

Cooperative Report of the Scott River Coho Salmon Rescue and Relocation Effort: 2014 Drought Emergency



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Final Report – August 2015

Acknowledgements

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- Funders for 2014 Water Trust leases: Bella Vista Foundation, Dean Witter Foundation, National Fish & Wildlife Foundation, The Nature Conservancy, NOAA-Fisheries, PacifiCorp
- Funder for Siskiyou RCD crews: U.S. Forest Service – Klamath National Forest
- ABC Nightline News staff

Cover photos were contributed by Siskiyou RCD and CDFW.

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Executive Summary

An extreme drought in the 2014 water year set the stage for the largest scale rescue and relocation effort of juvenile coho salmon (*Oncorhynchus kisutch*) in the history of the California Dept. of Fish and Wildlife (CDFW): an estimated 116,000 coho. Sharing how this complicated effort was accomplished by a diverse array of participants under trying conditions is a primary focus of this report. Recommendations are also made about what went well and what could be done better, in case similar emergency projects need to be implemented in the future.

On January 17th 2014, Governor Brown proclaimed a State of Emergency to exist in California due to severe drought conditions. In the Scott River watershed of the Klamath River basin, record low surface flows in the river and its tributaries-coincided with the biggest run of coho salmon since thorough adult records began in 2006. Scott River coho salmon are listed as threatened under both the federal and state Endangered Species Acts (ESA/CESA). Due to these low flows and lack of surface connectivity, more than 2,700 spawning adult coho salmon, arriving in late 2013, were unable to reach their customary spawning grounds in Scott River tributaries. They were instead forced to spawn in the mainstem Scott River, in the upper portion of Scott Valley. Concern quickly grew that the unusually large number and concentration of coho salmon progeny emerging from redds in the mainstem Scott River would not be able to get to and rear in stream reaches that would stay watered through the spring and summer of 2014. These conditions posed a real risk that an entire brood year of Scott River coho salmon, and as much as fifty percent of the natural run of adult coho salmon produced in California that year, might be lost.

The Scott River Water Trust (SRWT) and the Siskiyou Resource Conservation District (RCD) voiced concerns of potential large-scale juvenile fish stranding in the mainstem Scott River, and initiated coordination with the CDFW in late January. A month later a small, collaborative working group of agency, nonprofit, private, and Tribal organizations began meeting (in person or by conference calls) on a regular basis to prepare a coordinated strategy for when, where and how to rescue and relocate the juvenile coho salmon. Members of the working group knew that private landowner participation would be central to the success of any coho salmon rescue/relocation operation. Therefore, in April 2014, CDFW finalized a Memorandum of Understanding (MOU) that included assurances to protect participating landowners from ‘take’ under CESA of listed coho salmon associated with coho salmon rescue/relocation, as long as these landowners adhered to specific Best Management Practices (BMPs). NOAA Fisheries provided analogous assurances to participating landowners in the form of a Voluntary Drought Agreement. This agreement provided for “special consideration” should issues related to take of coho salmon arise during the rescue/relocation process, as long as the same BMPs were followed. Both CDFW and NOAA Fisheries officially announced this first of its kind framework as their “Voluntary Drought Initiative” to protect salmon and steelhead on May 14, 2014. Eleven private landowners in Scott Valley voluntarily signed these agreements.

Numerous potential receiving sites in the upper tributaries for rescued fish were evaluated by the US Forest Service - Klamath National Forest (KNF), CDFW, and RCD. Criteria for relocation site selection were: presence of perennial cold water; proximity to known tributary spawning areas;

physical accessibility for transporting trucks; and landowner permission. Candidate receiving sites were generally upstream from capture locations in tributaries known to accommodate spawning adult coho salmon. Sites that were determined suitable to receive rescued fish included: South Fork Scott River; Grouse Creek (tributary to East Fork Scott River); Sugar Creek; French Creek and two of its tributaries - North Fork French Creek and Duck Lake Creek; Mill Creek (tributary to Etna Creek); Canyon Creek; and Kelsey Creek.

As surface water receded and warmed, and salmonids risked stranding in isolated portions of the Scott River, Scott River Water Trust staff in the working group pursued water leases with ranchers to prolong surface connectivity in both rescue and relocation reaches. A unique spring lease, for a 37 day period in May-early June, added from 5.8 to 19.8 cfs to the challenging dredger tailings reach to help extend outmigration of 1+ salmonids as well as upstream migration of 0+ coho, before that reach dried up. During the summer 2014 water lease transaction period, the SRWT completed a total of twelve transactions in the Scott River, French Creek and Sugar Creek, dedicating 766.4 acre-feet to instream flows, and improving instream habitat conditions for 16.5 river miles.

Fish rescue and relocation took place from June 3 until August 19, 2014, using incline plane (McBain) traps and seines. The timing and location of trapping operations was dependent upon an almost daily assessment of habitat and fish conditions in the mainstem Scott River, from snorkel surveys conducted by the RCD field crews and subsequent decisions by CDFW biologists. More than 132,400 juvenile salmonids were relocated during this period, including an estimated 115,999 coho salmon, 16,292 steelhead, and 188 Chinook salmon. About 4,447 (3.8%) of all the coho salmon rescued were transported to holding tanks at Iron Gate Hatchery (IGH) on the Klamath River. Apart from approximately 435 (9%) that perished during captivity, the remaining coho salmon held at IGH were returned to the mainstem Scott River and to French Creek in late October, when improved conditions there ensured their best chances of survival. Visual health assessments of relocated fish were made continuously during the summer of 2014 by RCD, KNF, and CDFW crews. With the exception of stressed fish being observed from relocation-caused overcrowding in Etna-Mill Creek and Canyon Creek, no fish health or mortality problems were noted.

A total of approximately 2,640 (2.3% of total) coho salmon were PIT (Passive Integrated Transponder) tagged during fish rescue operations: 2,247 of which were relocated and 393 of which were released back into their capture sites. CDFW continues to operate 8 PIT tag stations in the Scott River watershed to evaluate the survival and movement of these and other tagged coho salmon. A wealth of new habitat information was also gleaned from the many monitored rescue and relocation sites, including water temperature, dissolved oxygen levels, stream flow, and pool depths.

This report concludes by listing and discussing a range of topics to be investigated in future monitoring efforts. Such monitoring will focus on: assessing the juvenile outmigration of this rescued/relocated coho brood year in 2015; determining the return rate of the next adult coho run in 2016; the ratio of coho smolts per adult for a freshwater survival metric; improving fish rescue and relocation operations in the future; and informing restoration actions to increase coho salmon smolt production within the Scott River Basin.

