so. As noted in Order WR 95-10 (p. 28): "In recent times, dry season surface flows below the Narrows at RM 10 have been depleted in most years as a result of heavy ground water pumping. This results in the stranding and death of many juvenile fish as surface flow recedes. (DFG:4,32.)." Although the steelhead rescues referred to above save some fish, some perish during the rescues (MPWMD 2008, Exhibit SC-8), and presumably a much larger number are not rescued and perish as the stream goes dry.

It is less obvious how habitat changes with smaller reductions in flow, or how that change should be assessed (Castleberry et al. 1996, Exhibit SC 9). However, there is now empirical evidence that moderate reductions in summer flow reduce the growth rate of juvenile steelhead, and this seems likely to decrease their prospects for survival.

The effects of flow reduction on growth is being studied by Bret Harvey of the U.S. Forest Service. He has published an experimental study showing that a major (~75%) reduction in late summer flow resulted in a major decrease in growth rate in juvenile steelhead in Jacoby Creek, in Humboldt County (Harvey et al. 2006, Exhibit SC 10). At the meeting of the Cal-Neva Chapter of the American Fisheries Society this April, he presented further work on this topic in a talk titled "The influence of streamflow reductions on salmonids in small streams." The abstract for this talk (Exhibit SC 19), which I heard and later discussed with Dr. Harvey, was:

> Reduced streamflow can alter a variety of processes that affect fish populations. While some empirical data suggest large dry-season streamflow reductions in small streams can affect the growth of salmonids, some population modeling suggests small reductions in dry-season streamflow will not detectably affect fish population dynamics. Empirical observations addressing the effect of moderate changes in streamflow seem desirable. To address this issues, we contrasted the retention and growth of tagged fish in 350-m long study reaches above and below a diversion on West Weaver Creek in northwestern California. The diversion reduced dry-season streamflow by 15-25%. We PIT tagged a total of 298 steelhead > 70 mm fork length in June 2007 and re-sampled them in October. Minimum retention of fish in the upper (control) reach as indicated by recapture of tagged fish exceeded minimum retention of fish in the lower (treatment) reach, 50% v 34%. Both % change in length (5% v 3%) and specific growth (0.01 versus -0.05) of recaptured fish were higher in the control reach compared to the reach below the diversion (t tests, both with sample sizes of 83 (upper reach) and 50 (lower reach), P = 0.01). The observed difference in growth dynamics raises concerns about the consequences of moderately reduced

streamflows for population dynamics and highlights some uncertainties in salmonid population modeling.

This experiment is currently being replicated, so Dr. Harvey has not yet written it up for publication, but the results to date are the best evidence that I know of regarding the effects of reductions in flow in the Carmel River.

<u>Impaired passage over Los Padres Dam</u>

A ladder was built at San Clemente for upstream migrants, and downstream migrants apparently can ride the spill from the dam into a plunge pool without serious injury (recall that CDFG plants trout in mountain lakes by dropping them from airplanes). However, Los Padres Dam was built without a ladder; instead, a trap was built to capture upstream migrants for transport by truck, and downstream migrants were forced to pass down a long cement spillway. The first trap apparently was ineffective. According to Order WR 95-10 at p. 28, "Access to a major portion of the steelhead spawning and rearing habitat was effectively eliminated in 1949 with the construction of Los Padres Dam at RM 23.5."

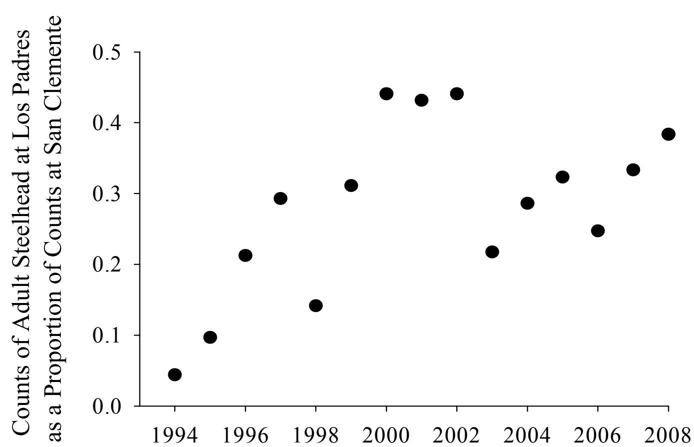
A digression on steelhead biology is necessary is necessary at this point to explain the consequences of this blockage. Steelhead are anadromous Oncorhynchus mykiss, and O. mykiss exhibit extremely variable life history patterns. Populations of south-central coast steelhead generally include both anadromous and resident fish (Boughton et al. 2007, Exhibit SC 11). It is not yet clear just what determines whether a particular fish will be anadromous or resident, but it is certainly some interaction between the fish's genotype and its environment. This matter is better understood for Atlantic salmon (*e.g.*, Thorpe *et al*. 1998) than for steelhead, but the problem is currently under investigation at UCSC and the NMFS laboratory in Santa Cruz. Mangel and Scatterswaith (In Press, Exhibit SC 12) describe the current state of the theoretical aspects of this work, and Bond (2006, Exhibit SC 13) and Hanson (2008) describe some of the empirical basis for it. The evolutionary consequences of habitat loss for Oncorhynchus , including steelhead, has recently been discussed by McClure *et al*. (2008, Exhibit SC

14). Thus, the proportion of fish in a population that adopt an anadromous life history can be affected either by changes in the environment, or by changes in the frequencies of the genes that determine the relevant traits. For example, it appears that the *O. mykiss* population in the upper Sacramento River is shifting toward a resident life history. In this case, it is unclear to what extent a genetic change is involved, and to what extent the change is a direct response to the summer releases of cool water from Shasta Dam.

Figure 2. Google Earth image of the Los Padres Dam spillway, probably in 2007. Juvenile steelhead and kelts have to pass down the long concrete ramp in shallow water.

The historical information reviewed above, especially the reported decline in the run after the construction of Los Padres Dam, indicates that *O. mykiss* in the upper Carmel River watershed used to be strongly anadromous. Currently, the majority of the population above Los Padres Dam seems to be resident, based on the investigations of Dettman and Kelley (1986) and on the small numbers of steelhead that have been trucked around the dam (Figure 1). There is evidence that a condition of Order WR 95-10 requiring the removal of a large rock just below the spillway, and other marginal improvements made since, have resulted in a greater proportional use of the habitat above Los Padres Dam by steelhead (Figure 3), but the proportion of anadromous fish using the upper watershed is still small. Conditions in the watershed above Los Padres Dam have not changed, however, so the shift toward a resident life history must be a response to changes in conditions for migration. It is possible that the change is a simple demographic change in response to continued high juvenile mortality passing over the dam, but in this case it seems more likely that genetic change has also occurred. That is, it appears that the *O. mykiss* in the upper Carmel River have evolved toward a resident life history, because mortality associated with passage at Los Padres Dam has outweighed the fitness benefits associated with migrating to sea.

