

Comments on the Alameda Creek Recovery Strategy and Instream Flow Assessment for Steelhead

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7 January 2008

At the request of Kristine Atkinson, CDFG, I have looked at the recently completed report by McBain and Trush and have the following comments:

1. In general, the strategy has focused on the crucial issue for restoring steelhead in the watershed, by emphasizing the production, growth and ocean survival (based on size) of steelhead smolts and the conditions that will produce them. Raising and getting smolts out of the watershed to the Bay will be a far greater challenge than getting adults upstream in the system. That is because getting adults upstream is, to a large extent, a technical problem of removing or modifying barriers. Management of flows at those barriers or through some stream reaches may take the use of some stored water, but unimpaired runoff would allow winter access to much of the watershed in many years. However, growing the fish in summer and especially getting the smolts out in spring requires efficiently providing substantial amounts of stored water to provide the flows necessary for fish growth and downstream passage.

The remaining comments are more specific about portions of the plan or background information.

2. Smolt-to-Adult Return (2.2, 3 and elsewhere).

Smolt survival depends very much on fish size at entrance to the ocean as Bill Trush has emphasized in this report and elsewhere. I very much agree; a goal should be to produce large (and numerous) smolts. However, the exact smolt size/survival relationship probably varies substantially with the system.

A. The “smolts” from the adfluvial populations upstream of the reservoirs have been selected for migration time and sizes for short migrations into the reservoirs, where they don’t face a saltwater challenge and presumably don’t face the same predation threats as fish entering the ocean. Their migration times and sizes may not be appropriate indicators of what “steelhead” might be selected for with the substantial downstream migration and a saltwater (and striped bass) challenge upon entrance to the Bay. The trapping inefficiency (with fish able to enter and leave the traps) during the above reservoir studies also makes the available data on fish sizes, numbers and timing suspect.

B. In the Shapovalov and Taft studies on Waddell Creek the trap was 1 mile upstream of the lagoon, and the lagoon provided a healthy feeding area and brackish transition area in spring. Larger fish did return at higher as adults, but there is no way to know (from the data presented) how much the fish grew in the lagoon/estuary before entering the ocean. In the early 1990’s I found that small unsmolted fish in my migrate trap at Waddell grew substantially in the lagoon and smolt coloration developed. Scales of returning adults showed that many relatively small fish at last freshwater annulus grew large increments in spring (presumably in the lagoon) and entered the ocean at relatively large size.

C. At Scott Creek (location of the Bond (2006) thesis) small smolts from the upper watershed contributed a relatively small portion to the adult run (compared to large fish reared in the lagoon) and smaller hatchery-reared fish had low survival to adulthood. However, the lagoon/estuary at Scott Creek normally is shallow and stream-like (absent the sandbar), provides little or no feeding habitat in spring, and no brackish water transition zone to aid adjustment to saltwater. It provides a worst case situation for size-dependent smolt survival.

D. The San Francisco Bay salinity in spring is normally in the range of 10-20 PPT (and varies with the tidal cycle) in the South Bay at the time of late smolt entrance. How well steelhead can feed and avoid predators when they hit the Bay is unknown, but the saltwater challenge, which is a part of the size-dependent smolt survival may not be particularly harsh. Conditions may be somewhat similar to Humboldt Bay (?), where there may be data on smolt return rates.

