EXHIBIT 7

TO ATTACHMENT NO. 1
TO PETITION FOR TEMPORARY URGENCY CHANGE
PERMIT NO. 2452
HELD BY MONTAGUE WATER CONSERVATION DISTRICT

The Nature Conservancy
Protecting nature. Preserving life.™

Memorandum

Date: 08/06/2013

Monitoring of pulse flows contributed to the Shasta River- April 2013
Prepared by: Amy Campbell, Chris Babcock, Ada Fowler

Introduction

In April 2013, The Nature Conservancy (TNC) partnered with the Montague Water Conservation District (MWCD) ("District") to release approximately 100 ac-ft of stored water from Dwinnell Reservoir. The purpose of this release was to assist with out-migrating juvenile salmonids past low flow and potential natural fish barriers in the Upper Shasta River. Specific salmonids targeted for this release include coho, Fall Chinook and steelhead. This release of stored water was coordinated with the California Department of Fish and Wildlife (CDFW), National Oceanic Atmospheric (NOAA) Administration, the Scott-Shasta Watermaster District, and the Shasta Valley Resource Conservation District (RCD). The funding to support this transaction was funded in part by TNC, NOAA and the National Fish and Wildlife Foundation (NFWF).

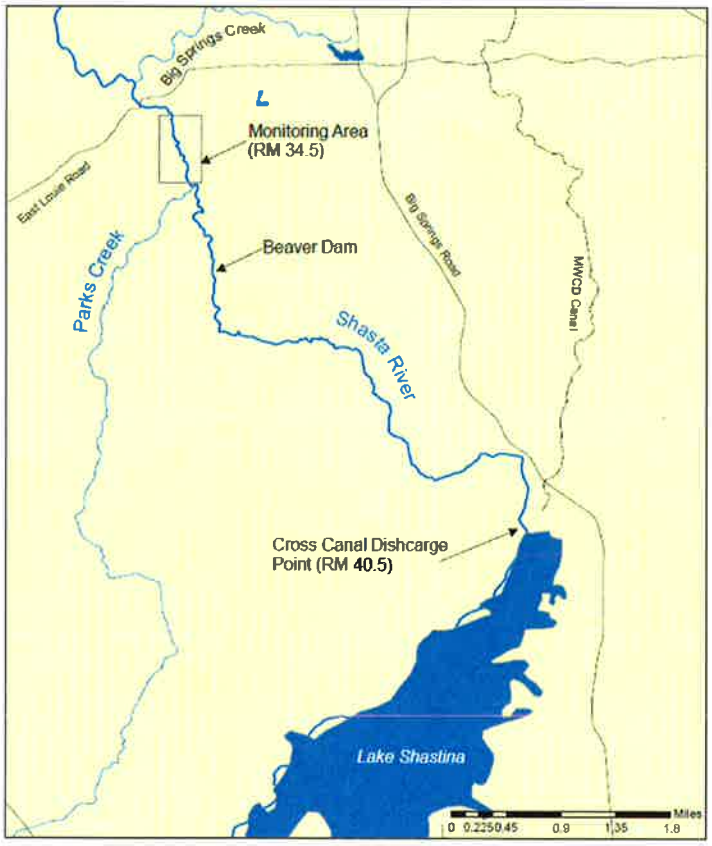

Figure 1: Location of April 2013 Pulse Flow in the Upper Shasta River

Approximately 100 ac-ft of water was released from Dwinnell Reservoir (Lake Shastina) during a 3 day period. This event is referred to in this document as a "pulse flow". The pulse flow release began on April 9th and was completed on April 12th. At its peak a total of 21.4 cubic feet per second of water was released into the mainstem Upper Shasta River via the District's cross canal (see Figure 1). The pulse

flow was timed to occur during April's new moon since it is believed that juvenile salmonids tend to move and relocate under the cover of darkness[1].

Low flows in this upper reach of the Shasta River are problematic to outmigrating juvenile salmon that use this reach of the Shasta River for overwinter rearing habitat. Natural hydrologic flows in this stretch of river (river mile 36 to 45) decrease beginning in March and occur through May due to the start of the irrigation season (March 1st). This reach of river is also isolated from the beneficial spring snow melt events in the Upper Shasta River due to the location of the upstream reservoir. In addition, natural barriers such as a beaver dam located below river mile 36 limits passage of outmigrating salmonids.

