



Upper Trinity River Tributary Coho Salmon Spawning Survey Summary, 2014/15 & 2015/16

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Abstract:

Coho Salmon *Oncorhynchus kisutch* redd and carcass surveys were conducted on three tributaries of the upper Trinity River in northern California. This study attempted to determine the timing and distribution of Coho Salmon and to identify the presence/absence of hatchery origin Coho Salmon. We found a total of four redds, twelve live fish, and six carcasses over the course of two survey years. We could not discern any difference in run timing or distribution between tributaries due to low numbers of observed fish. We were unable to determine if redds were made by Coho Salmon or if they were of hatchery origin. One of twelve live fish and four of six carcasses observed were confirmed to be of hatchery origin. Additional surveys are needed to address our objectives.

Introduction:

Coho Salmon populations that were once abundant throughout the Klamath River Basin have declined by at least 70 percent in the last century due to poor water quality and loss of habitat (Weitkamp et al. 1995). To mitigate for these losses within the Trinity River Basin, which is the second largest sub-basin of the Klamath River Basin, the Bureau of Reclamation (BOR) implemented the Trinity River Hatchery (TRH) Coho Salmon program in 1963. Coho Salmon propagated at TRH are part of the Southern Oregon/Northern California Coast (SONCC) Evolutionary Significant Unit (ESU), which was designated as “threatened” by the National Marine Fisheries Service (NMFS) in 1997 and the California Fish and Game Commission in 2005. There is an increased interest in determining the current status and trends of the SONCC Coho Salmon population because of these listings, but this information continues to be sparse due to various factors such as limited funding and life history traits that increase the difficulty of monitoring the species in its natural environment.

Recent reviews of the Trinity River SONCC Coho Salmon population, such as the California Hatchery Review Report (CA HSRG 2012) and the NMFS Recovery Plan (NMFS 2014), have concluded that there is insufficient data for all life stages of Coho Salmon throughout the entirety of the SONCC ESU (including the Trinity River population) and that additional monitoring and research is needed. Furthermore, because of the ESA-listing, a Hatchery Genetic Management Plan (HGMP) for the TRH has been developed to comply with federal law. The HGMP provides an outline of informational needs and associated monitoring activities that will provide fisheries managers the ability to properly administer and implement the protocols designed to recover the natural population of Trinity River Coho Salmon to historic levels.

Arguably, one of the most critical informational requirements for the HGMP will be the adult Coho Salmon return population size (escapement) to natural spawning grounds, including the natural/hatchery composition of that population. The proportion of hatchery origin spawners (pHOS) and proportionate natural influence (PNI) are the primary metrics that will be used to assess the health and status of the natural population of Trinity River Coho Salmon and will dictate the hatchery production levels of the TRH Coho Salmon program, as well as influence in-river harvest potential for tribal and sport fisheries. The HGMP has defined a long-term goal of pHOS levels less than 30 percent and PNI levels at a minimum of 0.5 with an average target of 0.67. The current method for estimating this population is provided by a mark-recapture effort performed by California Department of Fish and Wildlife (CDFW) utilizing adult returns caught and tagged at the Willow Creek Weir site and recaptured at TRH and during surveys of the natural spawning areas in the mainstem Trinity River. The data that is available from this effort indicates that the adult Coho populations that return to the Trinity River are largely made up of hatchery fish, with minimal natural production (Figure 1) (Brown and Moyle 1991; Sinnen et al. 2013).