3. Water Temperature Thresholds (2.3 5.5)

Smolting temperature thresholds. Prolonged exposure to high water temperatures can reverse the smolting process. However the temperature threshold used here may not always apply. The smolt reversal process is probably subject to substantial selection, since temperature may not be a physiological driver, but rather an environmental clue in the tradeoff between continued migration and ocean entrance versus remaining in the stream an extra year. In any case, smolts in some of the central coast streams (like the Pajaro River tributaries or Penitencia Creek as a tributary to Coyote Creek and the Bay) that have warm downstream reaches do apparently pass through stream sections that should reverse smolting or rear rather late in warming stream sections before beginning their migrations. The downstream passage through unsuitable habitat (warm, turbid) is apparently very quick, and, since it occurs primarily at night, exposure to high daytime water temperatures may be limited. The prolonged migration and growth period hypothesized for some growth strategies of Alameda Creek may turn out to be more of a “grow in place and then dash” strategy that fits the environmental conditions. This dash may limit the ultimate size of the smolts (and their survival), unless Bay entrance is relatively benign or they are able to growth substantially in the mouth of the creek. There is likely to be severe selection pressure against reversing the smolting and staying another year, since the large smolt-size fish would have high absolute food demands that would be unlikely to be met in another year in warm water; metabolic costs would be too high for survival.

Rearing Water Temperature. High water temperatures in summer/fall rearing increase the metabolic demands and potentially reduce steelhead growth and survival. If food is abundant enough, those metabolic demands can be met. In addition, digestive rate increases, so at warmer temperatures juvenile steelhead can grow faster (again if food is very abundant). In warm lagoons, some onchannel ponds, and stream areas with high summer stream flows providing fast-water feedings areas, these warmer than typical habitats can raise abundant, large steelhead. Most particularly for Alameda Creek this means that some stream habitats (including the dam population, 3.1.2. 3.2.2) may rear not just smolts, but relatively large 1+ smolts (which might have to feed very little in spring to reach sizes with high ocean return rates). There is a strong interaction between

temperature and food availability in determining whether the habitat would be suitable for growing juvenile steelhead. In Uvas Creek (Smith and Li 1983) in the 1970's and early 1980's large 1+ smolts were regularly produced in the fast-water habitats produced by the releases from the reservoir. Such production continues today, reduced by turbidity of the releases and a substantial decline in substrate quality that has reduced insect abundance in the upstream portion. At present, the largest, most numerous fish are actually further downstream where maximum temperatures are higher and stream flows decline because of the degradation of food and feeding conditions upstream (Joel Casagrande, ongoing thesis work on Uvas Creek). Similarly, the main stem of the San Lorenzo River has warm water but naturally high summer streamflow (due to convergence of tributaries and a steep gorge). Age 0+ steelhead regularly grow to smolt size in the first year, and most of the smolts in the watershed are actually produced in the warm mainstem habitats in most years (studies by Don Alley on the San Lorenzo since 1995). In the 1970's and 1980's I also found that resident rainbow trout were present in the fast-water habitats of Niles Canyon, despite the warm water; fast-water habitats (heads of pools, riffles, runs) were providing enough food for them to survive and also growth fast. Food would be too scarce for survival in the pools themselves (where there would also be intense competition with pikeminnow and possibly even with omnivorous hitch).

The mainstem (3.1.3, 3.2.3) recovery strategy would allow migrating smolts to grow in spring (when temperatures were cooler), but if flows were low and warm in late spring summer smolting would reverse for smolts and juvenile or smolt steelhead would starve in the absence of fast-water habitat with abundant drifting insects.

Some warm onchannel ponds can provide summer rearing for steelhead, but this wouldn't be possible if warm-water fish were present. The Niles Cone recovery (3.1.4, 3.2.4, 4.4.1, 5.4.1.1) strategy would apply only to spring migrants. Warmwater fishes including pikeminnow would probably prevent steelhead survival in warm, slackwater conditions in summer.

One aspect of temperature affects (4.2.2.2) is the relationship between mean and maximum temperature. On Uvas Creek the means in summer increase for some distance downstream as the hypolimnion releases are warmed in the sun. However, further downstream the means don't increase further; the maximums go up, but the means actually stay the same since the declining flows (due to percolation) allow greater cooling at night. The high flows down through Niles Canyon probably don't produce as much day-night fluctuation as for small streams.