This technical memorandum summarizes data collected during this pulse flow event downstream on the Shasta River on property owned by The Nature Conservancy (see Figure 1). The monitoring area is located at approximately river mile 34.5 on the Shasta River. Flows were discharged from the reservoir at approximately river mile 40.5. Several agricultural diversions are located on the Shasta River upstream from this monitoring location. The area monitored is also located downstream from the confluence of Parks Creek.

In an effort to document changes to instream habitat as a result of this pulse flow event, TNC monitored discharge (flow), temperature and aquatic habitat. Fish response monitoring was conducted by the CA Department of Fish and Wildlife. A summary of the Department's findings is included below with a more detailed report located in Appendix A.

Discharge Monitoring

This effort monitored stream discharge (flow) in several locations within the project area (Figure 1). The Montague Water Conservation District owns and operates a gauge located at the District's cross canal. This is the canal used to discharge flows from the reservoir. In addition, TNC collected periodic flow measurements on the Shasta River and Parks Creek throughout the duration of the pulse flow event and installed a pressure transducer in the Shasta River within the monitoring area. Figure 2 below shows the flows measured during the pulse flow event in the monitoring area.

As shown in Figure 1, the monitoring area for this pulse flow event was located downstream from the confluence of the Shasta River and Parks Creek. Fortunately, throughout the duration of the pulse flow period, Parks Creek flows remained fairly consistent (Figure 2). In addition, agricultural water diversions located upstream from the monitoring area on the Upper Shasta River did not change significantly during the pulse flow period[2] which implies that any change to flow measured in the monitoring area were a result of the flows discharged from the reservoir.

[1] Chesney, Bill, pers.com. Bill Chesney, CA Department of Fish and Wildlife, March 2013.
[2] Beck, Tim. Pers.com. Shasta River Watermaster April 2013.

Prior to the pulse flow event, flows in the monitoring area were around +/- 33 cubic feet per second (cfs) and increased to +/- 54 cfs during the pulse flow event. This increase of +/-20 cfs of water within the monitoring area corresponds to the amount of water released from the reservoir via the District's cross canal (Figure 2). This increase of flows by +/- 20 cfs falls within the range of flows recommended for the Upper Shasta River above Parks Creek in the *Shasta River Big Springs Complex Interim Instream Flow Needs Assessment*[3].

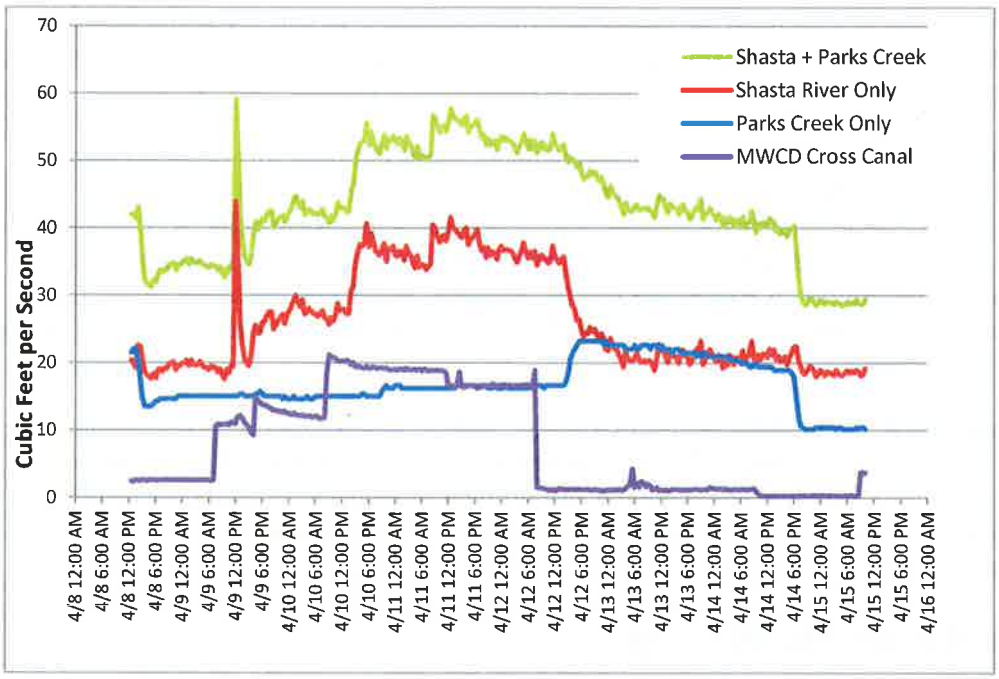

Figure 2: Discharge during April Pulse Flow Event.