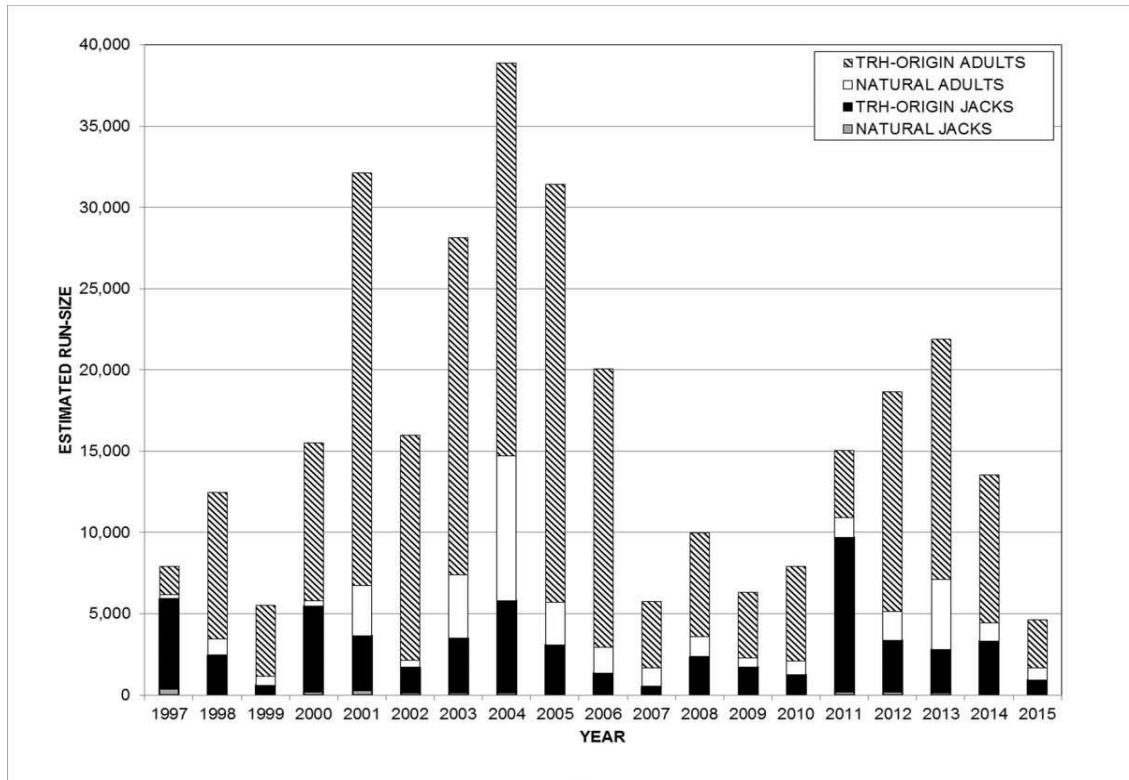


Figure 1. Run-size estimates of adult Coho Salmon returns to the Trinity River above Willow Creek Weir from 1997 through 2016. These estimates are apportioned by origin and age (i.e. natural/hatchery and adult/jack). Data and figure adapted from Kier and Hileman (2016).

During the late-fall of 2014 the Yurok Tribal Fisheries Program-Trinity Division began conducting TRH Coho Salmon spawning surveys in the tributaries of the Upper Trinity River most proximal to TRH. The primary goal of this project was to provide additional information on Coho Salmon spawning abundance in natural areas and report observed presence of TRH Coho Salmon in those areas. An additional benefit was that it provided the opportunity for crews and staff to become more familiar with the logistics (landowner access, stream hazards or barriers, etc.) of conducting tributary surveys in the Upper Trinity River in anticipation of participation in future, HGMP-centric interagency surveys.

This report summarizes data collected during spawning surveys of Trinity River tributaries in the late fall/early winter of 2014-2015 and 2015-2016.

Objectives:

- Assess presence/absence of hatchery Coho Salmon in Upper Trinity River tributaries.
- Determine timing and distribution of spawning Coho Salmon in upper Trinity River tributaries.
- Inform further coho management studies.

Methods:

The U.S. Forest Service (USFS) Trinity River Management Unit (TRMU) has been conducting annual Fall Chinook Salmon spawning surveys in the tributaries of the Upper Trinity River within the jurisdiction of their agency on a regular basis since 1999 (Table 1). The TRMU surveys are only intended to encompass the Fall Chinook Salmon spawning season, resulting in an incomplete assessment of Coho Salmon spawning for the tributaries surveyed. The surveys for this study are intended to mimic the USFS effort and were adapted for Coho Salmon by performing the surveys later in the season, as Coho life history dictates. The intent of these surveys was to document TRH Coho Salmon spawning in tributaries with natural-origin populations. The survey effort concentrated on the tributaries closest to TRH that are thought to have more hatchery strays of various species of salmonids. The tributaries of Deadwood Creek, Rush Creek, and Grass Valley Creek (GVC) were surveyed weekly, when flows and visibility allowed (Figure 2). Surveyors recorded sightings of live fish, redds, and carcasses with a handheld GPS. Carcasses were measured, sexed, checked for hatchery marks (right maxilla clip), and tagged for mark-recapture. Live fish were identified by species, sex, and origin (hatchery/natural) if possible. To determine the origin of live fish, crews used underwater photography equipment in an effort to get close enough to view hatchery marks, although this was often difficult in practice and produced a positive result only a handful of times. Air and water temperatures were also recorded at the beginning of each survey.