I. The 2014 Extreme Drought & Coho Salmon Emergency

In this year, a perfect storm of events occurred in the Scott River watershed: a record low flow in the river and its tributaries during the 2013 fall and 2014 winter, due to a record-setting statewide drought, coincided with the largest recently recorded spawning return of coho salmon (*Oncorhynchus kisutch*), a species listed as threatened under both the federal and state Endangered Species Acts (ESA/CESA). As a result, most of the adult coho were unable to reach their normal spawning grounds in the perennial tributaries and were forced to spawn in the mainstem Scott River in upper Scott Valley. Experienced observers became very concerned that this unusual concentration of spawning and impending poor flows would not be able to support sufficient migratory and rearing conditions for the large number of juvenile coho progeny anticipated to be in the mainstem reaches through the upcoming spring and summer. This chapter describes the context for the crisis which led to a coordinated reaction. (See the 2014 Chronology of Events in Appendix A.)

A. Drought Conditions

The U.S. Drought Monitor identified Siskiyou County as being under “extreme drought” intensity through most of the 2014 water year (National Drought Mitigation Center 2014.)

2014 Water Year Precipitation and Snowpack: Following two years of drought, the 2014 water year delivered even less moisture. During the salmon spawning season from October 2013 through January 2014, Fort Jones received just 1.79”, or 14% of average, of precipitation (CDWR 2014; Figure 1). Although February and March provided 6.7” of rain, the moisture content of the snow pack was only 9% by April 1st (USFS 2014a). All of the Scott River watershed snow survey sites, which extend to 6,600 ft. in elevation, were unusually devoid of any snow by May 1st. With above average rainfall in September, the 2014 Water Year ended up with 12.06” precipitation in Fort Jones, or 55% of average, and 12.63”, or 63% of average, at Callahan.

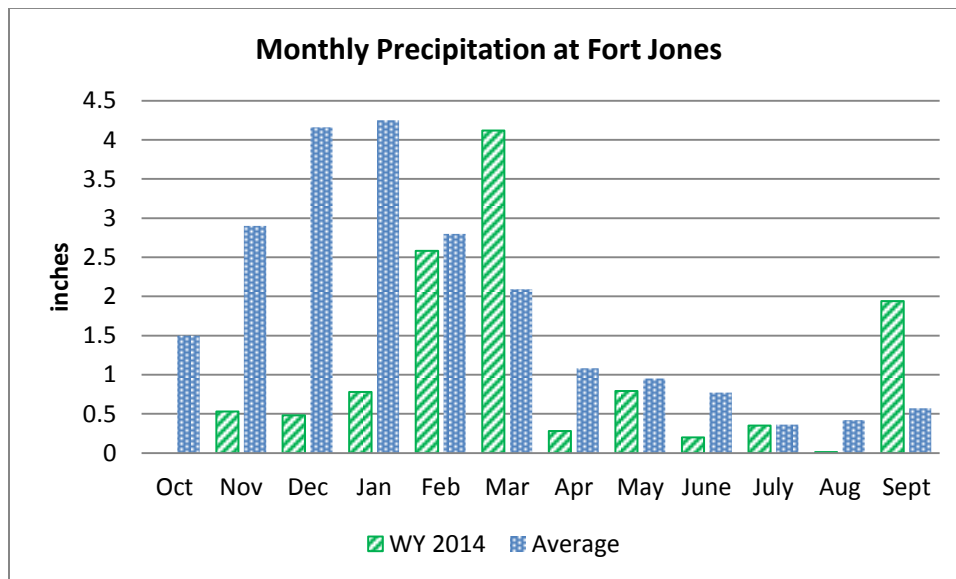


Figure 1. Monthly precipitation in Water Year 2014 compared to average (CDWR 2014).

2014 Water Year Runoff: As of October 1, 2013, the Scott River had a discharge of 55 cfs at the USGS gage at river mile 21 (rkm 35), following a large rainstorm during the last days of September that helped reconnect the flow through Scott Valley. With little precipitation over the next four months, the river’s flow fluctuated only slightly, from 42 to 62 cfs. Figure 2 depicts the discharge up to Feb. 8, 2014, when the CDFW video weir at river mile 18 (rkm 29) was removed (USGS 2014).