It took approximately 8 hours for the water that was discharged from the reservoir (RM 40.5) to travel into the monitoring reach (RM 34.5). Upon termination of the pulse flow it appears that transit time increased to 10 hours. The increase in transit time is likely due to the reduction of water volume instream at the time. When the pulse flow event began, river volumes increased which resulted in increased river velocities. When the pulse flow event was terminated, less water was instream and therefore it took the water longer to reach the monitoring area.

Aquatic Habitat Monitoring

TNC used the *Draft Instream Flow Field Monitoring Protocols* [4] to monitor for changes in aquatic habitat. A total of 11 cross sections were installed along a 420 foot section of the Shasta River (Figure 3). Wetted width, wetted cross sectional area, mean depth and

[3] McBain and Trush, Inc., *Shasta River Big Springs Complex Interim Instream Flow Needs Assessment,* February 2013.
[4] National Fish and Wildlife Foundation, *Draft Instream Flow Field Monitoring Protocols,* Draft 2011,

depth to width ratios were calculated based on these measurements (see Figure 4 and Table 1).

Figure 3: Study area and monitoring locations during the pulse flow event on the Shasta Big Springs Ranch in April 2013.

Table 1: Changes to aquatic area, width and depth as a result of pulse flow contributions.

	4/8/2013	4/10/2013	4/11/2013	4/15/2013	% change
Cross Sectional Wetted Area (m^2)	2.05	2.76	3.15	2.04	53.7%
Wetted Width (m)	9.74	10.35	10.33	9.72	6%
Mean Depth (m)	0.21	0.27	0.3	0.21	42.9%
Width:Depth Ratio (m)	46.36	38.76	33.92	46.39	
Shasta/Parks (CFS)	37.12	44.28	54.32	30.38	

The greatest change that occurred to instream habitat as a result of this pulse flow was to wetted area and mean depth of the river channel. The addition of +/-20 cfs of water to the Upper Shasta River increased river cross sectional wetted area by 53.7% and mean river depth by 42.9%.

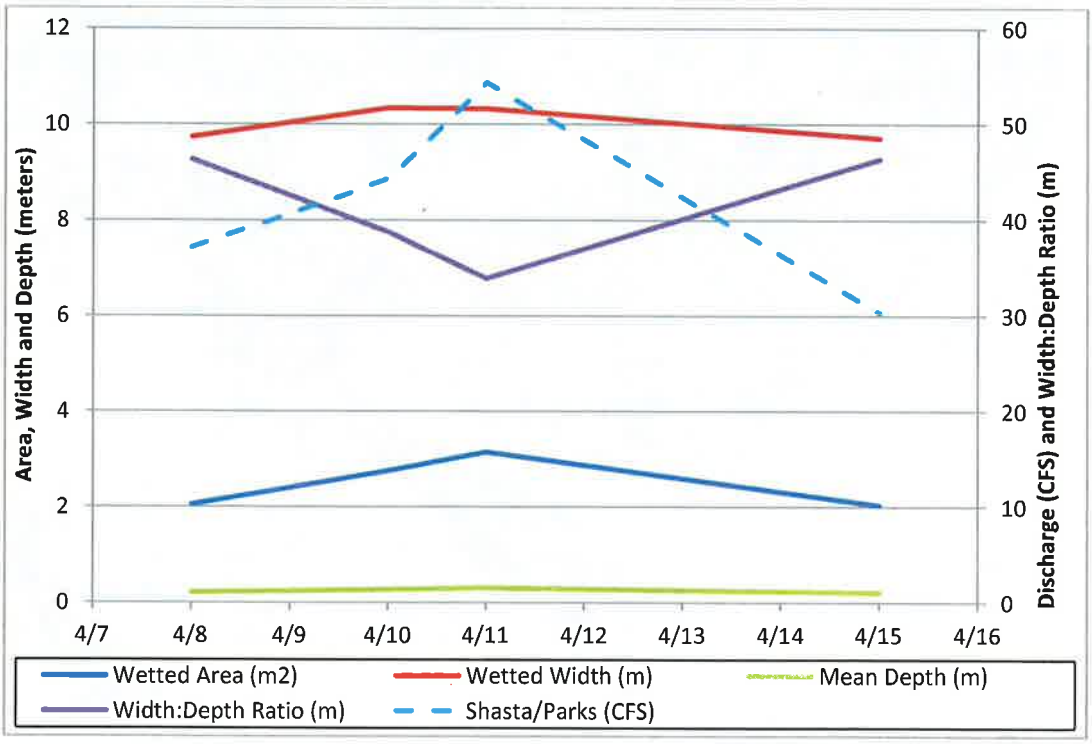

Figure 4: Changes to aquatic area, width, and depth as a result of pulse flow contributions to the Shasta River.