Table 1. Summary table of the total Coho-attributed redds encountered from USFS Trinity River Tributary Surveys conducted from 1999 through 2013, Data provided by USFS-Weaverville Office. NS indicates that no surveys were conducted on that tributary for a given year; whereas a "0" indicates surveys were conducted but no Coho spawning was observed.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Deadwood Creek	NS*	NS	NS	6	NS	138	33	65	2	1	NS	21	12	32	5	12	0
Rush Creek	NS	0	0	0	20	39	14	5	0	3	NS	3	7	19	47	24	29
Sidney Gulch	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	4	0	NS	NS	NS	NS
Soldier Creek	NS	NS	NS	NS	NS	0	0	NS	0	0	0	0	0	0	NS	NS	NS
Dutch Creek	NS	NS	NS	NS	NS	0	NS	NS	0	0	0	0	0	0	NS	NS	NS
Canyon Creek	0	1	0	6	5	7	0	0	0	0	1	0	17	1	11	14	8
North Fork Trinity	0	0	0	5	0	6	0	3	0	3	0	0	0	2	7	5	2
East Fork of NF	1	1	0	2	9	30	NS	6	0	8	0	0	11	24	13	1	3
Big French Creek	NS	0	0	0	0	0	NS	NS	0	0	0	0	0	0	0	0	0
South Fork Trinity	NS	NS	NS	NS	NS	NS	NS	0	0	40	24	0	0	0	0	0	0

