Juvenile coho salmon use of constructed off-channel habitats in two Lower Klamath River tributaries: McGarvey Creek & Terwer Creek

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Introduction

The Yurok Tribal Fisheries Program – Lower Klamath Division (YTFP) is dedicated to rehabilitating degraded stream and riparian habitats of the Lower Klamath River to levels that support robust, self-sustaining populations of native anadromous fish. Since 2007, YTFP has been working with Rocco Fiori of Fiori GeoSciences (FGS) to design and implement innovative stream and floodplain enhancement projects in priority Lower Klamath tributaries. Treatments have included installation of constructed wood jams and engineered log jams (CWJs & ELJs) to facilitate formation and maintenance of productive fish habitats (e.g. spawning beds, deep pools with cover, slow velocity areas), and enhancing off-channel habitats to increase salmonid rearing capacity (YTFP 2010; Hiner et al. 2011; Beesley and Fiori 2012a, 2012b, & 2013).

In 2009-2010, YTFP and FGS partnered with the U.S. Fish and Wildlife Service (USFWS - Tribal Landowner Incentive Program & Partners for Fish and Wildlife Program), the National Oceanic and Atmospheric Administration (Coastal and Marine Habitat Restoration Program - American Recovery and Reinvestment Act), and the U.S. Bureau of Reclamation (Native American Affairs Program). Primary objectives of these partnerships were to implement stream, riparian, and off-channel habitat restoration treatments in two priority Lower Klamath tributaries: Terwer Creek and McGarvey Creek (YTFP 2010; Fiori 2010; Fiori et al. 2009; Fiori et al. 2010; Fiori et al. 2011a & 2011b; Hiner et al. 2011; Beesley and Fiori 2012a).

In 2009, YTFP and FGS constructed two ELJs (ELJ 1 & Crib Wall Jam) and conducted extensive bioengineering in lower Terwer Creek as well as installed 13 CWJs in McGarvey Creek (Figures 1-6). In 2010, treatments included enhancement of two off-channel habitat features in Terwer Creek (Terwer Pond A & Terwer Pond B) and one in McGarvey Creek (McGarvey Alcove I) to increase juvenile salmonid rearing capacity (Figures 7-11). Physical habitat monitoring data collected in these treatment reaches indicates positive habitat response (e.g. reduced soil loss, increased pool formation & habitat complexity) to implemented treatments (Gale 2009; Hiner et al. 2011; Beesley and Fiori 2012b).

In 2012, YTFP and FGS installed an additional 15 CWJs and constructed a second off-channel habitat feature in lower McGarvey Creek (Figure 12) (McGarvey Alcove II). The 2012 project was funded by USFWS (Partners for Fish and Wildlife Program) and the U.S. Bureau of Reclamation (Klamath River Restoration Program). YTFP has been conducting fisheries investigations in the constructed off-channel habitats to document seasonal and long-term fish use of these areas to help assess project effectiveness and to guide future restoration efforts in the Lower Klamath River (Fiori et al. 2011a & 2011b, Hiner et al. 2011; YTFP 2012).

McGarvey Creek
Prior to off-channel enhancement in 2010 and 2012, the areas treated in lower McGarvey Creek were inundated only during very high tributary flow events or during backwater events created by high flows in the Klamath River. YTFP and FGS constructed the off-channel habitat features in a manner that has provided and will provide year-round habitat for native fish and amphibians.

Following construction of McGarvey Creek Alcove I, YTFP monitoring crews conducted fish surveys during winter, spring, and early summer 2011. In January 2011, crews captured a total of 54 juvenile coho salmon and several other native salmonids and amphibians. One of the coho captured during January was a PIT tagged fish that the Karuk Tribe marked in Slate Creek on 07/17/11. Slate Creek enters the Klamath River 51 river miles (RM) upstream of the Pacific Ocean (Figure 13). Trapping events in early March 2011 resulted in the capture of 21 juvenile coho. Five of the coho caught during spring had been previously captured (e.g. "recaptured" fish) in McGarvey Alcove I during the January 2011 survey. Surveys conducted in June 2011 resulted in the capture of 51 young of the year (YOY) coho, a YOY chinook, and other native fish and amphibians. Summer rearing habitat for juvenile salmonids is extremely limited in the Lower Klamath Sub-basin; therefore, these results are very encouraging and further support our plans to continue stream and floodplain restoration efforts in lower McGarvey Creek.