The changes to wetted area, depth, wetted width and the width/depth ratio are all reflections of increased flow provided instream. As discharge at a specific cross section increases, then velocity increases; and depth increases faster than the width which results in a decrease of the width to depth ratio.

Temperature Monitoring

Temperature monitoring occurred on the Shasta River, upstream of its confluence with Parks Creek, in Parks Creek and at the downstream extent of the monitoring area (see Figure 3 for monitoring locations). The graph below shows the data collected (Figure 5).

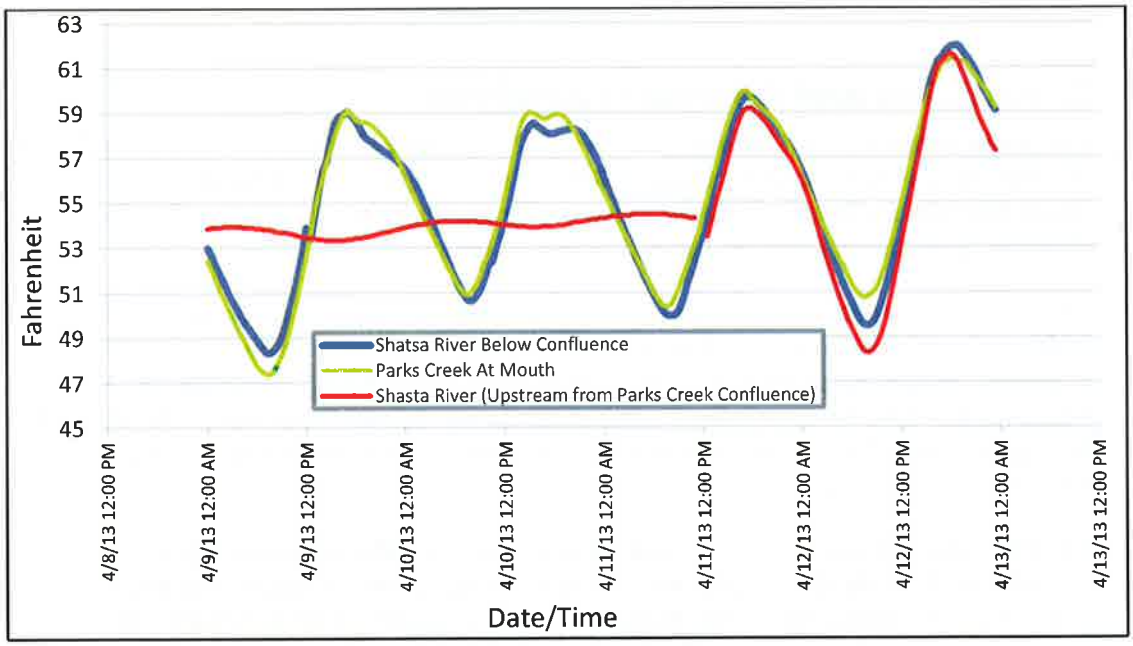

Figure 5: Changes to instream temperatures during the pulse flow event, April 2013.

Temperatures within the study reach did not appear to change during the pulse flow event. The muted temperatures observed in the Shasta River Upstream from the Parks Creek confluence were due to the temperature probe being buried in sediment during a portion of the study period. Once the probe was unburied temperatures in the Upper Shasta follow trends of temperatures in both Parks Creek and the Shasta River below the confluence. Temperatures in the project area appear to peak between 4:30 pm and 6:00 pm. Temperatures are at their lowest around 6:30 am to 7:00 am.

Data provided by the Montague Water Conservation District showed that the temperature of the water discharged from the reservoir during the flow event ranged from 52.3 and 52.9 degrees F.

Fish Response

The California Department of Fish and Wildlife (Department) has partnered with TNC to monitor fish response to pulse flow events. In previous years the Department had monitored fish response during pulse flow events in April and May of 2012. The report included in Appendix A describes the results of previous years pulse flow events.

The attached report states that due to the limited number of tagged coho in the system at the time of this April 2013 pulse flow event, no PIT tag detections were made and the Department was unable to evaluate the effects of the event[5].