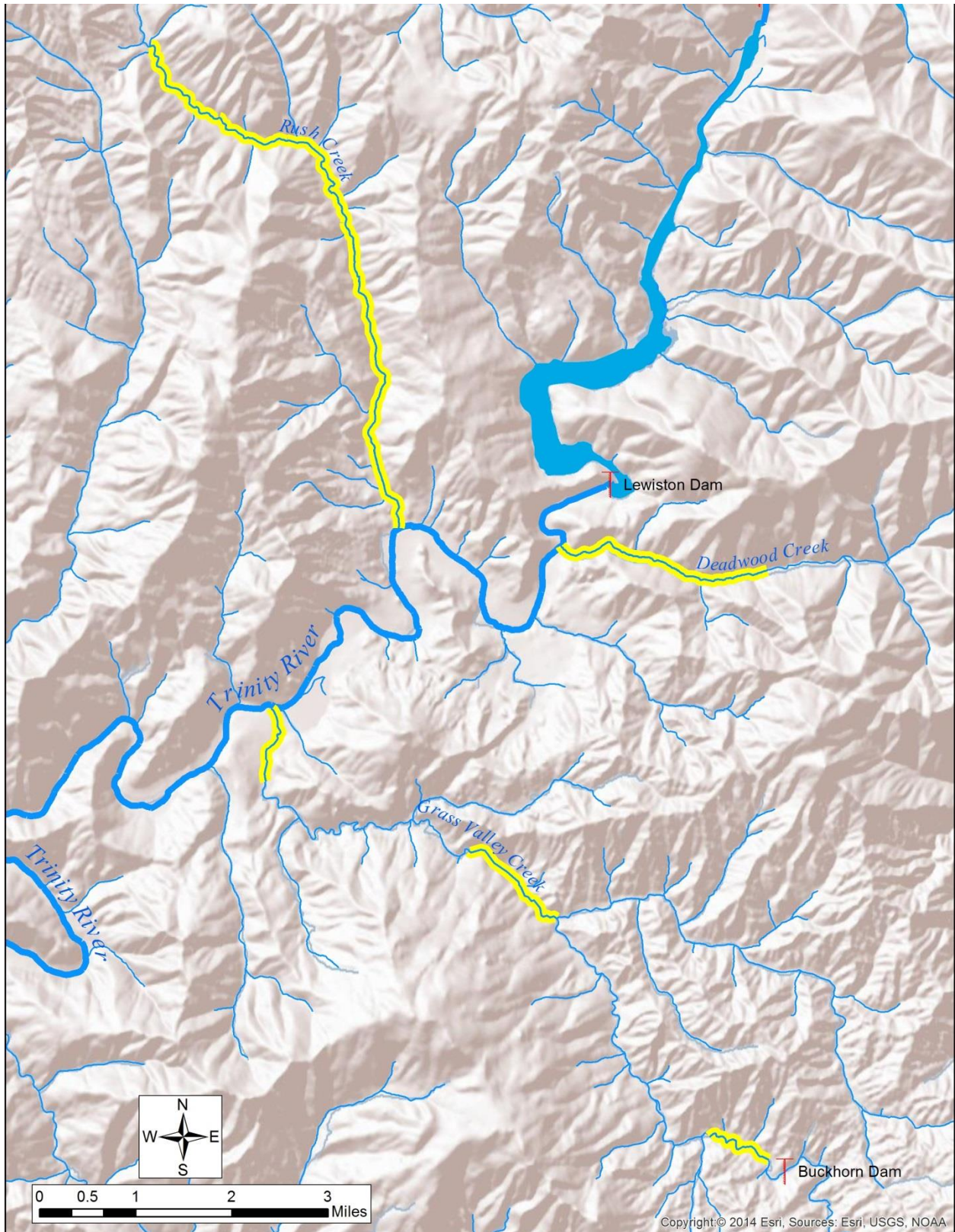


Figure 2. Map of the upper Trinity River tributaries surveyed for Coho Salmon. Areas surveyed in yellow.

Area of Study:

In both the 2014-15 and 2015-16 spawning seasons, crews surveyed Deadwood Creek, Rush Creek, and GVC. Deadwood Creek was surveyed from the confluence upstream for 2.5 miles to where an anadromous barrier is located. Rush Creek was surveyed from the confluence upstream for 3.5 miles. GVC was surveyed on three one-mile sections where access was permitted and Coho spawning had been observed (W. Brock, USFS, personal communication). The most upstream section focused on the mile immediately below the limit of anadromy, Buckhorn Dam. The lowest section starts at the confluence with the Trinity River and extended upstream one-half mile beyond Hamilton Ponds. The middle section of GVC was roughly halfway between the other two sections where the stream runs along Highway 299.

Results

Rush Creek, Deadwood Creek, and GVC were surveyed multiple times from early December 2014 to mid-January 2015 (Table 2). There were many surveys canceled during December 2014 due to high water and poor visibility (Figure 3). Deadwood Creek consistently had the most fish activity of all the tributaries that were monitored during the 2014-15 season. Unfortunately, we were unable to confirm hatchery/natural origin for observations of live fish on Deadwood Creek. In contrast, the surveys performed on Rush Creek showed no activity until the end of December and only on three of the five surveys conducted during the 2014-15 season. However, we did confirm hatchery origin of a Coho Salmon carcass recovered on January 7, which was the only positively identified hatchery origin Coho Salmon during the 2014-15 season.

Table 2. Summary table of the survey days performed for the 2014-15 Upper Trinity Tributary Spawning Surveys conducted by YTFP-Trinity Division crews. Asterisk denotes hatchery-origin Coho Salmon.

Tributary	Date	Distance Surveyed	Redds	Live Fish	Carcasses
GVC	12/2/14	3.0 miles	0	0	0
Deadwood	12/3/14	2.5 miles	0	2	0
Rush	12/3/14	1.3 miles	0	0	0
Deadwood	12/9/14	2.5 miles	0	3	1
Deadwood	12/29/14	2.5 miles	1	1	0
GVC	12/30/14	2.0 miles	0	0	0
Rush	12/30/14	3.5 miles	1	0	0
Rush	1/7/15	2.2 miles	0	0	1*
Deadwood	1/8/15	2.5 miles	1	2	0
GVC	1/13/15	3.0 miles	0	0	0
Rush	1/13/15	1.3 miles	0	0	0
Rush	1/15/15	2.2 miles	1	0	0
GVC	1/20/15	1.0 miles	0	0	0
Deadwood	1/21/15	2.5 miles	0	0	0

