

EFFECTS OF OPERATION OF PACHECO RESERVOIR ON STEELHEAD

Jerry Smith
Dept. Biological Sciences
San Jose State University
San Jose, CA 95192
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Existing Conditions (based upon Smith 1982 and 2007)

Summer stream flow in most of Pacheco Creek comes from releases from North Fork Pacheco Reservoir, which is operated by the Pacheco Water District to supply agricultural irrigation water through streambed percolation. Significant releases from the reservoir normally don't begin until demand for water increases in late May or early June, so flows are often low and water temperatures high in late spring prior to the commencement of reservoir releases. Paradoxically, this is more likely to be true in relatively wet years, when early demands for flows for agricultural use are less.

Adult steelhead access through Miller Canal and the lower portion of Pacheco Creek is restricted in dry years. In addition, the lowermost reach of Pacheco Creek has a wide channel and was likely to block smolt out-migration by April or May of all but the very wettest years through the late 1980's. However, rising ground water levels have converted the lower reach of Pacheco Creek into a perennial stream except in drought years. In very dry years smolts are likely to successfully emigrate only during winter, but in wetter years emigration is now possible through May. Lack of late spring releases from North Fork Pacheco Reservoir are now more likely to restrict emigration than are conditions in the lowermost reach of the creek.

Rearing habitat in Pacheco Creek is almost completely dependent upon releases from North Fork Pacheco Reservoir. The stream is generally sparsely shaded and percolation rates are high, so stream flows decrease and temperatures increase rapidly downstream. Even with good summer reservoir releases, conditions are rarely suitable for significant juvenile steelhead rearing much further downstream than the CDF fire station. Rearing steelhead are all associated with fast-water feeding habitat (riffles, runs and heads of pools), and fish density increases upstream where flows are higher and temperatures lower. However, as for Uvas Creek, those steelhead that do successfully rear in the fast-water habitats grow rapidly and reach smolt size by the end of their first summer. In many years in late spring, prior to reservoir releases for agriculture, low stream flows and high water temperatures severely impact steelhead fry and small juveniles. Later in summer the higher releases provide good potential rearing conditions, but many of the steelhead will have been already eliminated or reduced by the restricted, warm, earlier releases.

How Steelhead Could be Increased by Altering Flow Release Pattern

North Fork Pacheco Reservoir is relatively small (6000 AF capacity) and occupies a relatively dry (but large) watershed. The reservoir may not fill completely in dry years, and even in wet years there is usually no additional inflow to the reservoir by early to mid summer. In winter, even without reservoir spilling or releases from the reservoir, stream flow is usually provided by runoff in the South and East Fork watersheds and from Cedar Creek, a downstream north bank tributary. Therefore, how the stored reservoir water is released directly affects steelhead in Pacheco Creek primarily during spring out-migration (April and May) and spring through fall rearing (May through the first substantial rains in November or December).

Spring Outmigration

In spring of years that follow years when steelhead rearing occurred, steelhead smolts (almost all yearling aged fish in Pacheco Creek) migrate to the ocean. Some larger fish may migrate in late winter or very early spring (February through March) when stream flow from the South Fork of Pacheco Creek is still high. However, some larger smolts and most of the smaller smolts probably don't migrate until late March or April, after achieving some (potentially substantial) spring growth. By April and May stream flow may have declined sufficiently to make passage over shallow riffles difficult or passage impossible because of dry sections of stream upstream of Highway 156. In recent years perennial flow has usually been present downstream of Highway 156.

Potential Action. If the reservoir were operated in a manner to increase steelhead in Pacheco Creek, a portion of its stored water would be released in at least April to aid in steelhead passage. The amount of this release would have to be weighed against any loss of this water for local streambed percolation (because providing steelhead passage requires maintaining flow to a confined layer where all or a portion of the flow would leave the ground water basin and be lost from ground water storage). Spring releases would also have to be weighed against the potential use of the water for late spring through early winter steelhead rearing.

A set of guidelines could be developed for when and how much water would be released to aid smolt out-migration. The efficiency of water use for this purpose might be improved by the use of periodic "pulse" flows, rather than by maintaining continuous high flows during the period. The amount of water available for April and also for spring through fall releases would generally be well-known by 1 April, as relatively little additional runoff to the reservoir occurs after that date in most years.

Spring through early Winter Rearing

Most of the remaining amount of stored water would be apportioned among releases from May through December to provide rearing habitat that would be available until the winter rains. High releases in summer that drained the reservoir by early fall would result in good summer steelhead rearing, but also a cutoff in stream flow in fall that would dry

up most of the stream and kill most of the steelhead that were reared. Whatever the releases at the reservoir, the quality of rearing habitat would decline downstream as flow was lost to stream bed percolation and as water temperatures increased in the generally unshaded stream. In the past suitable rearing seldom extended further than the CDF fire station, even in wet years. Rearing quality would also potentially decline in late summer and fall as the cool water at the bottom of the reservoir was depleted and reservoir releases warmed. These warmer releases would have less adverse effect if delayed until September, when day length was shorter and afternoon air temperatures generally cooler.

Reduced summer releases that were capable of spanning the entire rearing season would reduce the extent of wetted channel in summer and also direct most of the ground water recharge to the upstream reaches of the creek in dry years. This would potentially affect recharge or diversion downstream, where water demand occurs.

Potential Action. The releases for steelhead rearing would have to be weighed against the risk of fall/early winter release cutoffs and against the percolation need and water demand in downstream reaches. Because steelhead food demands increase with fish size and with water temperature (Smith and Li 1983), optimal releases might not be steady over the summer, but actually increase over the summer as release water temperature increased and fish grew bigger and then decline in October – December as temperatures cooled.

A set of guidelines for water releases could be developed, based upon water storage available at the end of the runoff season (1 April or 1 May).

Carryover Storage

Carryover storage in the fall in the reservoir may be a consideration, based upon two factors. First, when the reservoir is very low in fall water quality in the reservoir (due to cyanobacteria [bluegreen algae] blooms) can sometimes produce releases that are toxic to fish and to the cattle that use the creek as a water source downstream. Maintaining a minimum reservoir pool in fall may alleviate this. Second, in years when steelhead are reared in the stream, it might be desirable to save some reservoir storage to provide potential smolt out-migration flows in the following spring in case the winter and spring were dry.

Potential Action. A factor in the release guidelines might be the amount of fall storage for either water quality concerns in releases or carryover for potential spring releases for smolt passage.

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