In March 2012, YTFP conducted a mark-recapture population estimate in McGarvey Creek Alcove I using the Chapman modification of the Petersen estimator (Ricker 1975). YTFP estimated a total of 213 juvenile coho residing in McGarvey Alcove I (Figure 14). Mark-recapture efforts conducted in McGarvey Alcove I during late July 2012 resulted in an estimate of 50 YOY coho (Figure 14). YTFP recently conducted mark-recapture surveys in both constructed off-channel habitats of McGarvey Creek. Late January – early February estimates for age 1+ coho were 121 for Alcove I and 154 for Alcove II (Figure 14). YTFP will continue monitoring salmonid abundance in these alcoves to further document seasonal and annual use of this constructed feature by natal and non-natal juvenile coho and other native fish. We are still processing the PIT tag data collected in these alcoves during fall 2012 - winter 2013.

Terwer Creek
YTFP conducted pre- and post-project fisheries investigations in the two off-channel habitat features in lower Terwer Creek. Pre-project trapping efforts conducted in Terwer Pond A during March 2009 resulted in the capture of 26 juvenile coho. One of these juvenile coho was initially PIT tagged by the Karuk Tribe in Independence Creek on 09/22/08 (Figure 13). In 2010, YTFP conducted pre-project mark-recapture population estimates in the Terwer Creek ponds using the Chapman modification of the Petersen estimator (Ricker 1975). In January 2010, YTFP estimated 39 juvenile coho in Terwer Pond A (Figure 14). Trapping events conducted in Terwer Pond B during March 2010 resulted in the capture of only two juvenile coho (Figure 14). The low numbers of fish observed in Terwer Pond B was likely due to limited connectivity and rearing capacity of this off-channel habitat prior to enhancement efforts.

Following enhancement of Terwer Pond A & B, YTFP conducted multiple mark-recapture population estimates in these habitats to assess seasonal fish use (Figure 14). The number of juvenile coho estimated in Terwer Pond A was 37 in January 2011 and 21 during March 2011. In May 2011, a majority of the age 1+ coho had left the pond while YOY coho and chinook

moved into the pond. Mark-recapture events conducted in May 2011 resulted in population estimates of 75 YOY coho and 766 YOY chinook. In February 2012, YTFP estimated 65 juvenile coho residing in Terwer Pond A (Figure 14). Post-project studies conducted in Pond A during 2011 indicated fish use of the newly enhanced portion of the pond was minimal relative to fish use in the untreated area. February 2012 trapping events indicated fish use of the treated area of Pond A had dramatically increased relative to the previous year.

The number of juvenile coho estimated in Terwer Pond B was 121 in January 2011 and 212 during March 2011 (Figure 14). As was observed in Pond A during May 2011, a majority of the age 1+ coho had left Pond B while YOY coho and chinook moved into the pond. Mark-recapture events conducted in May 2011 resulted in population estimates of 172 YOY coho and 930 YOY chinook. In February 2012, YTFP estimated 18 juvenile coho in Terwer Pond B (Figure 14). Low numbers observed during this effort may have been related to low flow conditions that persisted throughout winter. YTFP recently conducted mark-recapture surveys in both constructed off-channel habitats of Terwer Creek. Late February estimates for age 1+ coho were very low in both ponds (Figure 14). Data collected by YTFP crews as part of the Coho Ecology Study indicate very low juvenile coho numbers within many of the Lower Klamath tributaries. Low numbers of fish within the Terwer ponds during winter 2013 may also be associated with a very low water year. Pit tag data collected in the Terwer ponds has revealed substantial use of these habitats by non-natal juvenile coho salmon (Figure 13).

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Figure 1. An engineered log jam (Terwer ELJ 1) in Terwer Creek following construction and during the first flows post-construction, Lower Klamath River (Fall 2009).

Figure 2. Looking downstream at Terwer ELJ 1 and willow baffles protecting a side channel and Holocene soils and creating low velocity habitat (01/01/10 - near bankfull event ~1,600 cfs).

Figure 3. Looking downstream at an engineered log jam (Terwer Crib Wall Jam) in Terwer Creek during construction (Fall 2009).

Figure 4. Looking upstream from Terwer Crib Wall Jam at Terwer ELJ1 and willow baffles protecting and creating complex slow velocity habitats for native salmonids (Winter 2010).

Figure 5. Looking upstream at Terwer Crib Wall Jam two years post-construction (Fall 2012).

Figure 6. A constructed wood jam site (2009 - Site 5) in McGarvey Creek prior to construction (Top), first winter post-construction (Bottom Left), two years post-construction (Bottom Right).