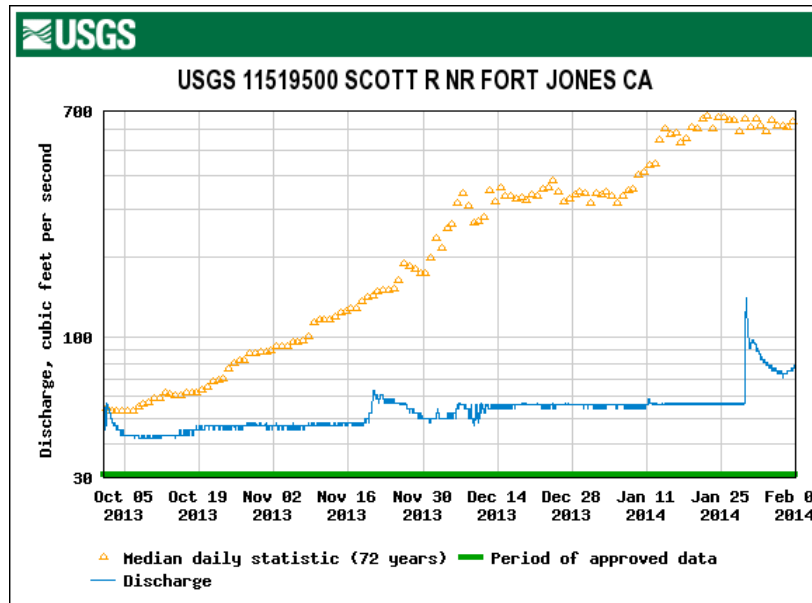
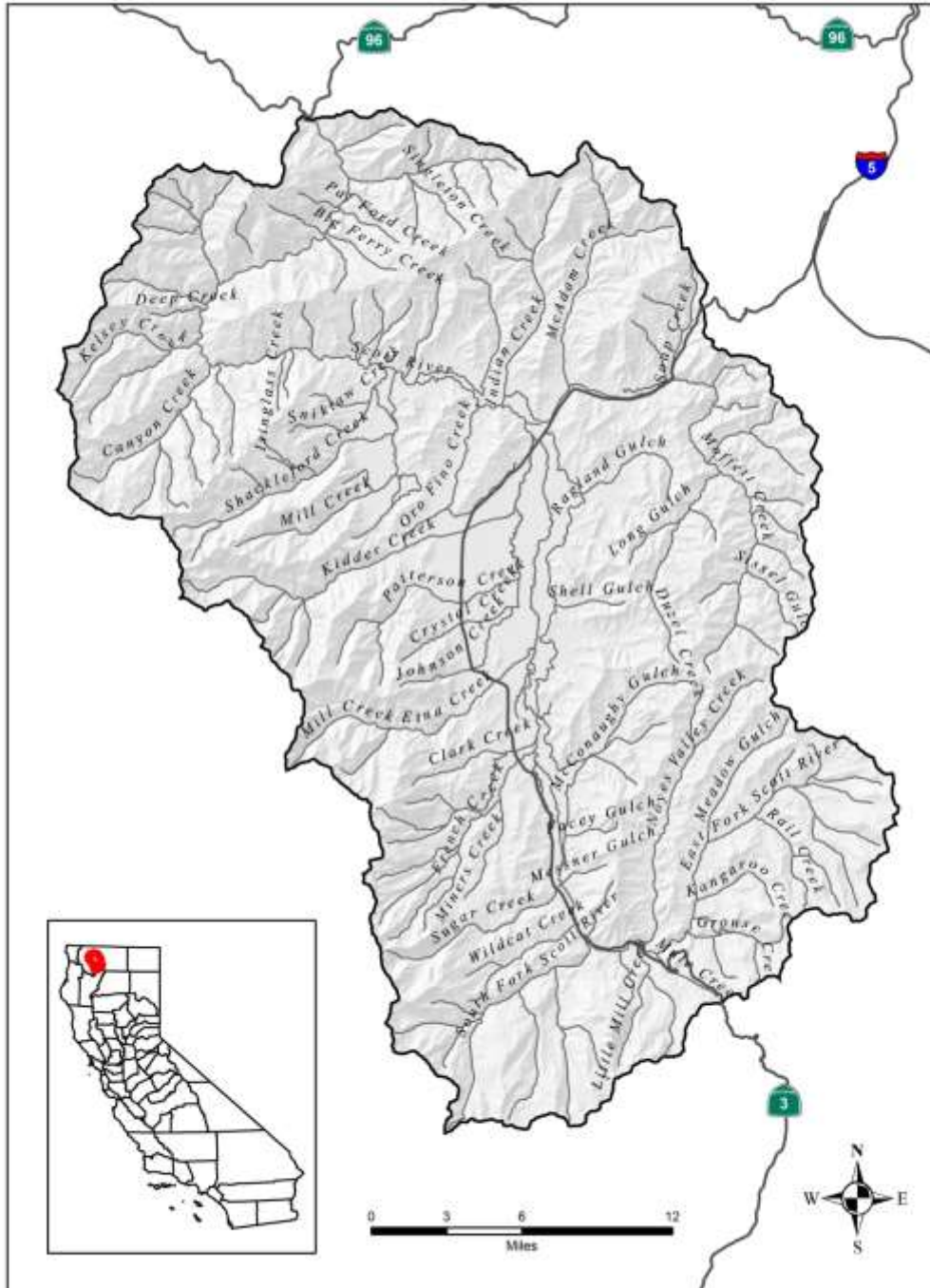


Figure 2. Scott River fall and winter discharge, Oct. 1, 2013 to Feb. 8, 2014. Data from U.S. Geological Survey (USGS) gage station below Fort Jones.

Flow was significantly below the median during this time period, from 20 to 550 cfs below depending upon the date. With such little runoff, the lower reaches of almost all the tributaries in Scott Valley were disconnected. French Creek was the main exception, with flows ranging from 3 to 12 cfs (CDWR 2014.) The upper mainstem through the dredger tailings reach below Callahan remained disconnected despite continuous inflow from the South Fork, East Fork and Sugar Creek.

Rainfall in Scott Valley of 2.5-3.5 inches in February and 2.4 to 4.1 inches in March (with little precipitation as snow in the mountains) significantly increased the discharge for those two months as shown in Figure 3 – the only time in the water year when discharge rose above the median for a few days. Tributaries and the tailings reach finally reconnected with the mainstem after 2/14/14. With no snowmelt contributing to the usual spring runoff, the Scott River’s flow declined significantly in April instead of June, which is earlier than usual when compared to the median.

Map 1. Location of Scott River Sub-basin and its tributaries, Siskiyou County, CA (map prepared by CDFW)



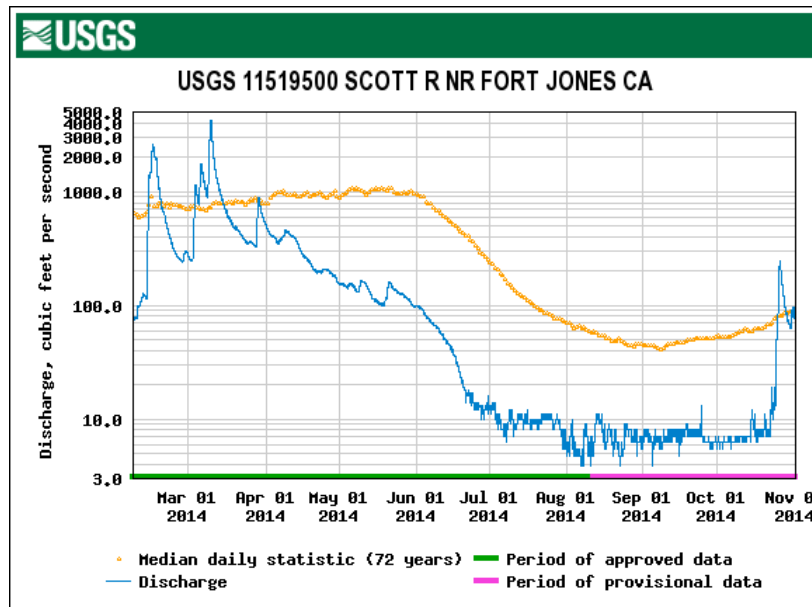


Figure 3. Scott River discharge, Feb. 8, 2014 to Nov. 1, 2014.

The tailings reach became disconnected about June 2nd, earlier than usual, despite the gage indicating 98 cfs over 30 miles downstream (USGS 2014). After July 1st, the discharge at the USGS gage generally remained below 10 cfs, reaching a low of about 4 cfs (according to provisional data) in August to early September (Figure 3). By July 22nd, the mainstem river was dry at Young’s Dam (RM 47/rkm 75), though there was still flow below the dam and in reaches above French Creek. It took several small rain events in September and a larger late October storm to reconnect the entire river and the tributaries.

Mountain wildfires and the resulting heavy smoke dominated the Scott Valley environment from July 30 to late September, when the last fire complex was finally contained. The heavy smoke cover may have helped reduce air and stream temperatures as well as the evapo-transpiration (ET) rate by upland vegetation. (With smoke providing a type of shade cover, less evaporation occurs from the soil and less transpiration results from plants.)