Figure 3. The proportion of adult steelhead passing San Clemente Dam that also pass Los Padres Dam.



Degradation of the lagoon:

Loss of surface and subsurface inflow to the lagoon probably is another important factor in the decline of Carmel River steelhead. Lagoons appear to be important habitat for steelhead in California. According to Bjorksteadt *et al*. (2005:125), in a NMFS report discussing steelhead habitat in the North-Central Coast Recovery Domain

Lagoon habitats are a common feature of watersheds throughout the NCCCRD. Lagoons are formed when deposition of sand on beaches during the spring and summer forms a sandbar across the mouth of a river and thus blocks direct flow into the ocean. After sandbars form lagoon size is usually dramatically increased, but inflows that convert the lagoon to freshwater or very strong winds are necessary to prevent strong salinity stratification in lagoons. Such stratification, even in shallow lagoons, prevents vertical mixing of heat and oxygen and often results in warm water (especially in the bottom salt water layer), poor bottom dissolved oxygen and low production of invertebrates as food for steelhead (Smith 1990). If streamflow is sufficient to maintain freshwater in the lagoon, such environments can provide highly productive habitats for juvenile steelhead. Although the conditions under which a lagoon provides favorable habitat have been characterized in general terms, *e.g*., the presence of a well-mixed water column and sufficient dissolved oxygen levels (Smith 1990), spatial and temporal variability in the suitability of lagoon habitats is not well understood, nor has the influence of such habitats on the dynamics of steelhead populations been adequately documented. In some small systems, though, juvenile steelhead grow extremely well in lagoon habitats, and this might have important implications for later survival in the ocean.

The importance of lagoon habitat for steelhead in central California has since been better demonstrated. As described in Boughton *et al*. (NMFS 2007:pp 12, 15, Exhibit SC 11):

> Studies of coastal O. mykiss populations in central and southern California reveal three principal life-history groups, which we here designate as fluvial-anadromous, freshwater resident, and lagoon-anadromous (Smith 1990, Hayes *et al.* 2004, Bond 2006). Both anadromous groups classify as winter steelhead, in that adults migrate during the winter rainy season. Fluvial-anadromous fish spend one or two summers (occasionally more) in freshwater streams as juveniles, then smolt and migrate to the ocean, using the estuary only for acclimation to saltwater and as a migration corridor (also occasionally for spring-time feeding). Freshwater residents (commonly known as rainbow trout) complete their entire lifecycle in the freshwater stream network. Finally, lagoon anadromous fish spend either their first or second summer as juveniles in the seasonal lagoon at the mouth of the stream. This last group may be unfamiliar to most steelhead biologists, so we will describe it a bit more fully below.

In the study area, the estuaries at the mouths of rivers and creeks are typically transformed into lagoons during the dry season, when the combination of low streamflow and coastal wave action allows a sandbar barrier to form between the ocean and the stream's mouth. Several case studies indicate that the resulting seasonal lagoons comprise exceptionally good rearing habitat for juvenile steelhead. Smith (1990) described data collected in 1986 from three creeks between Santa Cruz and San Francisco, in which juvenile steelhead reached high densities and grew extremely fast in the lagoons. Bond (2006) described a more intensive study conducted over 4 years in a fourth creek, with similar conclusions. Fast growth is generally beneficial to fish because large fish have lower mortality rates than small ones, particularly in the marine environment (Sogard 1997; see Ward *et al.* 1989 for a steelhead example). Indeed, of 27 adult steelhead examined by Smith (1990), backcalculation of growth rates (using scale samples) suggested that 60% - 70% had the high juvenile growth rates typically observed in lagoons. Bond (2006) conducted a discriminant-function analysis on scale samples from 406 adults, and concluded that 85% of successfully returning adults had reared in the lagoon. From these and other data, Bond (2006, p. vii) concluded that "estuary-reared steelhead showed a large survival advantage and comprised 85% of the returning adult population despite having been between 8% and 48% of the juvenile population. Although the … estuary comprised less than 5% of the watershed area, it was critical nursery habitat, as estuary-reared juveniles make a disproportionate contribution to the spawning adult pool."

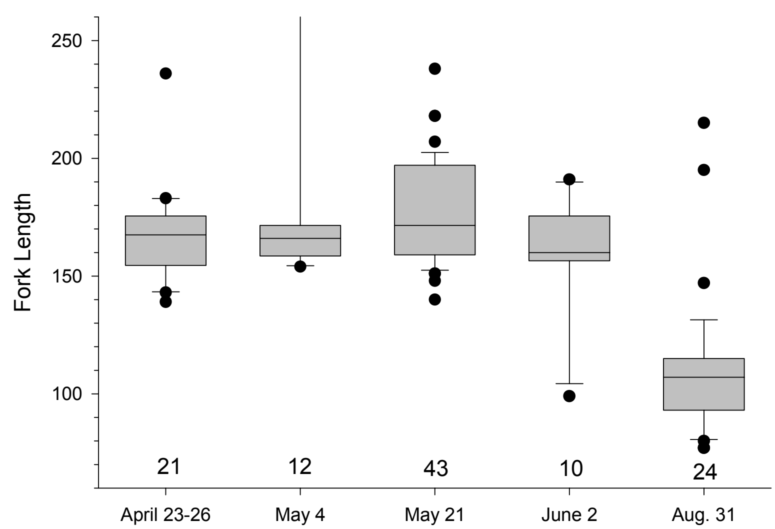
Bond's (2006) work suggests that the lagoon anadromous life history is very important for the viability of many anadromous populations. However, the other life-history types are also important because lagoons sometimes prematurely breach or become anoxic, with high mortality costs for the lagoon-anadromous component of the population (Smith 1990). In the winter following a lagoon failure the fluvial-anadromous life history would tend to predominate in the outgoing smolt run, and thus it probably contributes to the long-term viability of the population.

Finally, the long history of severe droughts in the study area (Haston and Michaelson 1997) leads one to believe that segments of mainstream migration corridors may dry up for multi-year periods, preventing anadromy of any type. During such events the adults in the ocean and the freshwater residents in the perennial segments of streams are the only buffer against extirpation (in the study area, many stream systems are spatially intermittent during dry periods, with alternating segments of surface and subsurface flows). Of these two groups of fish, only the freshwater residents would be capable of reproduction during an extended drought lasting longer than the lifespan of the fish. This suggests that the freshwater-resident component is critical for long-term viability of the ESU through multiple droughts. Conversely, the anadromous life-history types are necessary for migratory recolonization of basins from which the species has been extirpated by a catastrophic event. Additionally, the anadromous types probably allow some populations to maintain a larger size (and thus a lower extinction risk) than if they were solely composed of freshwater-resident fish.