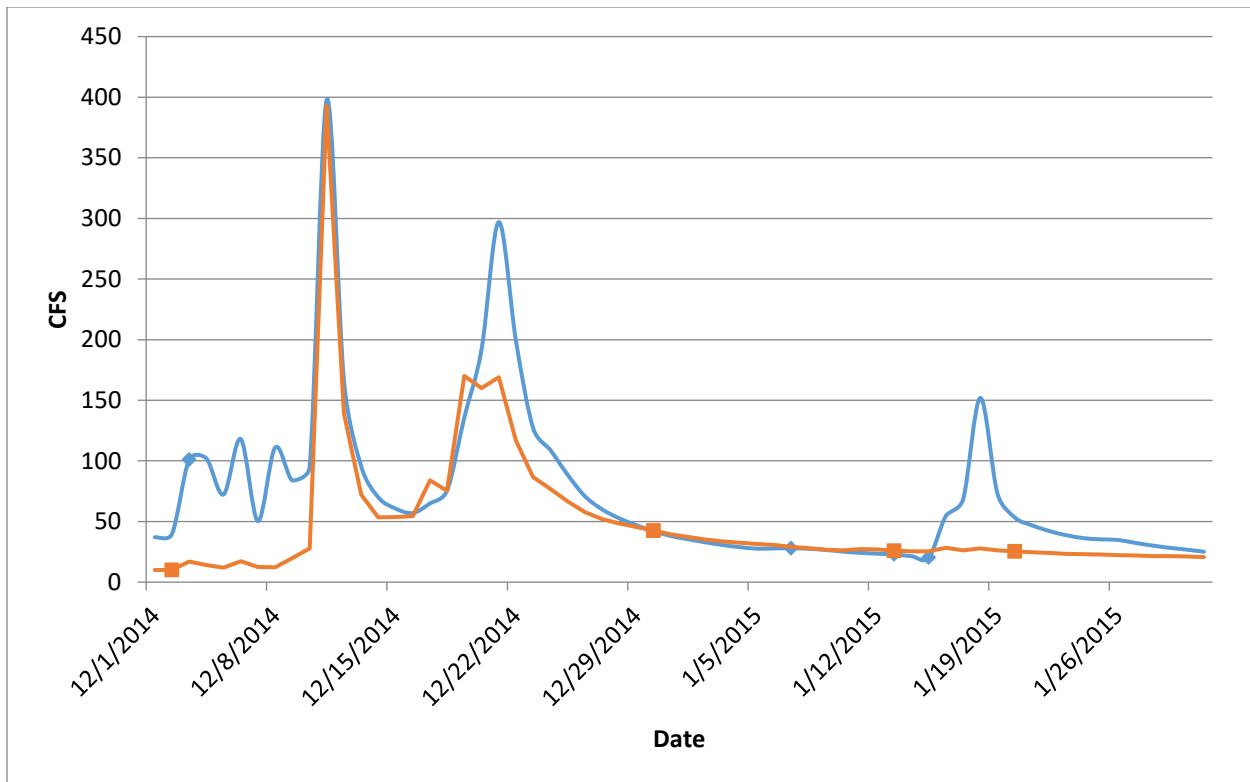


Figure 3. Hydrographs of Rush Creek (blue) and Grass Valley Creek (red) during the 2014-2015 survey year. Symbols on line indicate completed survey. Data from USGS gauging stations 11525530 and 11525630 respectively.

In 2015-16, surveys began earlier (late October) and were expanded to regularly include GVC (Table 3). Surveys were much more consistent and there was never more than a two-week period between surveys (Figure 4). Low-water persisted from the start of surveys to mid-December. Surveys ended slightly earlier during the 2015-16 season due to high water starting in mid-January. Hatchery Coho Salmon carcasses (a total of four) were found on the lowest reach of Rush Creek from early November through early January. A live hatchery Coho Salmon was observed in a downstream reach in mid-November. Three live fish were seen in lower Deadwood Creek in mid-December, which appeared to be Coho Salmon, but presence/absence of hatchery clips was not verified. No live fish, redds, or carcasses were found during any of the 7 surveys performed on the GVC reaches. A total of four hatchery Coho Salmon carcasses were tagged during 2015-16, all within the lower reach of Rush Creek, but none were recovered.

Table 3. Summary table of the survey days performed for the 2015-16 Upper Trinity Tributary Spawning Surveys conducted by YTFP-Trinity Division crews. Asterisk denotes hatchery-origin Coho Salmon.