B. Coho Adult Returns from 2013-14

CDFW’s video fish counting facility on the Scott River at RM 18 (rkm 29) observed the first coho salmon adult on Oct. 21, 2013 and the last coho on Feb. 6, 2014, with the weir removed on Feb. 8th due to high flows (Knechtle and Chesney 2014). This is the longest timeframe that the Scott River Fish Counting Facility has been able to operate during a season and it documented the coho run extending into February, which has not been previously observed (Yokel 2014). During this period, 2,731 coho salmon were counted moving upstream of the facility, with another 21 adults estimated below, for a total count of 2,752 coho in the Scott River for the season. This season’s brood year is typically the strongest of the three brood years in the Scott, as indicated in Figure 4, and the 2013 total represented the highest measured number to date (Knechtle and Chesney 2014). While a large return was anticipated, the significant increase over the previous return of 911 adults was notable during a drought.

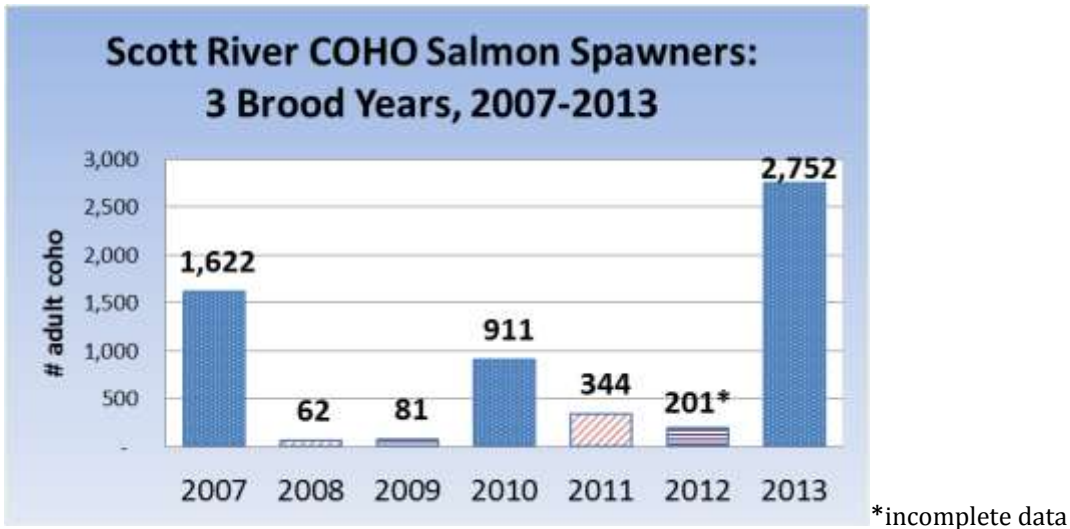


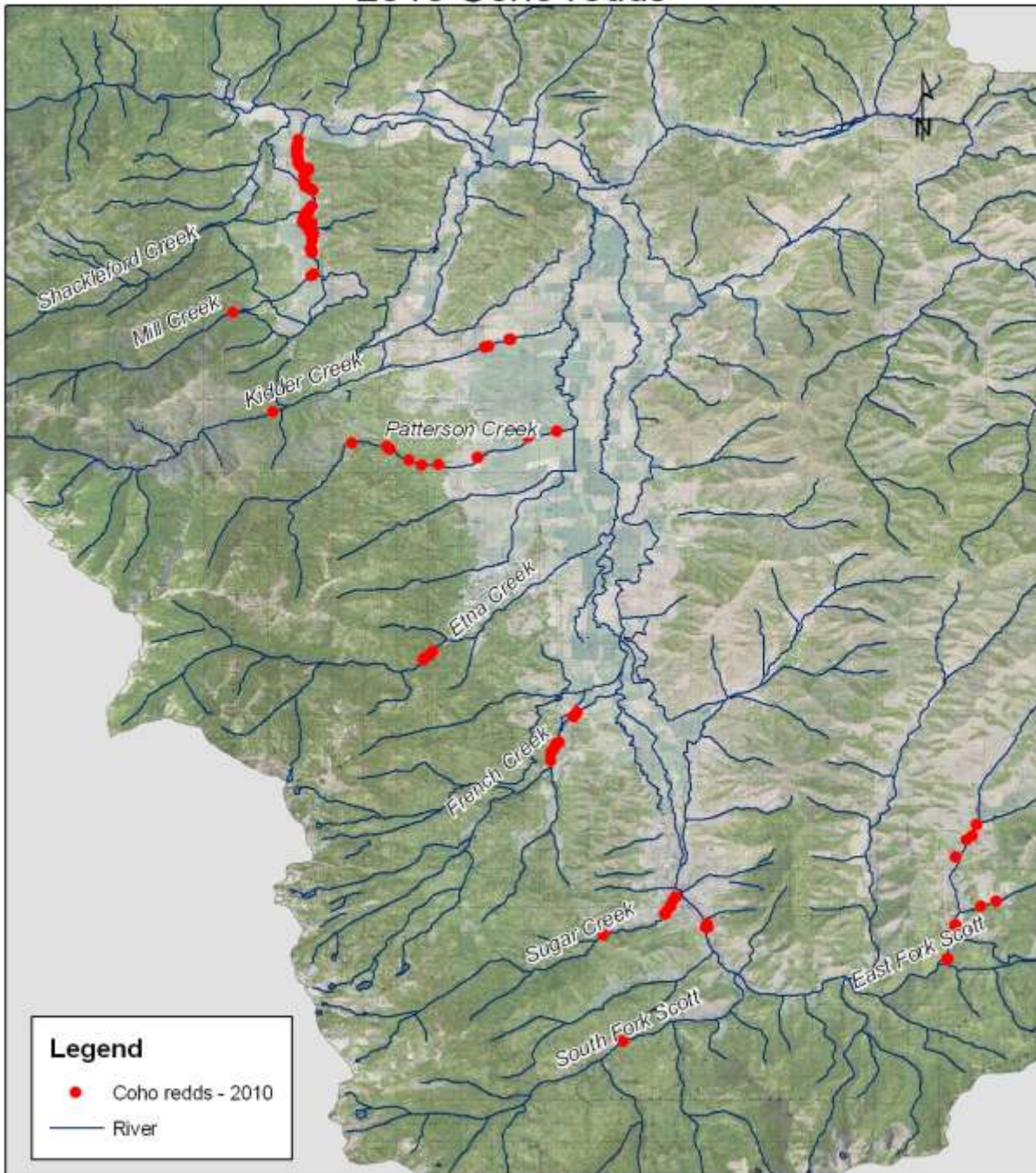
Figure 4. Comparison of 2013-14 coho count with past returns and other brood years (CDFW data).