There is evidence that a lagoon-anadromous life history is also important for Carmel River steelhead. In *Otey v. CSD* (Exhibit SC 5), Carmel Martin testified that "… in spring after the steelhead trout stopped running then we would fish for the small steelhead trout with a fishing rod. We did not use rods, however, we simply used a piece of cane pole, to fish, and we continued fishing for trout, more or less through the summer season, until the water got somewhat stagnant, by being impounded for a long period of time, when the trout tasted of the brackish water, …"

In 1982, consultants to the MPWMD sampled juvenile steelhead in the Carmel River lagoon (Dettman and Kelley 1986). They captured fish with median lengths about 170 mm from April to early June (Figure 4). These would have been fluvial-anadromous fish, using the terminology from Boughton *et al.* (2007). Beginning in early June, they also captured smaller fish, which would have been lagoon-anadromous. As described in Dettman and Kelley (1986:91): "Almost all of the steelhead captured in the lagoon prior to June were yearlings … Young-of-the-year moved into the lagoon during June and July."

Figure 4. Box plots of the length of juvenile steelhead captured in the Carmel River lagoon in 1982. Data from Dave Dettman.



Unfortunately, the fish that moved into the lagoon in 1982 mostly perished. In the fall, waves washed over the beach, and the sea water sank under the fresh water in the lagoon, because of its greater density. The lagoon remained stratified, and the lower layer became anoxic, forcing the fish close to the surface where they were preyed upon by birds.[2] This is the kind of event mentioned by Boughton *et al.* (2007) in the quotation above. Recent work on Scott Creek in Santa Cruz County using passive integrative transponder (PIT) tags shows that fish in the lagoon often move back upstream in the fall, likely in response to this problem (S. Hayes NMFS, Santa Cruz, pers. comm. 2008). However, this behavior requires that there be a river into which to move back. In some years, however, the lagoon remains habitatable through the summer. For example, about 3,000 were captured there in December 2006 (Kevan Urquhart, MPWMD, pers. comm. 2008). This many large smolts could easily account for the increase in returns in 2008.

Historical evidence indicates that before diversions began in the late 19th Century the Carmel River was perennial except perhaps in very dry years (Williams 1989). Even now, in very wet years, the Carmel River flows to the lagoon throughout the summer, so it is evident that increasing diversions increased the proportion of years without continuous surface flow into the lagoon, as well as the duration of the seasonal dry periods.

Another factor reducing the habitat value of the lagoon has been artificial opening of the lagoon to prevent flooding. Initially, according to testimony in *Otey v. CSD*, the lagoon was opened artificially when flow in the river began or increased in the late fall, to ensure that the opening would stay south of the large septic tank in the beach that served as Carmel's sewage treatment facility in the early years of the town. In the 1920's, Bruno Odello began farming artichokes on the south side of the river near the lagoon, and he took over opening the lagoon, to prevent water damage to the plants. Later, houses were built along the north side of the lagoon at elevations that would flood if the lagoon were not opened, and Monterey County took over the task. This is a matter of continuing controversy, for at least two reasons. Frequently, when the lagoon is opened, it drains nearly completely, posing the risk that

[2] This was observed by Gary Stern, now of NMFS, who then worked for D. W. Kelley and Associates.

juvenile steelhead in the lagoon may be carried into the sea before they are quite ready for it. Second, juvenile steelhead have a rich feeding opportunity when the water in the lagoon rises and floods the adjacent marsh. Draining the lagoon closes off this opportunity.

How does the Federal Endangered Species Act address harm to habitat?

As I understand it, the federal Endangered Species Act addresses harm to habitat through Section 9 and associated regulations. Section 9 prohibits "take," of endangered species, and this prohibition has been extended to threatened species (such as the SCCC steelhead Distinct Population Segment (DPS)) by regulations. Section 9 defines "take" as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." NMFS regulations define "harm" as including "significant habitat modifications or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." (50 CFR §222.102)

In its preface to rule-making governing take of 14 threatened steelhead ESUs[3], NMFS stated that activities like those of Cal-Am's diversions and dam operations are likely to result in "takings" of listed steelhead.

> "NMFS agrees that water diversions and …may have other deleterious effects on salmonid habitat. These may include impacts on sediment transport, turbidity, and stream flow alterations. …NMFS has revised the take guidance. One change is the water withdrawals have been added to the list of activities that are likely to injure or kill salmonids." 65 Fed.Reg. at 42429.

In this Take Guidance, NMFS listed activities most likely to result in injury or harm to listed salmonids, and included:

> A. Constructing or maintaining barriers that eliminate or impede a listed species access to habitat or ability to migrate…

[3] Final Rule Governing Take of 14 Threatened Salmon and Steelhead Evolutionarily Significant Units (ESUs). 65 Fed. Reg. 42422, 42429 (July 10, 2000).

D. Removing or altering rocks…gravel…that are essential to the integrity and function of a listed species habitat.

E. Removing water or otherwise altering streamflow when it significantly impairs spawning, migration, feeding, or other essential behavioral patterns. 65 Fed. Reg. 42472.

Section 10 of the ESA provides for "incidental take permits" that exempt otherwise lawful activities from the take prohibition. However, parties seeking incidental take permits must develop a conservation plan describing the steps that will be taken to minimize take, and why alternatives activities that might avoid or reduce take have not been pursued. As I have described above, Cal-Am's diversions and fish-passage facilities are harming steelhead in significant ways, with respect to breeding, spawning, rearing, migrating, and sheltering. As far as I know, however, Cal-Am has never obtained an incidental take permit, and therefore is not authorized to continue to take steelhead in the Carmel River.

What have been the effects of Cal-Am's illegal diversions on riparian vegetation and bank stability along the Carmel River?

In the1960's, when Cal-Am installed a new well or wells at about rm 9, the effects on riparian vegetation were obvious: the leaves of the cottonwoods and willows turned yellow and fell off in response to drought stress induced by the pumping (Figure 5, see also RWC-SC Exhibit 11 (92)) , and if this stress continued, the trees died. As additional wells were installed farther downstream, the affected area of vegetation increased, especially during the 1976-77 drought, when vegetation in the upper valley was also affected. (Williams 1983a, RWC-SC Exhibit 1 (92); Groeneveld and Griepentrog 1985, RWC-SC Exhibit 12 (92)). Because the river channel was incised into relatively coarse, non-cohesive alluvium, the loss of riparian vegetation resulted in dramatic bank erosion that caused considerable property damage (Kondolf 1982, MPWMD 116 (92); Kondolf and Curry 1986, Exhibit SC 7). There has been a dramatic recovery of riparian vegetation in the upper valley since diversions there were reduced (and moved

Figure 5. Riparian vegetation along the Carmel River, a short distance upstream from Highway 1, May 26, 1990. The healthy cottonwood in the distance was irrigated by a drain from development north of the river. The effect seen here occurred decades earlier farther upstream.

further downstream), although older trees that provide habitat for various animals such as cavity-nesting birds are not yet present. There has also been considerable recovery farther downstream, due in large part to restoration efforts by the MPWMD, but not as much recovery as in the upper valley.