Tributary	Date	Distance Surveyed	Redds	Live Fish	Carcasses
GVC	10/28/15	3.0 miles	0	0	0
Rush	10/29/15	1.3 miles	0	0	0
GVC	11/4/15	2.0 miles	0	0	0
Rush	11/5/15	3.5 miles	0	0	1*
Deadwood	11/5/15	2.5 miles	0	0	0
Rush	11/12/15	2.2 miles	0	0	0
Rush	11/13/15	1.3 miles	0	0	0
Deadwood	11/13/15	2.5 miles	0	0	0
GVC	11/13/15	1.0 miles	0	0	0
Deadwood	11/18/15	2.5 miles	0	0	0
Rush	11/18/15	2.2 miles	0	1*	0
Rush	11/19/15	1.3 miles	0	0	0
GVC	11/20/15	1.0 miles	0	0	0
Rush	12/2/15	3.5 miles	0	0	0
Deadwood	12/3/15	2.5 miles	0	0	0
GVC	12/3/15	1.0 miles	0	0	0
GVC	12/15/15	1.0 miles	0	0	0
Rush	12/15/15	3.5 miles	0	0	1*
Deadwood	12/16/15	2.5 miles	0	3	0
GVC	12/16/15	2.0 miles	0	0	0
Rush	12/30/15	3.5 miles	0	0	1*
Rush	1/5/16	3.5 miles	0	0	1

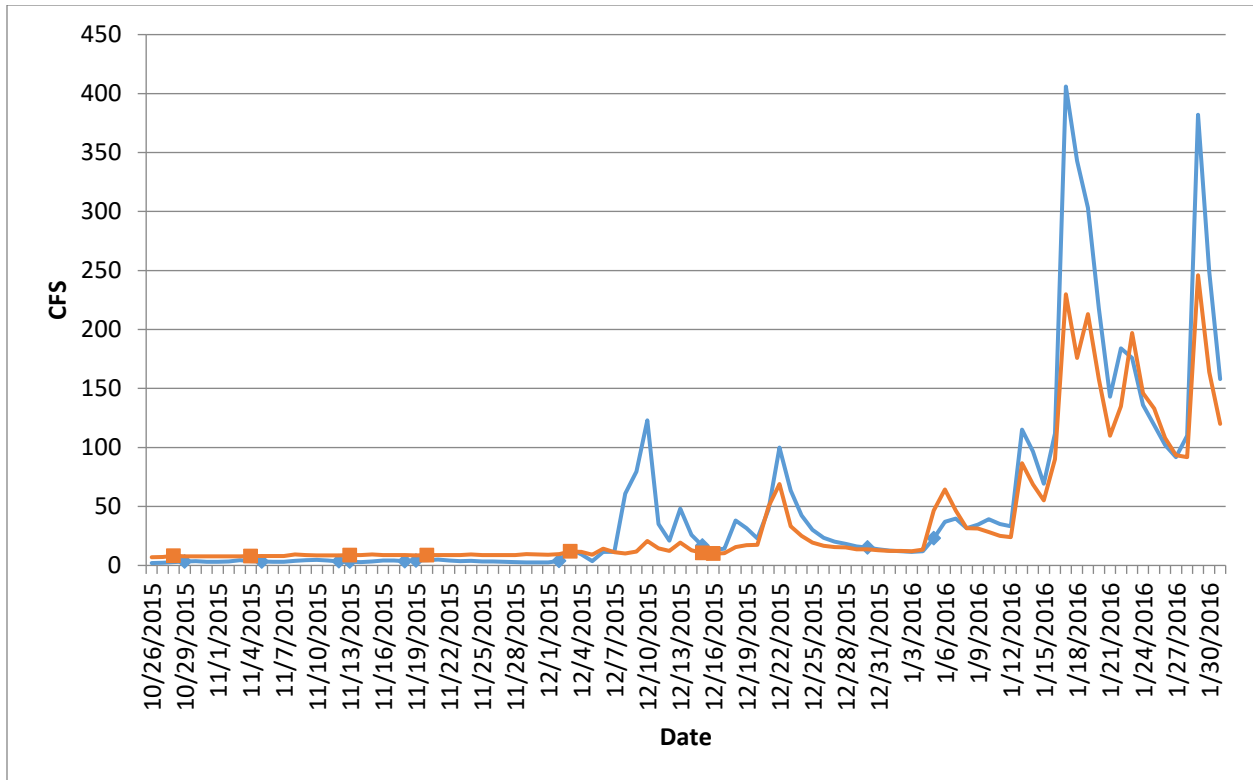


Figure 4. Hydrographs of Rush Creek (blue) and Grass Valley Creek (red) during the 2014-2015 survey year. Symbols on line indicate completed survey. Data from USGS gauging stations 11525530 and 11525630 respectively.