However, the adult coho spawning ground surveys by the Siskiyou Resource Conservation District (RCD) found that most of the spawning activity – as evidenced by redds, carcasses, and live fish -- was unusually concentrated in the upper mainstem of Scott Valley since all of the tributaries except two were inaccessible due to low flows, resulting in surface disconnection (Yokel 2014). French Creek was the only tributary open the entire coho spawning season, with Shackleford Creek connecting briefly from November 22-24, 2013. Extreme cold in early December created ice in the channels, possibly impeding passage for a short period. Normally, coho spawners seek the perennial reaches of the western tributaries as well as the East Fork Scott River, as documented in the 2010 survey shown in Map 2 (Yokel 2011). Stream disconnection during the 2013 coho run prevented spawner access into their natal streams of Kidder Creek, Patterson Creek, Etna Creek, Sugar Creek, and the South Fork and East Fork of the Scott River until after Feb. 14, 2014.

With the tailings reach dry and blocking upstream passage, the highest concentration of spawning - - 83% of the 354 redds counted -- were documented from the tailings downstream to below Etna Creek (between RM 52 and about RM 40) (Yokel 2014). Another 12% of the identified redds were found in the reach between Shackleford Creek (RM 24.7) and the end of the valley (RM 22.4), with only 9 redds found in French Creek and 2 in Shackleford Creek. Results of the 2013 Scott River coho spawner surveys by the RCD and CDFW are depicted in Map 3, for comparison to Map 2 for the same brood year. Thus, it was the upper reach of the Scott River that became the focus of the 2014 juvenile coho rescue and relocation effort.

Map 2. 2010 distribution of the Scott River coho spawning sites & origin of the 2013 adults.

Scott River coho redd distribution 2010 Coho redds

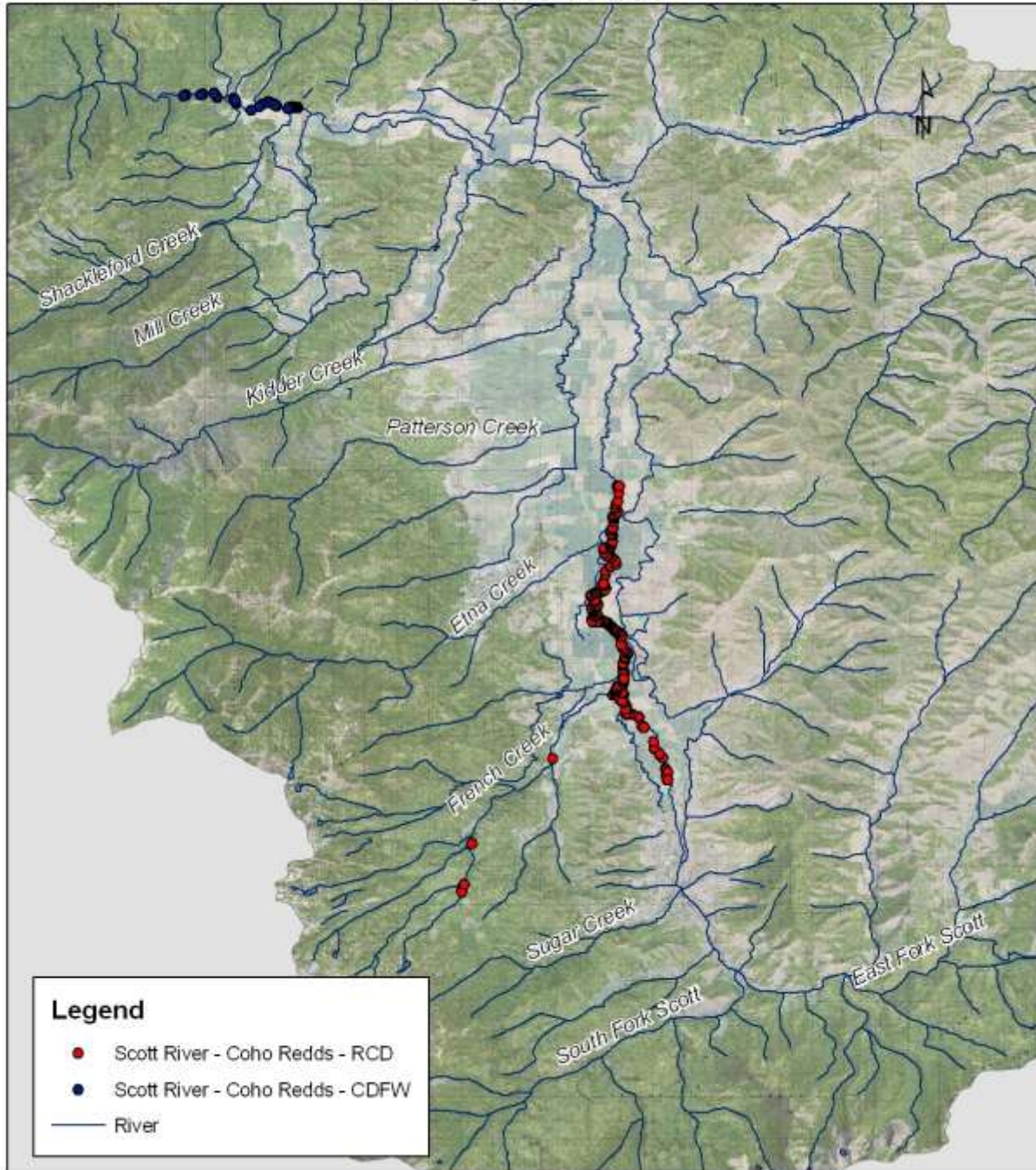


Cartography Siskiyou RCD - 6/9/2015
Coho Redd Data collected by Siskiyou RCD
and Cal. Dept. of Fish and Game

0 1 2 4 Miles

Map 3. 2013 distribution of Scott River coho spawning sites: same brood year as 2010.

Scott River coho redd distribution 2013 Coho redds



Cartography Siskiyou RCD - 6/9/2015
Coho Redd Data collected by Cal. Dept. of Fish and Wildlife
and Siskiyou RCD

0 1 2 4 Miles

C. Governor's Drought Proclamations

On January 17th 2014, Governor Brown proclaimed a State of Emergency to exist in California due to severe drought conditions. State agencies were directed to pursue water conservation and other related actions, with CDFW directed to "evaluate and manage the changing impacts of drought on threatened and endangered species." When low water supplies, reduced flows and poor snowpack persisted and challenges became more urgent, the Governor issued a Continued State of Emergency Proclamation on April 25th. Both the California Department of Water Resources (CDWR) and the State Water Resources Control Board (SWRCB or State Water Board) were ordered, among other actions, to enable voluntary movements of water, such as water transfers and forbearance agreements. CDFW was specifically directed to:

"...work with other state and federal agencies and with landowners in priority watersheds to protect threatened and endangered species and species of special concern and maximize the beneficial uses of scarce water supplies, including employment of voluntary agreements to secure instream flows, relocation of members of those species, or through other measures." [underline emphasis added]

In addition, environmental review under the California Environmental Quality Act (CEQA) was suspended for actions called for in the proclamation to allow them to quickly take place.