Conclusion and Recommendations

The information collected during April's Pulse Flow event documented that releases from Dwinnell Reservoir took approximately 8 hours to reach the monitoring area on the Shasta Big Springs Ranch. Once the event was completed changes to river flows were not observed in the project area for approximately 10 hours.

While there were documented changes to aquatic habitat observed in the project site due to this pulse flow event it is unclear as to whether the added flow from the reservoir improved passage for juvenile fish out of the Upper Shasta River. In the future, whenever possible, we recommend conducting aquatic habitat monitoring at locations in the Upper Shasta River where fish passage is limiting so to assess adequacy of the flow releases.

The data collected during April's Pulse Flow event was collected 6 rivermiles downstream from the discharge point. Fortunately upstream diversions remained relatively stable during the monitoring period which resulted in fairly reliable data. However, in order to insure that the data collected is truly representative of future releases from the reservoir it is important that the monitoring area is located as close as possible to the discharge point.

Relating fish response specifically to this April 2013 pulse flow event was impossible due to the fact that no juvenile coho were tagged in this area prior to the event[6]. However in talking with Chris Adams of the Department of Fish and Game who is coordinating the Departments PIT tag program, over 50 coho have been tagged in the Upper Shasta River to date. Assuming that these fish remain in the Upper Shasta River over the winter these fish may be detected in any pulse flow events coordinated next spring[7].

Furthermore the fish response monitoring that has been done in previous years and fish response data collected during a pulse flow event that occurred in May 2013 did suggest

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[5] Adams, Chris, *Summary of Juvenile Coho Response to Dwinnell Dam Pulse Flow Release,* Department of Fish and Wildlife April 2013.

[6] Ibid.

[7] Pers.com. Chris Adams, Department of Fish and Wildlife, email on August 5, 2013.

that pulse flow releases from Dwinnell Reservoir seemed to trigger the movement of fish out of the upper system.[8] Through sample size was small; the pulse flow may also enable coho to move into the upper system and closer to cold water spring sources.

Appendix A:

- *Fish movement information relative to Shasta River Pulse Flow May 9-11, 2013*
- *Summary of Juvenile Coho Response to Dwinnell Dam Pulse Flow Releases*

[8] Adams, Chris, *Fish movement information relative to Shasta River Pulse Flow, May 9-11, 2013.*

Summary of Juvenile Coho Response to Dwinnell Dam Spring Pulse Flow Release

Prepared by Chris Adams, cadams@wildlife.ca.gov 4/25/2013
California Department of Fish and Wildlife

Summary

Pulse flows from Dwinnell Dam were implemented by Montague Water Conservation District in the spring in 2011, 2012, and 2013 to improve conditions for migrating fish in the reach between Dwinnell Dam and Parks Creek. Data collected pursuant to the flow releases in 2011 and 2012 suggest that those pulse flows were beneficial to facilitating juvenile fish movement. In 2013, there were very few tagged juvenile coho salmon in the upper Shasta River and no data was obtained to evaluate the effectiveness of the 2013 pulse flow. It is important that continued monitoring of any future pulse flows is conducted to ensure that timing and volume of water releases are adequate to create conditions that facilitate fish movement.

Overview of juvenile coho movement

The reach of the Shasta River from Parks Creek upstream to Dwinnell Dam provides rearing habitat for juvenile coho salmon throughout the year. Based on detections of individually PIT tagged fish, age-0 coho move upstream into this reach in the late spring and early summer. The specific timing of these upstream migrations likely coincides with rising stream temperatures and therefore may vary from year to year. Springs emerging in this reach provide cold water habitat that these fish use throughout the summer. This reach also contains low velocity pools and complex woody structure (some associated with beaver activity) which provide favorable physical habitat. Additional coho move into the reach during the fall to rear through the winter. Coho outmigrate from this reach as age-1 smolts during their second spring. This downstream migration begins in late March, peaks in mid-April, and continues through May. Conditions may be unfavorable during this time period as a result of irrigation withdraws and tailwater return (low flow and increased temperatures). Pulse flows from Dwinnell Dam in the spring may improve stream conditions and increase survival for both age 0 coho moving in, and age 1 coho moving out of this important reach of the Shasta River. PIT tagging studies have provided some key information on fish movements and suggest improvements in survival in years with pulse flows. However, the majority of fish utilizing this habitat are not tagged, and benefits to those individuals are not as easily measured.

Data collection summarized by Brood Year

The following sections briefly summarize the data that was collected on juvenile coho salmon in the reach between Parks Creek and Dwinnell Dam for each brood year since PIT tagging studies began.