How long has Cal-Am known that its diversions from Carmel Valley wells might be illegal?

Cal-Am has known for at least 27 years that it might need permits for its Carmel Valley wells. This is documented in a 1981 letter from Carla Bard, Chair of the SWRCB, to Charles Fullerton (Exhibit SC 15), with a copy to Cal-AM, c/o Leonard Weiss.

Exhibit SC 15 describes and endorses a deal, proffered by CDFG staff, to develop measures to protect steelhead rather than proceed with a determination whether the wells pump underflow. At p. 2, however, the letter notes that "The question of underflow will need to be explored in detail at the time the District submits an application to the State Board to store water upstream or attempts to develop an additional water supply by alternative means. We recommend that the proposed agreement include the task of determining the limits of underflow and if any wells are pumping water that is from the underflow of the Carmel River." Subsequently, then-assemblyman Sam Farr got $50,000 in the state budget to fund development of a watershed management plan, the tasks for which included investigating the underflow matter, and I went onto the MPWMD staff to work on the plan. In 1983, the MPWMD circulated Working Paper No. 6 of the Carmel River Watershed Management Plan, "Legal status of Carmel Valley Ground Water) (Exhibit RWC-SC 3(92)) This study removed any serious doubt that Cal-Am needed to get permits for its wells.

What has been Cal-Am's attitude regarding the effects of its illegal diversions on the public trust resources of the Carmel River?

From the beginning, Cal-Am's attitude has been one of denial and delay. This began in the 1970s, when Cal-Am began using wells downstream from the Narrows. The effects on the riparian vegetation were quickly apparent, and local residents hired a UC Berkeley professor, Ed Zinke, who wrote a report (Zinke 1971) identifying the wells as the culprit. Instead of addressing the problem, Cal-Am hired another UC professor, Ed Stone, who wrote a report arguing that, in the absence of disturbance, the willows and cottonwoods along the river would naturally be displaced over time by trees such as bay and oaks that are more drought resistant, so the wells were only accelerating a natural process (Stone 1971). Because riparian zones are characterized by disturbance, as detailed for the Carmel River by Kondolf and Curry (1986, Exhibit SC 7), this is like defending a murder charge on the grounds that the victim was going to die sooner or later anyway, but Cal-Am used this report to block any significant response by Monterey County to the continuing death of the willows and cottonwoods.

After I was elected to the MPWMD, I arranged another study of the issue (Woodhouse 1983) that demonstrated the effects of the wells on the trees with measurements of leaf water potential. Again, instead of dealing with the problem, Cal-Am hired another study that underestimated potential evapotranspiration in the area by a factor of about 10. The MPWMD had to conduct yet another study

(McNiesh 1986, Exhibit MPWMD 64 (92)) that documented the obvious in excruciating detail before Cal-Am gave up contesting the point.

Part of Cal-Am's defense was a claim, tendered by their consulting geologist, Russell Mount, that there was a confining layer in the lower Carmel Valley aquifer that effectively buffered the upper layer of the aquifer from the effects of the diversions through the wells in the lower Carmel Valley. Cal-Am maintained this claim, in the face of mounting evidence to the contrary, until 1983. Another geologist, John Logan, carefully reviewed Mount's work and found that he had misinterpreted a well test (Exhibit SC 16).

About the time that the effects of Cal-Am's wells on riparian vegetation became an issue, a controversy developed regarding the point of diversion of water from the American River to supply the East Bay Municipal Utility District (EBMUD), and by 1980 this was focused on whether an upstream diversion is "an unreasonable method of diversion" within the meaning of Article 10 sec. 2 of the California constitution, when a diversion farther downstream is feasible. Article 10 sec 2 requires that water resources "be put to the beneficial to the fullest extent of which they are capable," and it seemed logical that the water of the Carmel River could be put to greater beneficial use if it were released from San Clemente and re-diverted at wells farther downstream.

After I was re-elected to the Board of the MPWMD in 1983, the district began to develop an ordinance to require such releases. I recall that Pete O'Day, then president of Cal-Am, told us that doing this was impossible. Even Russell Mount could not support this claim, so Cal-Am retreated to the claim that the details of their system of pumps and pipes required that they maintain a diversion of 5 cfs from San Clemente.

This stalling tactic was successful for almost a decade, probably because the other parties involved lacked either the means or the will to make an independent evaluation of Cal-Am's system. In 1989, for example, in "Proposed terms for interim resolution of complaints against the California-American Water Company and Water West Corporation by the Carmel River Steelhead Association"

(Exhibit MPWMD 54 (92)), the Chief of the Division of Water Rights, Walter Pettit, wrote that "No system replumbing of Cal/Am's upper Carmel Valley system is proposed, due to the high cost and operational problems," although to the best of my recollection Cal-Am's assertions were the only evidence available regarding the "high cost and operational problems." In response to Order WR 98-04, Cal-Am submitted studies that grossly underestimated the environmental benefits of reducing diversions from San Clemente or the associated filter plant (3 April 2000 letter to Harry Schueller of the SWRCB from Laurens Silver on behalf of Sierra Club, and attachment). When the SWRCB finally ordered Cal-Am to cease diversions from San Clemente in Order WR 2002-02, Cal-Am did so, apparently without great difficulty.

What is the state of scientific knowledge of Central and South-Central California steelhead?

Until recently, surprisingly few scientific papers had been published on the biology of steelhead in California, as is evident from the reference lists of various NMFS technical memoranda published in the last decade (*e.g.*, Busby *et al.* 1996; Bjorkstead *et al.* 2005; Boughton *et al.* 2006, 2007; Lindley *et al.* 2006). The main exception was a major study of steelhead and coho salmon in Waddell Creek that was conducted in the 1930's, although it was not published until 1954 (Shapovalov and Taft 1954). I recall being annoyed around 1980 when the MPWMD received a proposal for work by Don Kelley & Associates that involved considerable basic data collection to elucidate matters of steelhead life history that I had assumed were already well known, but turned out not to be. That work was described in a consulting report (Dettman and Kelley 1986, Exhibit SWRCB 36 (92)). At about that time, a fisheries biologist named Jerry Smith obtained a position at San Jose State and began doing work on steelhead in various streams in Santa Cruz and San Mateo counties (*e.g.*, Smith 1990) that also involved basic data collection. No doubt other consulting studies were done as well. Similarly, various CDFG reports, such as Snider (1983) and Titus *et al*. (1997), also included valuable information. However, these also were consulting or agency studies, and unfortunately the material they reported was not published in the peer-reviewed literature, and is of variable quality. Similarly, the MPWMD has collected data on the steelhead in the Carmel River, but these data remain mostly unanalyzed.