D. Curtailment of Water Rights by State

On the same day as the Governor's first Emergency Drought Proclamation, the State Water Board issued a statewide public notice of surface water shortage and the potential for curtailment of water rights in California (SWRCB 2014a). On January 22nd, it followed up with a specific notice to junior water right holders under the Scott River Decree regarding their potential curtailment (SWRCB 2014b).

With drought conditions prevailing over the next four months, the State Water Board sent out on May 16th curtailment notices to junior water right holders in the Scott River watershed "*to protect the senior [instream] water rights of the U.S. Forest Service as identified in Scott River Adjudication Decree No. 30662. The priorities of the junior class water right holders have been determined by the Superior Court of Siskiyou County and were identified as either Surplus Class rights, Post-1914 water rights in Schedule E, or junior priority rights in Schedule D4*" (SWRCB 2014c). Affected Scott Valley water users were directed to immediately stop diverting during the irrigation season and submit a Curtailment Certification form within 7 days. SWRCB's Division of Water Rights had enforcement staff perform field checking and found no violations (Kevin Porzio, pers. comm.). Those water users with riparian, pre-1914 or groundwater rights or those under the separate French Creek and Shackelford Creek decrees were not affected by the curtailment. Diversions for stockwater use and domestic use are considered first priority rights under the Decree and were also unaffected.

With higher flows anticipated at the end of the year, the State Water Board issued another notice on Dec. 3rd, "*temporarily lifting the water right curtailment for junior priority class rights in the Scott River watershed ...until further notice*" (SWRCB 2014d). By December 5, 2014, the gage was at 550 cfs with the river peaking over 3,000 cfs by 12/12. The U.S. Forest Service's instream 1st priority

right, as interpreted in paragraph 45 of the Decree, is for 426 cfs for December thru May and drops down to 77 cfs in August and 62 cfs in September (SWRCB 1980).

II. Coho Rescue and Relocation in the Scott River: Background

A. History of Fish Rescue in Scott Valley

A number of anadromous fish-producing tributaries of the Scott River and sections of the upper mainstem Scott River lose surface flow connectivity at some point in the spring to mid-summer period of many years and especially during droughts. This seasonal loss of connectivity is likely due to a combination of natural and artificial factors: low rainfall and snowpack, alluvial fan deposits, highly disturbed channels from past mining activities, a declining water table, and irrigation water demand. The actual date an individual stream or stream section disconnects is dependent upon annual rainfall and snowpack, stream location, and irrigation diversion timing and rates. As a result of streams or sections of streams running dry or flowing sub-surface, juvenile anadromous fish attempting to rear in this habitat area can become stranded in shallow, isolated pools where elevated water temperatures, depleted dissolved oxygen, and predation may inflict heavy mortality.

Fish rescue from these inhospitable habitats, and relocation into better habitats, has been carried out on a generally consistent basis by CDFW for the purpose of trying to increase survival of this vulnerable, early life stage of coho salmon and steelhead (*Oncorhynchus mykiss*). These species must spend their first one or two years, respectively, in fresh water before migrating to the ocean. Salvaged fish also include, to a much lesser extent, juvenile Chinook salmon (*O. tshawytscha*).

Since 1951, CDFW Yreka Screen Shop personnel have set inclined plane traps (also called McBain traps) near the downstream extent of wetted channels and pool to collect fish that are attempting to emigrate, either upstream or downstream, but that will likely perish as the water recedes. The salvaged fish, primarily young-of-the-year (age-0), are routinely transported in an oxygenated, temperature-controlled tank to accessible release sites. Poor water years sometimes require salvage effort to begin as early as May, whereas in exceptional water years, fish salvage is reduced and occurs later in the season, or is abandoned entirely. Between 1993 and 2012, the number of coho rescued by CDFW has annually ranged from 0 to 30,182 (2008), for a total of 82,349 rescued coho during that 20 year period (CDFW 2013).

In the past, fish rescued early in the year were released downstream of the mouth of the tributary where captured and when water temperatures were still suitable. Later in the summer as the water temperature increased, fish were released farther downstream. The lower Scott River (canyon reach) typically will become too hot to provide adequately cool water temperature for rearing salmonids except at localized refugial areas or cold water inputs from tributary streams or seeps. Consequently, late season releases entailed placing salvaged fish into the lower reach of Canyon Creek or the Kelsey Creek spawning channel. Fish recovered from the upper mainstem Scott River in the dredger tailings reach have been moved to Grouse Creek, a cold water tributary to the East

Fork Scott River, a few miles upstream. Recently, some rescued fish were moved upstream to perennial streamflow in Kidder and Shackleford creeks.

B. CDFW Policy and Procedures on Fish Rescue

As defined by CDFW, “fish rescue” is an action taken to remove finfish from habitat, which is or will soon be unsuitable, and to relocate those fish either to more suitable habitat, an interim holding facility, or a permanent artificial environment (CDFW 2013). Fish rescue operations have gained interest and criticism in recent years following the listing of coho salmon as threatened under federal and state Endangered Species Acts. The decision to relocate fish found in deteriorating or unsuitable habitat serves to allay the negative public perception regarding the death of fish that are, by measure of the regulatory environment and resources expended on their behalf, extremely valuable. Others contend that fish rescue/salvage operations may be having a negative effect on juvenile fish already rearing in the receiving waters if the added density results in increased competition and stress for space and food. The opposing argument is that salmonids are naturally fecund species with a high number of eggs and natural mortality of juvenile fish in excess of the available habitat is normal when adult spawner escapement is adequate. Proponents of this premise sometimes also contend that the limiting factor is fresh water rearing habitat for the juvenile life stage during the summer months and that stranded fish are a product of habitat loss due to water development and use, not a natural situation.

To address these and other related issues, the CDFW Director adopted its “Policy and Procedural Guidance for Fish Rescue” in 2013. Before any fish rescue effort can begin, the agency’s Regional Manager, in consultation with others, must approve a request to rescue fish, which includes an assessment of the conditions observed and the need and urgency of the effort. The decision needs to determine if the “probable benefits of fish rescue are reasonable when balanced against other factors” and also must be documented in a memorandum to responsible parties. Upon completion, the rescue’s procedures and results are also to be reported. The Policy is consistent with an interagency anadromous fish rescue agreement with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service later adopted in April 2014.