Figure 7. Oblique aerial photograph of lower Terwer Creek restoration sites (Summer 2011).

Figure 8. Photographs of Terwer Creek Pond A prior to construction (Top – 7/15/10) and during the first flows post-construction (Bottom - 10/30/10).

Figure 9. Photographs of Terwer Creek Pond B constructed during 2010 (Dates: a) 7/15/10, b) 7/28/10, and c) 10/31/10).

Figure 10. Looking downstream at McGarvey Alcove I prior to construction (Top – Fall 2010) and two years following construction (Bottom – November 2012), McGarvey Creek.

Figure 11. Looking upstream at McGarvey Alcove I during winter flows (Winter 2011).

Figure 12. Looking downstream at constructed wood jams and McGarvey Creek Alcove II inlet during low (Top Left), moderate (Top Right), and high flows (Bottom) during November 2012.

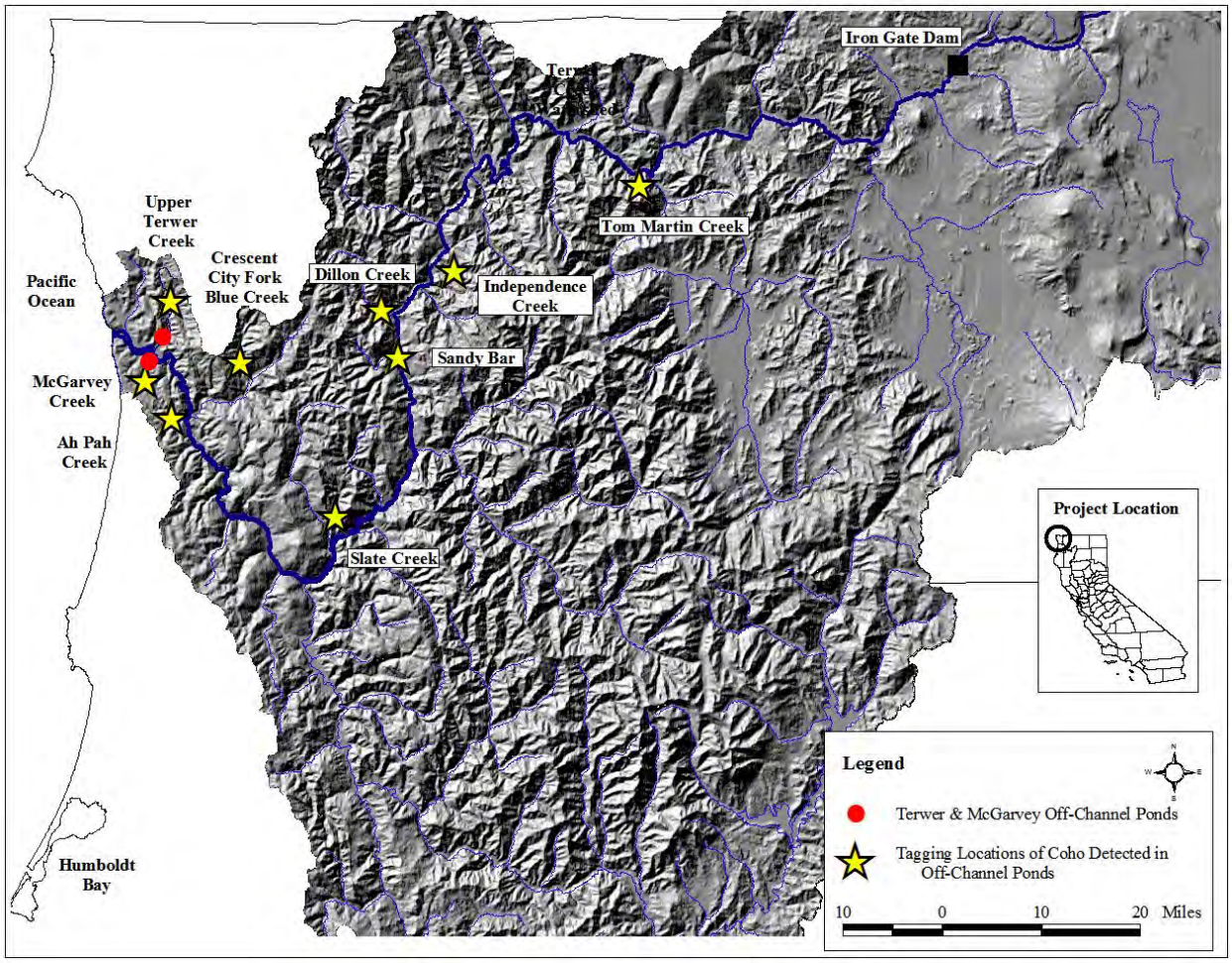

Figure 13. Map indicating tagging locations of non-natal juvenile coho recaptured in off-channel ponds constructed in two Lower Klamath tributaries between November 2010 and winter 2012.