Knowledge of steelhead in California is now increasing rapidly, mainly because the listing of steelhead under the federal ESA in 1997 has made money available for research. There are now relevant research programs at the NMFS Fisheries Ecology Division in Santa Cruz and the UCSC Long Marine Laboratory, and another at the USFS Redwood Sciences Laboratory in Arcata. A third at UC Davis, focused on the Navarro River, recently concluded. Although there is overlap, the Santa Cruz program emphasizes use of lagoons by coastal steelhead; the Navarro River program was more physiologically oriented; and the Arcata program focuses more on use of habitat in streams. Published studies from these programs include Hayes *et al.* (2004), Werner *et al.* (2005), Viant *et al.* (2006), and Harvey (2006) and Hayes *et al.* (2008, Exhibit SC 17); theses include Feliciano (2005), Bond (2006) and Hanson (2008). Perhaps equally important, researchers at UCSC have developed a much better conceptual framework for interpreting data on steelhead. This is described in Mangel and Satterthwaite (in press, SC Exhibit 18), which states in the abstract:

> One of the great challenges of biology is to understand pattern and variation simultaneously. In the salmonids, this challenge arises in the context of the major life-history events of migration from freshwater to the sea and returning from seawater to freshwater. We have developed life-history models that combine proximate (physiological mechanism) and ultimate (natural selection) considerations and that allow us to understand both the pattern and the variation in Atlantic and coho salmon and steelhead trout. The conceptual framework can be implemented by stochastic dynamic programming and leads to generalizations about top-down and bottom-up control of life histories, the evolution of diadromy, implications for the management of fisheries, the recovery of salmonid population, and effective aquaculture. The salmonids are one of the best examples that nature is indeed complicated and variable but that much of that variability can be understood.

The virtue of models such as these (which are works in progress, not ultimate answers) is that they have relatively modest requirements for data, but can provide powerful insights into the reasons that salmonids such as steelhead in a given stream have the life history strategies that they do, and how the fish are likely to respond in the short and long term to different modifications of the stream habitat. For example, when the model described in Mangel and Satterthwaite (in press) is extended to include the resident life history pattern [which is underway, with a CALFED grant], then the model could be used to explore the likely response of Carmel River steelhead to mortality associated with passage over Los Padres Dam, discussed above, or to other major changes in the Carmel River habitat. As it is, the model could be used to assess the effects of reductions in growth of the magnitude described in the abstract of Bret Harvey's recent talk, quoted above. That is, it could be used to assess the effects of the reduced diversions resulting from the CDO.

Unfortunately, good data on steelhead are not yet available, for the Carmel River or any other stream. At p. 10, Mangel and Satterthwaite note that "Although such models would ideally be based on data collected with a single river system, no one system has been studied in sufficient depth to provide full parameterization of a model. We therefore draw from a variety of sources in the literature to illustrate the approach." This limits but does not destroy the utility of the model, which can be run with a range of plausible parameter values. Moreover, models like this can be used to assess the utility of monitoring or research programs, by exploring the utility of the kind of data that would be collected. Thus, such models can both guide research programs and translate their findings into assessments useful to management.

Why is the state of knowledge of steelhead so poor?

There are several reasons. One is a change in the attitude of the California Department of Fish and Game. In the early 20th Century, CDFG biologists had a good reputation for doing scientific work, often published in the CDFG Fish Bulletin series, or in the quarterly journal California Fish and Game. This is particularly true for its work on sardines, but biologists such as Leo Shapovalov, Almo Cordone, Don Fry, Richard Hallock, and Don Kelley represented the same attitude in work on salmon and steelhead. Probably because of a changing attitude by CDFG management, this reputation, and the reasons for it, languished in the late 20th Century, and until recently there were few publications by CDFG biologists in peer reviewed journals.

A second factor was the development in the 1970s of a method for assessing instream flows, now called the Physical Habitat Simulation System, or PHABSIM, that has high acceptance among agencies, even though it has been severely criticized in the literature by prestigious scientists (*e.g.*, Castleberry *et al.* 1996, Exhibit SC 9). For various reasons, this method is fundamentally flawed, and almost all applications of it fail to meet elementary norms for statistical practice, such as probability sampling and estimation of confidence intervals. Nevertheless, the method seems to provide a way to answer the question that management is usually interested in, and so it has reduced the motivation for developing better biological understanding.

Similarly, the management of agencies such as the MPWMD generally show little interest in developing scientific information that does not have direct relevance to management; that is, information that goes beyond addressing the questions pressing on management in the short term. For example, my understanding is that Dave Dettman, formerly the biologist at the MPWMD, has a sizable collection of scales from Carmel River steelhead, but was never given the time to read the scales to determine the ages of the fish, or the budget to have someone else do so. Accordingly, data on the growth rate of Carmel River steelhead (*e.g.*, Figure 6) are very limited, but growth rate is an important parameter in the Mangel and Satterthwaite model.

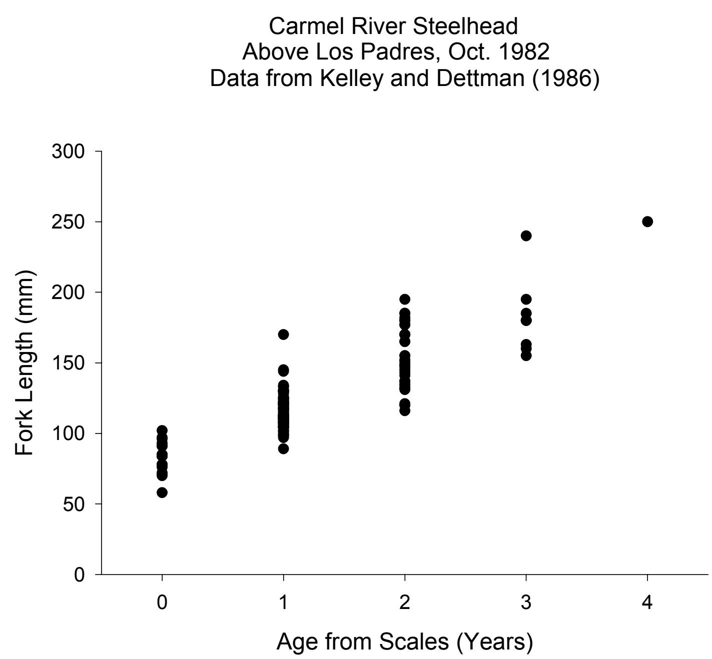


Figure 6. Length at age of *O. mykiss* sampled above Los Padres Dam in October, 1982. Note the substantial overlap in size at age, which makes estimates of age from length alone highly imprecise.

