



February 24, 2015

To: Rich Marovich
Chris Lee

Subject: Putah Creek Fish Video Project - 2014 Salmon Run



Steelhead alevin (Sac Fry) attempting to seek harbor in gravel. Gravel is too small to allow entry.



Benthic invertebrate (stonefly) hiding under rock.



Salmon attempted to dig redds near I-505 (2005). Exposed claypan and marginal gravel was not sufficient for spawning.

BACKGROUND

In the past I reported that sections of Lower Putah Creek had cobble which was 60 - 90% embedded or covered with fine sediment. *Embeddedness* is the degree to which fine sediments surround coarse substrates on the surface of a streambed. Increases in embeddedness levels decrease the space between particles and limit the available area and cover for small fish, macroinvertebrates, and periphyton. The condition is followed by a reduction in species diversity and density. My main concern was getting the appropriate benthic structure for aquatic invertebrates and small fish such as sculpin.

Due to local and/or regional mineralization, a high degree of embeddedness can result in a condition called cementation.

Embedded gravel is the current condition in many areas of Lower Putah Creek. The long-term cemented condition makes it difficult for trout and salmon to break open such areas for spawning. If spawning does occur, the eggs are typically washed away as I witnessed in 2004 near Yolo Housing (Image bottom left). Actions taken prior to the 2014 salmon run in Lower Putah Creek scarified several planned study areas immediately below the Putah Diversion Dam. The action was successful and facilitated at least 20 pairs of salmon to spawn in the newly scarified areas.

REPORT

Between November 30, 2014 and December 10, 2014, I walked the section of Lower Putah Creek from the Putah Diversion Dam (PDD) to Scarification Site 6 every day looking for spawning salmon. On some days, I walked that area 5-7 times due to the servicing requirements necessary for subsurface video equipment. Site 6 is the downstream limit of 2014 scarification actions. In part, my activities were due to contract obligations for the Putah Creek Fish Video Project and invertebrate monitoring. The following are observations, images captured during the spawning period, recommendations, and links for video footage available at <http://www.creekman.com/putah-salmon-2014.html>



Scarification Section No 3. Lower Putah Creek



Magnificent male that courted females in the Scarification Control Section.



Chinooks paired on Scarification Control Section



Female Chinook resting after digging a deep redd on Scarification Section No. 5.

Estimated Number of Salmon:

Due to daily observations, notes, video footage and images captured during the salmon spawn, I kept a good fix on the number of salmon using the Scarification Section from the PDD to Scarification Site 6 (middle of Morales Property). From direct observation, I estimate the number of salmon in that section at 160+. From incidental observations in other areas (Dry Creek, Winters Parkway, Yolo Housing, Vickery property) and conversations with landowners, I think it is reasonable to claim that 30-40 salmon spawned downstream from the Morales property. Based on the above observations and information, I estimate that a total of 190-200 Chinook salmon entered Putah Creek and participated in the 2014 spawn.

Number of Redds

I cannot provide an estimate for the number of redds due to:

- Scarified sections looked like large redds
- Scarified Sections were used 100% and expanded by spawning salmon.
- Salmon continued to enter the system and use the same areas as the initial spawners.
- Both storms moved gravel in the spawning sections

OBSERVATIONS GERMANE for MANAGEMENT

Scarified Sections:

Areas planned for scarification were given numbers, measured and marked in June 2014. Invertebrate samples were collected and cementation measurements were recorded during that month. Prior to the salmon run only six sections were included in the study area. Section One remained as a control area and Section Two was essentially abandoned due to a lack of gravel. Four Sections (3 - 6) were scarified at various depths and lengths (Fowler 2014).

Important to discuss: I suggest that if scarification is approved by DFW that the majority of the process be conducted 30 days prior to the expected arrival of salmon.