Brood Year 2007 Coho (Approximately 250 returning adults)

In 2008 CDFW conducted surveys of the Shasta River above Parks Creek and identified age-0 coho rearing in the reach below Clear Spring. A sample of these fish was PIT tagged, and antenna stations were installed at RKM 58 and 59 (Figure 1). Coho tagged lower in the Shasta River (RKM 51 and 53) were detected at these stations, indicating that individuals had migrated up to eight kilometers upstream to rear in this reach. Individuals reared successfully throughout the summer in this reach, and additional coho moved into this reach in the fall of 2008. In the spring of 2009, brood year 2007 coho outmigrated from this reach as age-1 smolts. Based on detection of PIT tagged individuals at RKM 59, 58, and 56, survival rates were low (approximately 60%) during the outmigration period. Though the exact cause of mortality is not known, it was likely attributable to decreased flows and increased stream temperatures associated with the start of irrigation season. The migration of PIT tagged coho smolts successfully moving out of the reach above Parks Creek began in mid-March, peaked in mid-April, and ceased on April 21 2009, based on their detection at RKM 56 (Figure 2). No spring pulse flow was implemented in of 2009.

Brood year 2008 and 2009 (Approximately 30 and 9 returning adults)

With very few adult coho during these years, study of juveniles in the upper Shasta River was not possible. No spring pulse flows occurred during the spring of 2009 or 2010.

Brood year 2010 (Approximately 44 returning adults)

Access to the reach between Parks Creek and Clear Springs was limited in 2011 and 2012, and PIT tag detection stations were not in place at RKM 58 and 59. However, the detection station was in place at

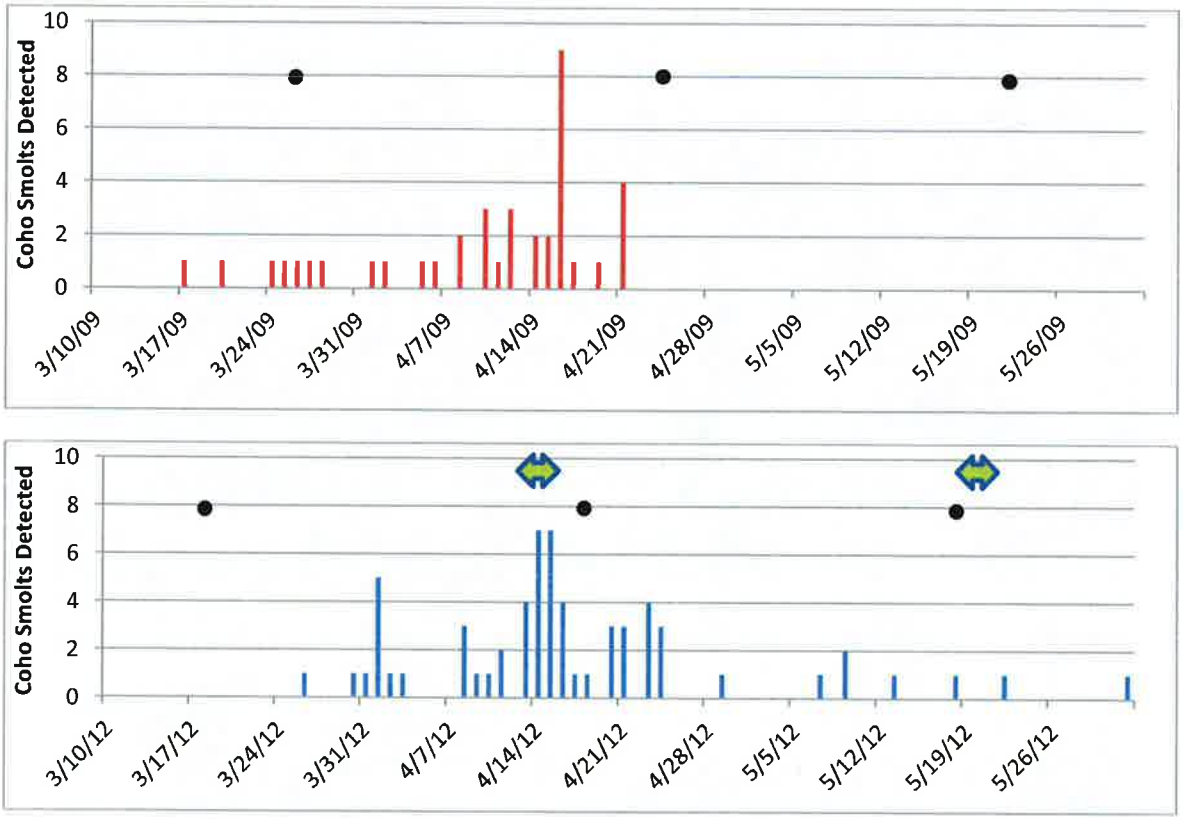
RKM 56, and age-0 coho were again detected moving upstream into the reach above Parks Creek in May and June of 2011. An additional antenna station was installed at RKM 60, and juvenile coho were also detected moving upstream beyond that point in 2011. Additional coho again moved into this reach in the fall of 2011. Based on findings from the brood year 2008 study, pulse flows from Dwinnell Dam were recommended and implemented to improve conditions for outmigrating smolts. These occurred on April 13 and May 21, 2012. Outmigration timing of these coho as age-1 smolts began in late March, peaked in mid-April, and continued through May (Figure 2). The peak coincided with the first pulse flow, and individuals continued to outmigrate during and after the second pulse floe (Figure 2). Nearly 100% of the PIT tagged coho known to be rearing in the Shasta River above Parks Creek successfully outmigrated from this reach in the spring of 2012.