Although agencies and companies are reluctant to spend money on developing better scientific information about the systems that they manage or manipulate, they have proved willing to spend very large amounts of money on dubious projects such as a new dam on the Carmel River. For example, Cal-Am spent over three million dollars on the Carmel River Dam even after the Carmel River steelhead were listed under the federal ESA in 1997 (Exhibit CAW 31), when it should have been obvious that the dam was not a viable project.

What is adaptive management?

Adaptive management is an approach that recognizes that management actions normally must be based on uncertain evidence, and so tries to provide that the management actions will develop more information about the system being managed (Williams 1998, Exhibit SC 18). The Court's Decision in *EDF v EBMUD* is an example of adaptive management (Castleberry *et al.* 1996, Exhibit SC 9). That is, Judge Hodge set flow standards that conditioned EBMUD's ability to divert water from the American River at Nimbus Dam, in order to protect public trust resources, but he recognized the uncertainty in the evidence supporting the standards, so he retained jurisdiction and ordered the parties to cooperate in studies to provide better information. In that case, EBMUD decided to move its point of diversion downstream, and the study program ceased.

How should the draft CDO be modified?

The CDO should be modified in three ways:

1. The CDO should mandate reductions in illegal diversions, but the proposed CDO should be modified to provide a better balance between the protection and restoration of public trust resources on the one hand and the inconvenience and expense for Cal-Am's customers on the other. This can be done by focusing the reductions in diversions on periods when flows in the river are low, and incremental increases in flow will provide greater benefit to steelhead and other public trust resources:

Define "low flows" as flows less than 20 cfs at the Don Juan Bridge gage, as in Order WR 2002-0002.

Define "marginal flows" as flows greater than 20 cfs at the Don Juan Bridge gage, but less than the minimum flow requirements in Table A of Amended Permit 20808A, with the modification given below.[4] Define "high flows" as flows greater than the minimum flow requirements of modified Table A.

Define "base unlawful production" as the means of unlawful Cal-Am production from Carmel river sources amounts for the years 1996-2007, for time periods such as days, weeks or months.[5] My calculations of these, based on monthly data from the MPWMD, are in Figure 7 in acre feet per month, but similar numbers could be calculated for other time periods.

Then, initially require a 25% reduction from base unlawful production during periods of low flow, a 15% reduction during periods of marginal flow, and no reduction in periods of high flow. In each following year, the required reduction would be increased by 2% of base unlawful production for each situation, such that, in the second year, the required reductions would be 27%, 17%, 2%, etc., until illegal diversions no longer occur.

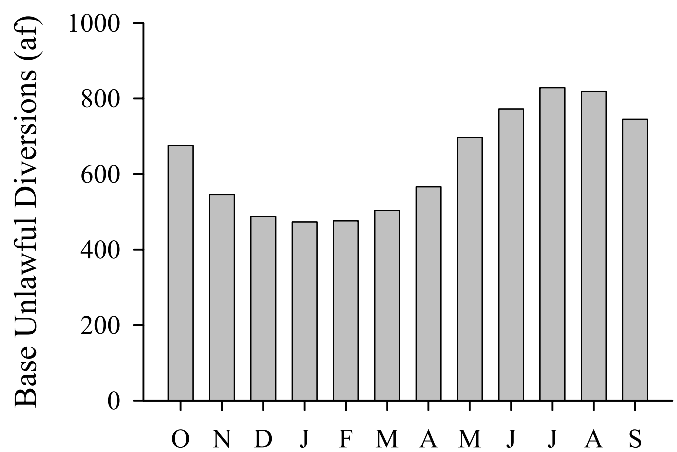


Figure 7. Suggested "Base Unlawful Diversions" in acre-feet per month, for calculation of allowable Cal-Am diversions.

---

[4] Table A in Amended Permit 20808A should be modified to remove the provisions allowing diversions after December 1 when flow at the Highway 1 gage is greater than 40 cfs, if an attraction flow has not occurred. The change would have a very small effect on the productivity of the ASR project, and would reduce the potential for the project to result in a taking of adult steelhead in years when the lagoon opens in response to flows lower than the attraction flows specified in Table A.

[5] Cal-Am production from Carmel River sources for 1996-2007, excluding ASR diversions, averages 10,967 af (Exhibit MPWMD-DF2). Subtracting 3,376 gives 7,591 average annual unlawful production. I distributed this over months following Exhibit SC-2, adjusting for the varying numbers of days in the months, to give the numbers shown in Figure 7.

Rationale: We believe that the CDO should be based upon four principles. First, the CDO should provide that the timing of reductions in diversions maximize the benefits from the reductions to public trust resources, relative to the burden placed on Cal-Am's customers. Public acceptance of the policy embodied in the CDO will be important for its success, and timing the reduced diversions so that the river and the public share the shortages will further such acceptance; sharply restricting water use when lots of water is flowing out to sea will not. Second, the CDO should provide for a substantial immediate reduction in diversions, during periods when public trust resources are at risk. This will reduce take of steelhead and provide public trust resources with some relief from Cal-Am's years of delay. Third, the CDO should provide for continuing reductions in diversions, to keep the pressure on Cal-Am and the MPWMD to move rapidly to develop new sources of supply. Fourth, the CDO should specify the reductions in terms of unlawful production, rather than total production, to encourage Cal-Am to develop small sources of new supply.

2. The CDO should mandate that Cal-Am undertake the following activities to mitigate the effects of its continuing unlawfully diversions, with the following conditions:

A. As long as Cal-Am continues to divert water unlawfully, it shall pump water from the San Carlos Well or other lower Carmel Valley well to the lagoon as necessary to provide a minimum surface inflow of 0.5 cfs. Unless monitoring is conducted by other agencies such as the MPWMD, Cal-Am shall monitor conditions in the lagoon to determine the extent to which the minimum surface inflow maintains good habitat conditions in the lagoon for steelhead, and shall report annually to the Chief, Division of Water Rights on the results of the monitoring. The monitoring shall include the amount and quality of water in the lagoon, including vertical gradients of temperature, oxygen, and salinity, and not less than three estimates per year of the population of juvenile steelhead in the lagoon with standard errors not greater than 50% of the abundance estimates. The Chief, Division of Water Rights may modify the required minimum surface inflow if the Chief finds that a different amount of inflow is necessary to maintain good habitat conditions for steelhead. The Chief, Division of Water Rights, may also modify the monitoring requirements if the Chief finds that different monitoring is required to determine whether habitat conditions in the lagoon for steelhead are good.

Rationale: Cal-Am's unlawful diversions clearly reduce the duration of surface flow into the lagoon, and the available evidence strongly suggests that the lagoon can be important habitat for juvenile steelhead, and lack of surface inflow reduces the habitat value. I have suggested 0.5 cfs as an inflow that seems large enough to make a difference, but small enough to be practical and to have a modest effect on the aquifer (~1 af d^{-1}). The measure embodies adaptive management, especially in conjunction with 3 below.