Depth of Redds

It appeared that after the scarified sections were 100% utilized by spawning salmon, new arrivals started digging redds in areas that were not scarified in 2014. In some sites, the salmon expanded the margins of the sections that were scarified. It also appeared that the depth and "quality" of the redds was greater in the scarified sections. I believe that was due to the depth of scarified gravels and "redd molding" accomplished by female salmon.



Female Chinook on shallow redd located in the Scarification Control Section Number 1.



Female Chinook above shallow redd on Scarification Control Section Number 1. The redd was approximately 7 cm. in depth.



Male Chinook above a deep redd on Scarification Section No. 5.



Female rainbow trout above her redd near the Harris property line.

Measurement of Redds

There appeared to be a significant difference in the depth and condition of the salmon redds when comparing the scarified and non-scarification sections.

I carefully measured the depth of redds that I could reach without impact to the redds or developing eggs. I took an average of the depth of water (cm.) outside the redd and the depth at the deepest area of selected redds. There was a distinct difference of depth between the redds in scarified sections and those in non-scarified sections.

| Approximate Depth of Redds (In scarified and non-scarified sections) | | | |
|---|--------|-----------------|--|
| Study Section | Redd # | Scarified | Depth (cm.) (inside redd minus outside) |
| 1 | 1A | Control (No) | 7 |
| | 2B | | 8 |
| | 3C | | 10 |
| 2 | | No gravel | No Redds |
| 3 | 3A | Yes | 25 |
| | 3B | | 20 |
| | 3C | | 27 |
| 4 | 4A | Yes | 30 |
| | 4B | | 31 |
| | 4C | | 41 |
| | 4D | | 37 |
| 5 | 5A | Yes | 25 |
| | 5B | | 33 |
| 6 | 6A | Yes | 26 |
| | 6B | | 44 |
| | 6C | | 40 |
| | 6D | | 32 |
| | 6E | | 25 |
| | 6F | | 28 |

Rainbow Spawning

For many years locals and anglers asked if rainbow trout spawned at the same time as the population above the Putah diversion Dam. This year we proved that LPC trout do spawn in the late fall and in the same scarification sections as the Chinooks. This occurrence should be discussed to ensure additional protection, mostly from over-zealous viewers.



Salmon redd and hiding area. Pickerel North Side Channel. 12/10/14



Salmon moving under overhanging vegetation in North Pickerel side channel. 12/10/14



Female Chinook resting in area underneath overhanging vegetation in Pickerel North Side Channel.



Paired salmon on Scarification Section No 6. Additional case showing large (normal size) male and 18 inch female

Pickerel Side Channel Use by Salmon

2013 Salmon Run: In 2013, only one female successfully spawned in the side channel.

2014 Salmon Run: In the 2014 salmon run, at least three (3) pairs of salmon spawned in the North Pickerel side channel. At least two female salmon used the overhanging vegetation for aerial cover and appeared to dig deeper into the bank to develop hiding areas. Video is available of this action.

The female on the left would rest in a section immediately below her redd and appeared to dig into the bank to enlarge her hiding site. She favored the section which had over-hanging vegetation.

VIDEO: <http://www.creekman.com/putah-salmon-2014.html>

Of particular interest is that behavior used by the fish when they moved upstream near the banks and under the overhanging vegetation. The upper canopy is rather sparse in this area.

Scarified Sections

The salmon heavily favored the sections that were scarified. That includes the pair on the left that successfully spawning in Scarified Section # 6. Note the size differential between the sexes. Male on left, female on right.

VIDEO: <http://www.creekman.com/putah-salmon-2014.html>



Salmon spawning in Scarification Section Number 6.

Salmon Spawning

Salmon spawned on every Scarified Section. This video was captured on Scarification Section 6.

Video: <http://www.creekman.com/putah-salmon-2014.html>



Salmon with larger cobble exposed by scarification.

Cobble Exposed by Scarification

The Scarification process exposed larger cobble in some areas such as at Section Number 3 (Image left). The larger cobble provides additional harbor for developing salmon, fish such as sculpin already in the creek, and larger aquatic invertebrates which can recruit from Miller Creek if sediment conditions allow their survival.