III. Analysis and Coordination

As mentioned above, the Scott River supported a record adult run of at least 2,731 coho salmon in the 2013-14 spawning season, as measured at the Scott River Fish Counting Facility (aka “video weir”) operated by CDFW at river mile 18 (rkm 29) (Knechtle and Chesney 2014). A very large number of progeny, estimated at between 1 to 2.8 million emergents, were produced from this significant adult run that spawned in a relatively limited reach of the river. Anticipation of diminished surface flows during the spring and summer of 2014 due to severe drought conditions helped crystalize emergency fish rescue and relocation efforts.

A. Who was Involved and Why

Spurred by concerns of large-scale juvenile fish stranding in the Scott River and voiced by the SRWT and RCD, initial coordination meetings occurred with CDFW on Jan. 22 and Feb. 12, 2014. Beginning on Feb. 26th, weekly or biweekly meetings or conference calls were held among a working group of agency, nonprofit, private, and tribal interests. The primary objective was to coordinate and strategize on a concerted effort to best respond to the anticipated stranding of juvenile salmonids migrating and rearing in the spring and summer. The group worked together to ensure that efforts to provide additional instream flows were pursued, while developing and debating the merits of ways to rescue and relocate large numbers of stranded juvenile fish, focusing on coho salmon.

Organizations involved in the Working Group included: California Department of Fish and Wildlife , Scott River Water Trust; Siskiyou Resource Conservation District; U.S. Forest Service - Klamath National Forest (KNF); Karuk Tribe; and NOAA Fisheries.

The coho salmon in the Scott River are part of the federal Southern Oregon/ Northern California Coasts (SONCC) evolutionarily significant unit (ESU) of this species. Under the federal and California Endangered Species Acts (ESA/CESA), the Klamath River coho populations are listed as “threatened”. Both CDFW and NOAA Fisheries are required to respond to the impending stranding and death of a listed species to protect their numbers and health. However, landowners and others are vulnerable to accusations of illegal “take” of a listed species if their activities are seen to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (ESA) or “ hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill” (CESA).

Water users and ranchers along the Scott River were quite concerned that a potentially large fish kill could occur unless a major rescue effort was made to relocate the juvenile coho to habitat with better water conditions. Additionally, considerable restoration work has been performed in the watershed over the past several decades to improve stream habitat, especially for the listed coho salmon (e.g., www.siskiyoucd.com/projects). The Scott Valley community wanted to see these young fish survive, setting aside any political differences (Hinds-Doyle 2014).

B. Legal Provisions Guiding Rescue Actions of the Agencies Involved

Developing drought conditions in early 2014 ultimately triggered a statewide response to the potential for disastrous consequences for fish. An “Interagency Anadromous Fish Rescue Strategy” was jointly agreed to by NOAA-Fisheries (West Coast Region California-based offices), the U.S. Fish and Wildlife Service (Pacific Southwest Region), and CDFW on April 17, 2014, based on a previous agreement from May 2009. This new Interagency Strategy addresses anadromous fish rescue coordination from 2014 through 2019. It acknowledges that continuing drought conditions affecting many regulated rivers and artificial systems in California require fish rescue planning and implementation as a last resort, to provide the best opportunity for fish survival. As a last resort strategy, the agreement stresses that fish rescue should not preclude or hinder the correction of underlying land and water development problems that might be causing or contributing to the isolation or stranding of fish. The agreement also stipulates that relocated fish should be placed in proximity to their current distribution and range, to minimize the risk of vectoring disease and/or increasing competition with resident fish. In exceptional cases, and with interagency consultation, fish may be trans-located to recovery facilities or placed outside of their current distribution/range.

The 2014 Interagency Anadromous Fish Rescue Strategy accords with Section 7 ESA regulations (50 CFR §402.05): emergency provisions for situations involving acts of God, disasters, national defense or security emergencies, etc. . The ESA also provides exemptions to the section 9 take prohibitions for fish rescue and salvage activities via 4(d) rule Limit Number 3 Rescue and Salvage Actions (50 CFR §223.203(b)(3)) for threatened salmon and steelhead. Therefore, under the existing section 4(d) rules, the federal ESA does not affect CDFW's statewide authority to rescue or salvage anadromous fishes that are listed species under the ESA. CDFW holds a section 4(d) permit under the ESA to cover rescue work. In addition, the California Fish and Game Code section 2081.a. provides for allowed take of listed species for research and management purposes, including fish rescue activities.

C. Coordinated Strategy

The Working Group began discussions in late January 2014 about the issues, objectives, and methods to be used for the cooperative effort. By February, an initial strategy, “Drought Planning and Potential Need to Relocate Juvenile Salmonids”, had been drafted by CDFW for others to comment upon, with a second draft prepared in April. Anticipating extremely low summer surface flows, concern initially focused on improving capacity, through natural or artificial means, for: (1) outmigration by age-0 Chinook, age-1 coho, and age-1 and age-2 steelhead; and (2) access to perennial summer rearing habitat for age-0 coho and age-0 and age-1 steelhead. As flow scenarios deteriorated by early May, the focus shifted to enabling age-0 coho to successfully rear in identified suitable locations.

At least 6 initial options for relocation sites were identified (in order of priority):

1. Relocate fish within the source tributary, from the lower reach to an upper perennial reach;
2. Relocate fish from the Scott River mainstem to suitable sites upstream (mainstem or tributaries);

3. Relocate fish downstream in the Scott River, either in tributaries with suitable conditions or in the mainstem (canyon reach) to allow them to choose where to go;
4. Relocate fish to downstream Klamath River tributaries;
5. Relocate fish to the Shasta River into suitable habitat;
6. Move fish to a captive holding facility – Iron Gate Hatchery (IGH).

The benefits and risks of each of the six options above were discussed: the first three options were generally supported, with options 4 and 6 considered as potential options if the priority options were insufficient to meet the needs. CDFW decided that moving Scott River fish to the Shasta River was not advisable and this option was not further considered.

Fish rescue and relocation efforts would need to be based on current and potential flow and water temperature conditions in both the rescue and relocation sites. Additionally, fish would only be relocated to areas where existing densities of juvenile salmonids were either absent or low enough to be able to support additional fish. Regular assessments of juvenile salmonid density were recommended where spawning occurred, in potential relocation sites, and in actual relocation sites. The timing of trapping and relocation operations was to be dependent on the assessment of habitat conditions.

Besides the rescue/relocation action, several potential flow scenarios involved the use of water leases by SRWT to help maintain the spring flow as long as possible for outmigration of juvenile salmonids from the river, as well as allow age-0 fish to find suitable rearing areas on their own volition, and to help sustain suitable summer rearing conditions in the relocation sites. Due to time constraints, a final strategy was not agreed upon by the Working Group before action became necessary.