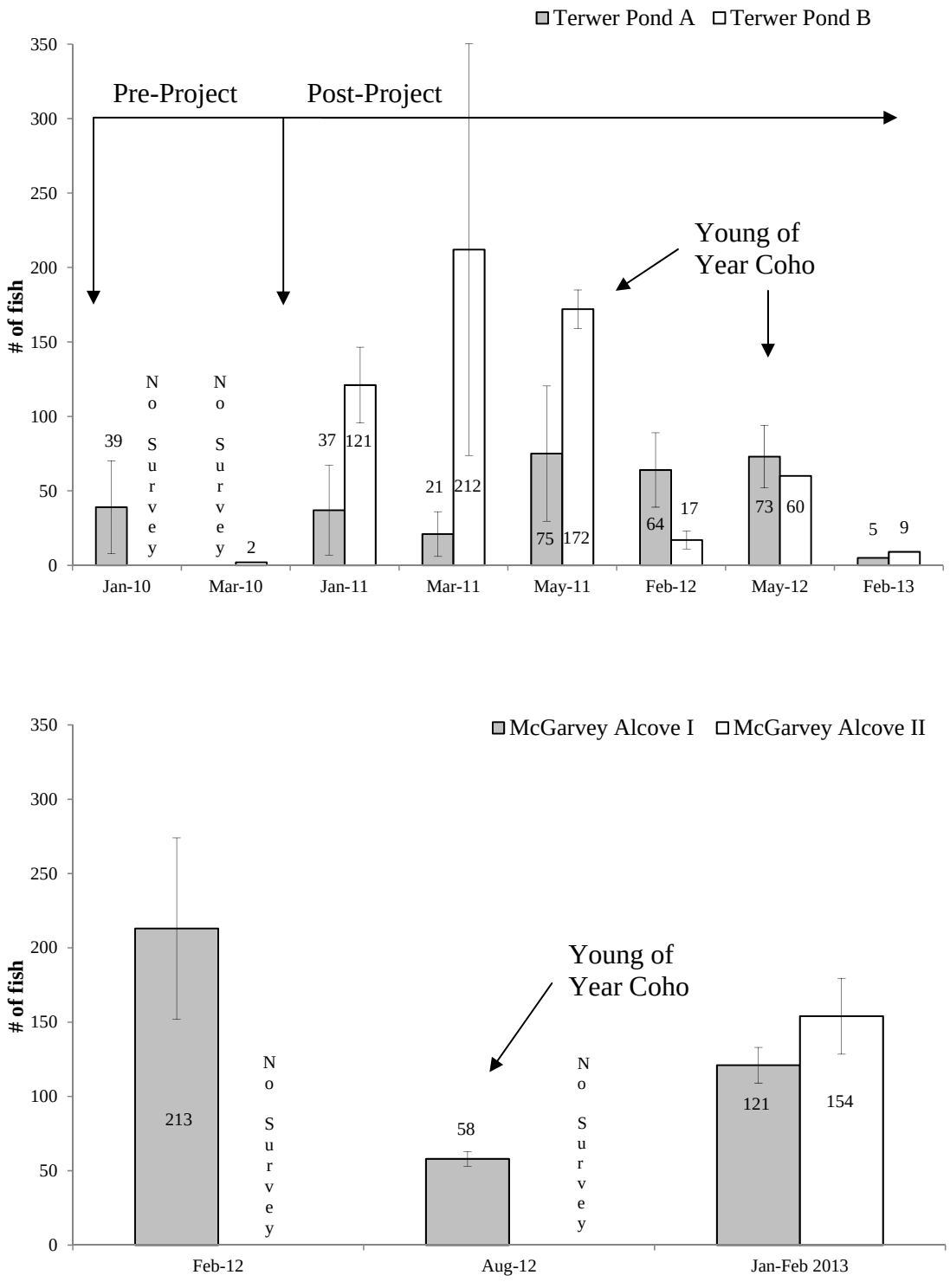

Figure 14. Mark-recapture population estimates for juvenile coho (1+ fish except where otherwise indicated as young of the year) in Terwer (Top) and McGarvey (Bottom) ponds.