VIDEO: <http://www.creekman.com/putah-salmon-2014.html>



18 inch female Chinook at Scarification Section 3.

Small Female Chinook

Small salmon, 15 to 18 inches in length, were common in some areas of the scarified sections. Typically, these small fish are 1-2 year males. I asked Peter Moyle to look at this situation and comment on the observation that these small females were digging redds (only female action) and being courted by normal size males. Dr. Moyle witnessed this occurrence.

VIDEO: <http://www.creekman.com/putah-salmon-2014.html>



18 inch female Chinook after digging redd at Section 3.

Small Female Chinook After Digging Redd

The small females actively dug redds in the Scarified Sections of the creek.



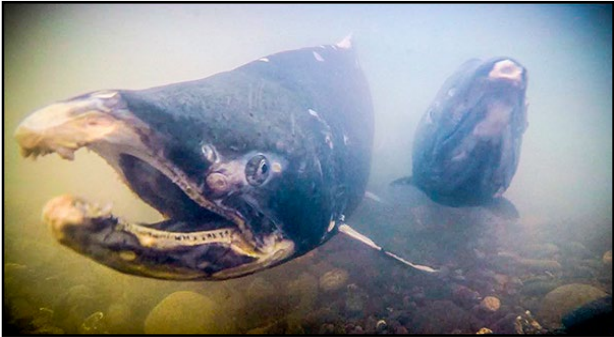
Wildlife Survey & Photo Service

2443 Fair Oaks Blvd. # 209 • Sacramento, CA 95825 • (916) 747-8537

REPORT 4963 2014 Putah Salmon Run



Gang of Seven. Beat-up, highly scarred salmon that were part of a run that came up the creek after the second storm. They settled on Scarification Section 4 on 12/ xxx/14.



Beat-up, highly scarred salmon that were part of a run that came up the creek after the second storm.



Five salmon were stranded in Mc Cune Creek. They entered the creek during the last storm event.

Submitted Via E-mail on February 24, 2015

Ken W. Davis
Aquatic Biologist / Wildlife Photojournalist
Wildlife Survey & Photo Service
2443 Fair Oaks Blvd. # 209
Sacramento, CA 95825
(916) 747-8537
ken@creekman.com
www.creekman.com

Late Salmon Run (After Second Storm)

During and after the second storm (12/22/14) two separate groups of salmon arrived in the Scarification Section (PDD to Morales). One group was represented by the very healthy looking fish stranded in Mc Cune Creek and spawners in the Pickerel Run. The second group was represented by beat-up, highly scarred fish that traveled in relatively tight groups (Image left).

No Spawning Above Pickerel Crossing

The section of the creek between the Putah Diversion Dam and the Pickerel Crossing was not used for spawning probably due to the lack of gravel. There appears to be sufficient "gravel-holding" barriers (boulders and woody debris), but a definite lack of gravel suitable for spawning. I saw no salmon or trout redds in that section.

Recommendation / Discussion

1. The Scarification action was highly successful. I encourage scarification process to continue in the Study Area and in any other areas where approved. **Important:** If scarification is approved by DFW, I suggest the process be primarily undertaken about 30 days prior to arrival of salmon.
2. Encourage the development of side channels whenever possible. The North Side Channel was used again this year by several pairs of salmon and a group of rainbow trout.
3. Suggest the coordinated planting of sedges along all side channels. Documented this year with video that salmon and trout use the overhanging vegetation as cover.
4. Encourage the use of alders whenever possible as over-stream vegetation and bank protection.
5. Suggest that The Putah Fish Video Project continue as footage captured in the last two years has documented the presence of juvenile salmon in May 2012, the presence of adult salmon in 2013, and numerous successes in 2014 including documenting the use of salmon using side channels, spawning in all scarification sections, trout spawning in scarification sections and the side channels.
6. If ever possible, I suggest the addition of spawning gravel immediately below the Putah Diversion Dam.

END