Brood year 2011 (Approximately 62 returning adults)

Access was again limited to the reach between Parks Creek and Clear Spring. Very few age-0 coho were PIT tagged in the upper Shasta River, and only in Big Springs Creek, where individuals remained throughout the summer of 2012. A few of these fish were detected moving above Parks Creek in the fall of 2012, but have not yet been detected moving out as age-1 smolts. Age-0 coho were observed in the reach near Clear Spring in the summer of 2012, though none were PIT tagged. A pulse flow occurred from April 10 to 12, 2013, to improve conditions for coho smolts outmigrating from this reach. With so few tagged coho in the system, no PIT tag detections were made and we were unable to evaluate the effects of the pulse flow.

Figure 1. Map of sampling locations in the Upper Shasta River -Big Springs Creek Complex.

Figure 2. Coho smolts detected at RKM 56 (just above Parks Creek) as they outmigrated from winter rearing areas in 2009 (above) and 2012 (below). No pulse flows from Dwinnell Dam were implemented in 2009. In 2012, two pulse flows occurred. Green arrow indicates pulse flows from Dwinnell Dam. Black points indicate dates when a new moon occurred.



Fish Movement Information Relative to Shasta River Pulse Flow

May 9-11, 2013

California Department of Fish and Wildlife

Background

On May 9-10, 2013, Montague Water Conservation District provided increased instream flows in the upper Shasta River by releasing additional water from Dwinnell Dam. The release took place over two night period, coinciding with the occurrence of the new moon. Flows were ramped up to approximately 20 cfs on Thursday evening and held steady overnight. On Friday morning, flows were ramped down to approximately 14 cfs during the day. On Friday evening flows were again ramped up to approximately 20 cfs, and continued overnight. Flows returned to pre-pulse levels on Saturday, May 11 (Figure 1). Flows in the lower Shasta River were also elevated during this time as a result of precipitation, and likely provided better conditions for downstream migration as well.

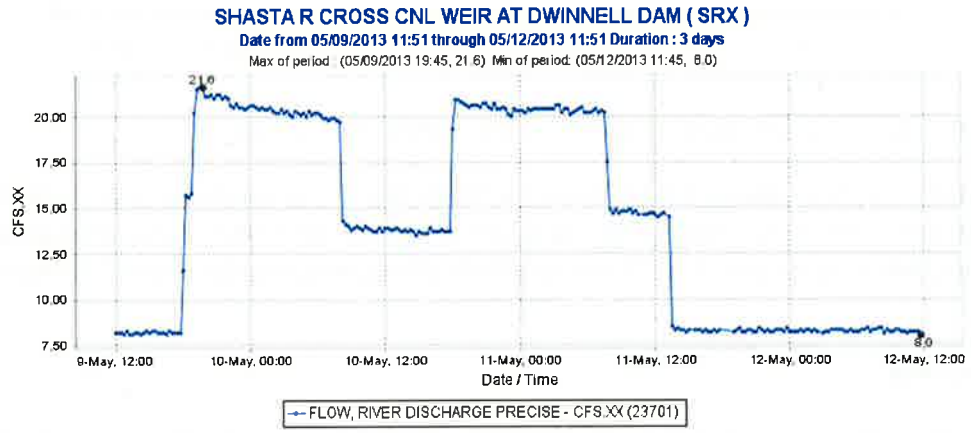


Figure 1. Flows measured at the MWCD cross-canal weir during the May 9-11 pulse flow period.