4. Water Quality (2.4, 3.1.1)

Turbidity in spring is recognized in the report as a major constraint on smolt success, since it would reduce feeding efficiency and smolt spring growth. Stored reservoir water is planned to be used to provide for passage in spring. However, a major problem with spring releases from local reservoirs is that the reservoirs fill with, and store, turbid runoff in winter and early spring. While the streams entering them clear between and after storms, the releases from the reservoirs continue to release the stored turbid water,

as the fine clay settles very slowly. Uvas, Lexington and other reservoirs in Santa Clara County frequently do not produce relatively clear releases until late April or May. The clay settles as the surface water warms and phytoplankton increases. The organic matter breaks up the charges on the clay, clearing the water so more phytoplankton grow, precipitating more clay; much of the spring the releases will be turbid, but then clear relatively rapidly. Fish that migrate early may have a better chance of getting out of the system, but may have limited growth opportunities because of the turbidity. Fish that migrate during the later, clearer conditions may face warm water challenges. (5.6.1) Data should be gathered on the turbidity levels of the reservoirs, so that turbidity conditions of the reservoirs can be factored into the plans for flow management.

5. Chain of Lakes (4.3.2.1)

If the chain of lakes on Arroyo del Valle is a series of onchannel ponds one of the major issues will be that the surface flow out of the lakes will be much warmer than the stream inflow into the ponds, severely warming and reducing the habitat quality. A similar situation applies in Santa Clara County on the Ogier Ponds on Coyote Creek, where cool reservoir releases potentially support steelhead rearing, but downstream of the onchannel ponds temperatures are too warm for much steelhead rearing. Ogier ponds may be taken offchannel (the original condition) in the future to provide a much greater length of habitat with usable temperatures.

6. Thermal stratification in pools (4.3.2.2, 5.5.1.5)

I have only found thermal stratification under very low flow or backwater conditions. Usually any substantial stream flow tends to mix the water column of streams. In Niles Canyon and upstream, I doubt that “cold pools” are a significant factor. In the ponds above the rubber dams bottom waters will be cooler, but the the steelhead will probably do poorly in the presence of abundant warmwater fish (see 3, above).

7. Habigraphs and habitat profiles (4.3.2.3, 4.3.2.4, 5.1.1.1)

(See 3 above) There is a strong interaction between temperature and food availability (as fast-water feeding habitat) in determining how good the habitat will be. This will also differ for different age (size) groups because of the higher absolute food demands of bigger fish. Higher flows not only result in slower warming downstream of the release points, but also provide the fast-water habitat allowing growth and survival at higher temperatures.

(5.1.1.1) For habitat typing on Uvas Creek we added a new category that was crucial to understanding ecology for steelhead there—Head of Pool. This was defined as the fast-water feeding area (>0.5 ft / sec) at the head of a pool. Juvenile steelhead were concentrated in deeper riffles, runs and especially at the heads of pools. The remainder of the pool had few or no steelhead. Unlike the traditional riffle, run, glide, pool (where typing results are supposed to be relatively independent of flow), the amount of this habitat is not fixed but varies with flow (ie. at 2 cfs the “head of pool” of a large (50-100 ft) pool might only average 4 feet long, but at 15 cfs the “head of pool” might be 25 feet long and provide feeding areas for a large number of steelhead.)

8. Predator populations in backwater pools (5.4.1.2)

Another major potential predator above the rubber dams is pikeminnow. They are abundant in Niles Canyon. Observations in Llagas Creek and Uvas Creek in Santa Clara County show that they can migrate up and down in the streams to take advantage of food resources.

9. Steelhead Adult Migration times (2, 5.9.1.1)

Adult steelhead in this area generally don't migrate in substantial numbers until January, presumably because the first large rains come later the further south you go in California. Younger males may enter in late December. Providing flows for steelhead passage in December would probably not provide much benefit for steelhead migration. The timing for Chinook salmon versus steelhead adult migration is therefore substantially different. This means that efforts to provide flows for adult passage for fall-run Chinook (which are of central valley origin, and thus attempt to migrate into local streams before winter storms) will provide little benefit for steelhead. Providing flow for both, with limited water available for restoration, may seriously affect adult passage for the native steelhead.