Discussion

Overall, we observed very few Coho Salmon during the surveys compared to past surveys completed by USFS (Table 1). Both survey years saw smaller than average run sizes return to the Trinity River with the 2015/2016 returns being the lowest in the last twenty years (Kier and Hileman 2016). Although Coho Salmon escapement was higher in 2014/2015 compared to the 2015-2016, we observed roughly the same amount of Coho Salmon activity in the tributaries both years. One possible explanation was flows were not conducive to surveying during the peak of Coho Salmon spawning during mid-December. The large flow events that occurred during December 2014 also likely washed out carcasses and may have made previously dug redds more difficult to identify. The 2015/2016 season had better conditions for surveying, but low flows coupled with low run size likely contributed to our poor numbers of observed fish and redds.

We were able to document hatchery origin Coho Salmon in Rush Creek, but were unable to do so in Deadwood Creek and GVC due to limited observations. The proximity to the hatchery and the relatively few natural origin fish recorded at the Willow Creek weir (Sinnen et al. 2013) makes it likely that hatchery origin fish are present in both Deadwood Creek and GVC. In order to verify hatchery-origin fish in these tributaries, surveys during years with larger run sizes (i.e. 2001-2006) (Figure 1) or over a longer period with more effort would be needed to accomplish the goal of quantifying PHOS in natural spawning areas. Understanding the proportion of hatchery-origin Coho Salmon in natural spawning areas is essential to the long-term viability of the Upper Trinity River population, as the presence of hatchery-origin Coho Salmon is a primary threat to natural origin Coho Salmon (NMFS 2014).

We were unable to determine precise timing and distribution of spawning Coho Salmon due to the low run-sizes and environmental conditions, resulting in limited data collected during these surveys. Understanding the timing and distribution of spawning is critical for efficient and effective future surveys due to the difficulty of locating Coho Salmon consistently. Since many of these tributaries have very small runs, it is important to locate when and where spawning activity occurs. If we are able to identify smaller spatial and temporal scales to classify spawning (index reaches), it will make it more likely to achieve our goals with limited resources. Surveys that are more frequent will be needed to enable us to identify these trends. In addition, analyzing previously collected data by the Yurok Tribe and USFS can also help accomplish this objective.

Further refinement of our methods is needed to address the difficulties with documenting hatchery/natural origin Coho Salmon and their hatchery/natural origin in small tributaries. Spawning surveys are somewhat unreliable for Coho Salmon on tributaries of the Trinity River due to the annual variation of flows and small run sizes. The cryptic nature of Coho Salmon to follow flow events on these small tributaries further compounds our inability to detect Coho Salmon. Conversely, spawning surveys are well supported in the literature and are commonly used to document spawning activity. Identifying major spawning areas is extremely important to addressing our outlined objectives in the future. Conducting additional annual surveys or using new techniques such as environmental DNA (eDNA) to identify presence/absence of Coho Salmon on certain reaches can help us identify these more prevalent spawning areas.

References

- Brown, L.R., and P.B. Moyle. 1991. Status of Coho Salmon in California. Report to the National Marine Fisheries Service.
- California Hatchery Scientific Review Group (CA HSRG). 2012. California Hatchery Review Report. Prepared for the US Fish and Wildlife Service and Pacific States Marine Fisheries Commission.
- Kier, M. C. and J. Hileman. 2016. Trinity River Basin Salmon and Steelhead Monitoring Project Annual Report: Chinook and Coho Salmon and Fall-run Steelhead Run-size Estimates Using Mark-recapture Methods 2015-16 Season. California Department of Fish and Game, Northern Region, Redding, CA.
- National Marine Fisheries Service. 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionary Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service. Arcata, CA.
- Sinnen, W., S. Borok, S. Cannata, A. Hill, J. Hileman, and M.C. Kier. 2013. Final Annual Report Trinity River Basin Salmon and Steelhead Monitoring Project 2010-2011 Season. California Department of Fish and Game, Northern Region, Redding, CA.
- Weitkamp, L. A., T. C. Wainwright, G. J. Bryant, G. B. Milner, D. J. Teel, R. G. Kope, and R. S. Waples. 1995. Status Review of Coho Salmon from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-24.