At the time of the increased flows, 36 age-0 Chinook and six age-0 coho salmon were PIT tagged in the upper Shasta River (above Parks Creek). In addition, approximately 50 age-0 coho had been tagged near the Shasta River/Big Springs confluence. PIT tag detection arrays and temperature recorders were in place at several locations. A snorkel survey also took place on 5/7/13 at several locations in the Shasta River above Parks Creek, prior to the flow increase.

Results

PIT Tag detections

On 5/7/13, just prior to the pulse flow, 36 Chinook salmon were PIT tagged at Shasta RKM 7 (approximately 1 kilometer upstream of Parks Creek). Nineteen of those individuals were detected as they migrated downstream from 5/9/13 to 5/13/13, coinciding with the pulse flow release (Figure 2). The graph below shows the downstream migration timing, based on detections of tagged Chinook.

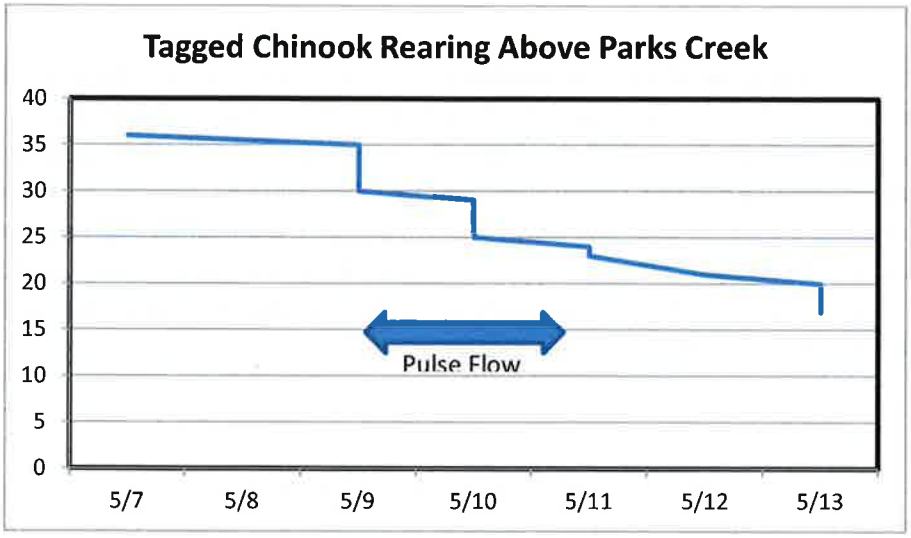


Figure 2. PIT tagged Chinook rearing in the Shasta River above Parks Creek.

Approximately 50 age-0 coho were tagged near the Shasta/Big Springs confluence prior to the May pulse flow. One of these was detected moving upstream into the reach above Parks Creek on 5/12/13, immediately following the pulse flow. There were likely other untagged coho moving into that reach as well.

Snorkel Surveys

Snorkel surveys were conducted in several locations in the Shasta River on Hole In The Ground Ranch on 5/7/13 (prior to pulse flow) as shown on the map below (Figure 3). Fish observations in these reaches are shown below (numbers estimated). No post-flow survey has been conducted as of the date of this report.

A. 1,000 age-0 Chinook, 20 age-0 coho, 20 age-0 steelhead, 10 age-1 or age-2 steelhead. Of these, 36 Chinook and 6 coho were captured with a hand net and PIT tagged.

B. 5 age-0 Chinook, 5 age-0 coho, 20 age-1 or age-2 steelhead

C. 1 age-0 Chinook and 2 age-0 coho were observed just below the debris jam pictured below. Above that point, no age-0 salmonids were observed. Several age-1 or age-2 steelhead, a school of suckers, tui chubs, and speckled dace were observed above the debris jam.

D. 5 age-1 or age-2 steelhead were observed in this reach, just below Clear Spring.

Summary

It appears that a number of fish moved during the pulse-flow period. Many of the tagged Chinook salmon moved downstream from the reach above Parks Creek, which suggests that a significant portion of those observed during snorkel surveys also moved downstream. Tagged age-0 coho moved upstream into this reach to rear over the summer. It is also likely that age-1 and age-2 fish (smolts) moved downstream during the pulse flow. Additional surveys will provide information regarding fish presence after the pulse compared to before.

Figure 3. Map of locations surveyed