B. Cal-Am shall construct, maintain, and operate a ladder or other new passage facilities over Los Padres Dam, to specifications approved by the California Department of Fish and Game.

Rationale: This is suggested as additional mitigation for the effects of Cal-Am's unlawful diversions. Even though the locus of this measure is upstream from the effects of the unlawful diversions, the steelhead population that is affected by the unlawful diversions also occupies the habitat upstream from Los Padres Dam, and it is doubtful that the full effects of the unlawful diversions can be mitigated by activities within the portion of the river that the diversions affect.

C. As long as Cal-Am continues to divert water unlawfully, it shall provide funding to support one post-doctoral fellow and one graduate student of the UCSC Long Marine Laboratory, or equivalent personnel at the NMFS Fisheries Ecology Laboratory, to conduct basic scientific studies of steelhead, primarily in the Carmel River. Study plans for this work shall be subject to approval by the Chief, Division of Water Rights.

Rationale: This is also suggested as mitigation for the continuing effects of the unlawful diversions. The results from such studies should be particularly useful for adaptive management of the Carmel River lagoon, discussed above, but could also help make the Mangel-Satterthwaite model more for effective for assessing instream flows or the effects of changes in fish passage over Los Padres Dam. Moreover, Cal-Am has an application filed for its "Table 13" water, and the information developed from these studies, and other information developed by the Santa Cruz research program, will assist the SWRCB in evaluating the environmental effects of these applications.

References:

Bjorkstedt, E. P., B. C. Spence, J. C. Garza, D. G. Hankin, D. Fuller, W. E. Jones, J. J. Smith, R. Macedo. 2005. An analysis of historical population structure for evolutionarily significant units of Chinook salmon, coho salmon, and steelhead in the North-Cenral California Coast recovery domain. NOAA-TM-NMFS-SWFSC-382

Bond, M. H 2006. Importance of estuarine reaaring to Central California steelhead (*Oncorhynchus mykiss*) growth and marine survival. M.A. thesis, Ecology and Evolutionary Biology, University of California, Santa Cruz. Exhibit SC 13

Boughton, David. 2005. South-Central California Coast Steelhead ESU. Pages 268-276 in T. P. Good *et al.* (Eds.) Updated status of federally listed ESUs of West Coast salmon and steelhead, NOAA Tech. Mem. NMFS-NWFSC-66. Waples, Robin. 2005. Steelhead BRT conclusions. Pages 300-306 in T. P. Good *et al.* (Eds).

Boughton, D. A., P. B. Adams, E. Anderson, C. Fusaro, E. Keller, E. Kelley, L. Lentsch, J. Nielsen, K. Perry, H. Regan, J. Smith, C. Swift, L. Thompson, F. Watson. 2007. (draft) Viability criteria for steelhead of the South-Central and Southern California California Coast. NOAA-TM-NMFS-SWFSC-XXX. Exhibit SC 11.

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, K. Neely, and I. V. Lagomarsino. 1996. Status review of West Coast steelhead Washington, Idaho, Oregon, and California. NOAA TECH. MEMO. NMFS-NWFSC-27.

Castleberry, D.T., J.J. Cech Jr., D.C. Erman, D. Hankin, M. Healey, G.M. Kondolf, M. Mangel, M. Mohr, P.B. Moyle, J. Nielsen, T.P. Speed, and J.G. Williams. 1996. Uncertainty and instream flow standards. Essay, Fisheries:21(8):20-21.

Dettman, D.H. and D.W. Kelley. 1986. Assessment of the Carmel River steelhead resource. Vol. 1. Biological Investigations. D. W. Kelley & Associates, Newcastle,CA (report to MPWMD) Exhibit SWRCB 36 (92).

Groeneveld, D. P. and T. E. Griepentrog. 1985. Interdependence of groundwater, riparian vegetation, and streambank stability: a case study. Symposium on riparian ecosystems and their management, Tucson, Arizona, April 16-18, 1985.

Harvey, B.C, R. J. Nakamoto, and J. L White. 2006. Reduced streamflow lowers dry-season growth of rainbow trout in a small stream. Transactions of the American Fisheries Society 135:998-1005. Exhibit SC 10.

Hayes, S. A., M. H. Bond, C. V. Hanson, and R. B. MacFarlane. 2004. Interactions between endangered wild and hatchery salmonids: can the pitfalls of artificial propagation be avoided in small coastal streams? Journal of Fish Biology 65(Supplement A):101–121.

Hayes, S. A., M. H. Bond, C. V. Hanson, E. V. Freund, J. S. Smith, E. C. Anderson, A. J. Ammann, and R. B. MacFarlane. Steelhead growth in a small Central California watershed: upstream and estuarine rearing patterns. Transactions of the American Fisheries Society 137:114-128.

Kondolf, G. M. and R. R. Curry.. 1986, Channel erosion along the Carmel River. Earth Surface Processes and Landforms 11:307-319. Exhibit SC 7, also RWC-SC 2 (92).

Kondolf, G. M., Maloney, L. M., and Williams, J. G. 1987. Effects of bank storage and well pumping on base flow, Carmel River, Monterey County, California. 1987. Journal of Hydrology 91:351-369.

Lindley, S.T., R.S. Schick, A. Agawal, M. Goslin, T.E. Pearson, E. Mora, J.J. Anderson,, B. May, S. Greene, C. Hanson, A. Low, D. McEwan, B. McFarlane, C. Swanson, and J.G. Williams. 2006. Historical population structure of Central Valley steelhead and its alteration by dams. San Francisco Estuary and Watershed Science 4(1) article 3.

Mangel, M. and W. H. Satterthwaite. In Press. Combining proximate and ultimate approaches to understand life history variation in salmonids with applications to fisheries, conservation, and aquaculture. Bulletin of Marine Science 83(1). Exhibit SC 12.

McClure, M. M., S. M. Carlson, T. J. Beechie, G. R. Pess, J. C. Jorgensen, S. M. Sogard, S. E. Sultan, D. M. Holzer, J. Travis, B. L. Sanderson, M. E. Power, and R. W. Carmichael. Evolutionary consequences of habitat loss for Pacific anadromous salmonids. 2008. Evolutionary Applications 300-38.

McNeish, C. M. 1986. Effects of production well pumping on plant stress in the riparian corridor of the lower Carmel Valley. Unpublished report to Monterey Penninsula Water Managemt District.

MPWMD 2008. 2005-2006 Annual Report (July 1, 2005 - June 30, 2006) for the MPWMD mitigation program, Ch. IX (Exhibit SC 8)

Shapovalov, L, and A. C. Taft, 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and Silver Salmon (*Oncorhunchus kisutch*). Sacramento: California Department of Fish and Game. Fish Bulletin No. 98.

Snider, W.M. 1983. Reconnaissance of the steelhead resource of the Carmel River drainage, Monterey County. Calif. Dept. of Fish and Game, Environmental Services Branch Administrative Rept. 83-3.

Smith, J. J. 1990. The effects of sandbar formation and inflows on aquatic habitat and fish utilization in Pescadero, San Gregorio, Waddell and Pomponie Creek estuary/lagoon systems, 1985-1989. Report prepared by San Jose State University under Interagency Agreement 84-04-324, for the California Dept. of Parks and Recreation, Sacramento, California

Stone, E C. 1971. The dynamics of vegetation change along the Carmel River. Unpublished report to Cal-Am.

Thorpe, J.E., Mangel, M., Metcalfe, N.B., Huntingford, F.A. 1998. Modeling the proximate basis of salmonid life-history variation, with application to Atlantic salmon, *Salmo salar* L. **[?]**Evolutionary Ecology 12:581-599.

Titus, R.G., D. C. Erman, and W. M. Snider. 1997. History and status of steelhead in California coastal drainages south of San Francisco Bay. Unpublished manuscript.

Viant, MR, Werner, I, Rosenblum, ES, Gantner, AS, Tjeerdema, RS, Johnson, ML. 2003. Correlation between heat-shock protein induction and reduced metabolic condition in juvenile steelhead trout (Oncorhynchus mykiss) chronically exposed to elevated temperature. Fisheries Board of Scotland, Annual Report 22 (Part 3) 29:159-171.

Werner, I, Smith, TB, Feliciano, J, Johnson, ML. 2005. Heat shock proteins in juvenile steelhead reflect thermal conditions in the Navarro River Watershed, California. Transactions of the American Fisheries Society 134:399-410.

Williams, J. G. 1983b. Legal status of Carmel Valley groundwater. Carmel River Watershed Management Plan Working Paper No. 6. Exhibit RWC-SC 3 (92).

Williams, J. G. 1983b. Habitat change in the Carmel River Basin, Carmel River Watershed Management Plan Working Paper No. 1. Exhibit RWC-SC 1 (92).

Williams, J. G. 1989. Historical changes at the Carmel River lagoon and vicinity. Philip Williams & Associates, San Francisco, Report # 509. MPWMD Exhibit 185 (92).

Williams, J. G. 2006. Central Valley Salmon: a perspective on Chinook and steelhead in the Central Valley of California. San Francisco Estuary and Watershed Science, Volume 4, Issue 3, Article 2.

Zinke, P. J. 1971. The effect of water well operation on riparian and phreatophyte vegetation in middle Carmel Valley. Unpublished report Carmel Valley Property Owners Association.

PROOF OF SERVICE

I declare as follows:

I am over 18 years of age and not a party to the within action; my business address is 875 Linden Lane, Davis, CA, I am employed in Yolo County, California.

On July 9, 2008, I served a copy of the foregoing following documents entitled

TESTIMONY OF SIERRA CLUB WITNESSES JOHN G. WILLIAMS AND MARCIN WHITMAN, AND EXHIBITS

on the parties listed in the attached Service List

[ ] BY MAIL

By following ordinary business practice, placing a true copy thereof enclosed in a sealed envelope, for collection and mailing with the United States Postal Service where it would be deposited for first class delivery, postage fully prepaid, in the US Postal Service that same day in the ordinary course of business as indicated in the attached Service List.

[X] BY ELECTRONIC MAIL

I caused a true and correct scanned image (PDF file) copy to be transmitted via the electronic mail transfer system to the email address(es) indicated in the attached Service List of Participants.

I certify under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration was executed on July 9, 2008, at Davis, California.

____

John G Williams

JUNE 19, 2008 HEARING
SERVICE LIST OF PARTICIPANTS

Service By Electronic Mail

Jon D. Rubin
Jonathan R. Marz
Diepenbrock Harrison
400 Capitol Mall, Suite `1800
Sacramento, CA 95814-4413
jrubin@diepenbrock.com

State Water Resource Control Board
Reed Sato
Water Rights Prosecution Team
1001 I Street
Sacramento, CA 95814
rsato@waterboards.ca.gov

Public Trust Alliance
Michael Warburton
Resource Renewal Institute, Room 290, Building D
Fort Mason Center
San Francisco, CA 94123
Michael@rri.org

Carmel River Steelhead Association
Michael B. Jackson
P.O. Box 207
Quincy, CA 95971
mjatty@sbcglobal.net

California Sportfishing Protection Alliance
Michael B. Jackson
P.O. Box 207
Quincy, CA 95971
mjatty@sbcglobal.net

City of Seaside
Russell M. McGlothlin
Brownstein, Hyatt, Farber, Schreck
21 East Carillo Street
Santa Barbara, CA 94101
RMcGlothlin@BHFS.com

The Seaside Basin Watermaster
Russell M. McGlothlin
Brownstein, Hyatt, Farber, Schreck
21 East Carillo Street
Santa Barbara, CA 94101
RMcGlothlin@BHFS.com

Pebble Beach Company
Thomas H. Jamison
Fenton & Keller
P. O. Box 791
Monterey, CA 93942-0791
TJamison@FentonKeller.com

National Marine Fisheries Service
Christopher Keifer
501 W. Ocean Blvd., Suite 4470
Long Beach, CA 90802
Christopher.keifer@noaa.gov

Monterey County Hospitality Association
Bob McKenzie
P. O. Box 223542
Carmel, CA 93922
bobmck@mbay.net

California Salmon and Steelhead Association
Bob Baiocchi
P. O. Box 1790

Planning and Conservation League
Jonas Minton
1107 9th Street, Suite 360
Sacramento, CA 95814

Graeagle, CA 96103
rbaiocchi@gotsky.com

jminton@pcl.org

Monterey Peninsula Water Management District
David C. Laredo
De Lay & Laredo
606 Forest Avenue
Pacific Grove, CA 93950
dave@laredolaw.net

City of Sand City
James G. Heisinger, Jr.
Heisinger, Buck & Morris
P.O. Box 5427
Carmel, CA 93921
hbm@carmellaw.com

Division of Ratepayer Advocates
Andrew Ulmer
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102
eau@cpuc.ca.gov

City of Carmel-by-the-Sea
Donald G. Freeman
P. O. Box CC
Carmel-by-the-Sea, CA 93921
mlaughlin@ci.carmel.ca.us

Sierra Club Phase 2 Exhibits

5. Pages from Otey v. CSD trial transcript
6. Williams notes from Shapovalov conversation
7. Kondolf and Curry 1986
8. Pages from MPWMD 2008: 2005-06 mitigation report
9. Castleberry *et al*. 1996
10. Harvey *et al.* 2006
11. Boughton *et al.* 2007
12. Mangel and Satterthwaite Inpress
13. Bond 2006
14. McClure *et al*. 2008
15. Carla Bard letter to Charles Fullerton
16. Pages from Logan Report
17. Hayes *et al*. 2008
18. Williams adaptive management essay
19. B. C. Harvey abstract