D. Landowner Agreements and Assurances

A critical part of organizing the juvenile coho monitoring and relocation effort was the development of state and federal legal assurances for Scott Valley landowners. As it became clear that the strong run of coho salmon would be primarily limited to an approximate ten-mile reach of the Scott River due to critical drought conditions, representatives from SRWT initiated discussions with personnel from CDFW and NOAA Fisheries to develop an approach that would allow for monitoring and relocation work to be completed in-stream during the low flow period of 2014. In order to achieve this, an option had to be developed that offered legal assurances for “take” under ESA and CESA for landowners who were willing to participate in the process.

Beginning in March of 2014, representatives from SRWT, CDFW and NOAA Fisheries began meeting with eight Scott Valley landowners, whose property contained the majority of coho spawning sites, to discuss their willingness to participate in the developing juvenile coho monitoring and relocation effort. All eight landowners were very open to the idea of allowing a large-scale effort to take place on their properties. However, they all shared general concerns about letting regulatory personnel on their land knowing that coho juveniles were at risk regardless of any intervention. Ultimately, these landowners agreed to allow juvenile coho monitoring and rescue to proceed on their properties as long as they had guarantee of state and federal protection against ‘take’. They also

requested legal protection that would stem from any third party lawsuits, which was not possible for the agencies to provide.

In April the assurances, in the form of a CESA Memorandum of Understanding (MOU) from CDFW based on Fish & Game Code section 2081(a), were agreed upon but were only applicable as long as the respective landowner was operating under a defined set of Best Management Practices (BMPs). Assurances from NOAA Fisheries were in the form of a Voluntary Drought Agreement between NOAA and the landowner. It provided for “special consideration” should issues related to impacts to coho arise during the rescue process, if the same BMPs were followed. Both CDFW and NOAA Fisheries officially announced this framework as their “Voluntary Drought Initiative” to protect salmon and steelhead on May 14th (CDFW 2014).

The assurance process expanded to encompass coverage for landowners who were willing to have salmon relocated to their property, and these assurances—like those for the mainstem Scott River—operated under the condition of BMPs, though different in content. In all, a total of 11 landowners covering rescue or relocation sites signed the CESA MOU (CDFW 2014) and the NOAA Voluntary Drought Agreements. The successful conclusion of this process proved to be a fundamental contribution to implementing the Scott River’s emergency juvenile coho monitoring and relocation effort.

It should be noted that one major landowner did not sign the MOU due to disagreement on the conditions of the BMPs and suggested a Safe Harbor Agreement instead. Due to time constraints, this request was not feasible (Bonham 2014a). As a result, this large landowner’s permission was not granted to potential relocation sites on property that extended across the middle elevations of about 5 tributaries that are known coho rearing areas.

E. Water Lease Transactions by the Scott River Water Trust

In 2014, the Scott River Water Trust focused all of its efforts on providing instream flow to assist with the emergency juvenile coho monitoring, rescue and relocation effort. It worked in close coordination with field crews from CDFW and the RCD to coordinate water transactions that would augment stream flow in the most critical locations within the Scott River mainstem and tributaries to allow for better migration access, increased rearing habitat, or improved instream conditions until rescue/relocation crews were able to access the respective sites. Emergency funding from several non-governmental funders was obtained which allowed for better pricing incentives and more transactions.

Spring Transaction: Farmers Ditch Company

Water leasing during the spring months has never been a critical need for the Water Trust -- until the extreme drought of 2014, when snowpack was nearly absent on April 1 (USFS 2014). Located within the highly disturbed tailings reach of the upper Scott River, the Farmers Ditch Company’s spring transaction at river mile 55 (rkm 88) was for two-thirds of the decreed water right of 30 cfs 1st priority (pre-1914 appropriative right). On April 30th, the leased amount of surface flow began at 19.8 cfs and declined proportionally as the river’s water supply naturally decreased (Table 1).

A primary function of the Farmers Ditch transaction was to allow for the outmigration of any age-1 coho (as well as age-1 steelhead) rearing above the tailings reach of the Scott River and to allow for upstream migration of age-0 coho that would otherwise have had extremely limited migration access to sustainable habitats due to drought conditions. Though it is impossible to know how many age-1 juveniles benefited from this transaction, we do know that this lease was effective as very few age-1 coho were subsequently identified through dive surveys above the tailings reach after the river disconnected in early June. Furthermore, several thousand age-0 coho were observed in and around the mouth of Sugar Creek (RM88/rkm 54), which is near the Farmers Ditch point of diversion. Since adult coho were not able to access this upper portion of the river through the tailings reach during the 2013-14 spawning season, the presence of juveniles in this area indicated that the water transaction was effective in assisting age-0 coho upstream migration.

Flow monitoring efforts specific to the Farmers Ditch lease included weekly coordination with the company's ditch tender to validate leased flows, as well as downstream flow monitoring, which was conducted by SRWT for the purpose of validating the distance of leased flow in relation to water supply. Measurements were taken at four different locations on a near weekly basis including three in-stream locations and one staff gauge reading within the Farmers Ditch canal (Map 4). Monitoring sites F1, F2 and F3 were used to validate leased water and non-leased water at the transaction location, while another monitoring site was established 1.6 miles downstream, within the most problematic reach of the Scott River for flow connectivity, to monitor the effectiveness of leased flows through this section.

Additionally, direct observation was used at various points along the Scott River mainstem to gauge the overall zone of benefit during various stages of the transaction. SRWT confirmed that, during the height of the water transaction, leased flows were observed approximately 7.1 miles downstream to the Scott Valley Irrigation District diversion point at river mile 47 (rkm 75). Fisheries monitoring was conducted by CDFW and the RCD at various points along the lease's 7.1-mile zone of benefit. As is consistent with coho spawning access in 2014, high coho densities were observed at the downstream end of the transaction's zone of benefit. The lease ended on June 6th, shortly before the reach above became dry.

Table 1. Spring 2014 transaction by the Scott River Water Trust

Stream / Tributary / Diversion No.	Date Began	Date Ended	Flow Leased Range (cfs)	Volume Leased	Max. Distance of benefit
Scott River #183	Apr. 30	June 6	Approx. 2/3 of water right	3,350 acre-feet	37,488 ft.
TOTAL	1 lease	37 days	19.8 cfs – 5.8 cfs	n/a	7.1 mi.



Map 4. Location of Spring water lease and monitoring sites at Farmers Ditch Company (rkm 88)

Summer Transactions: Mainstem Scott River and Tributaries

During the course of the summertime transaction period, SRWT completed two transactions on the mainstem Scott River, eight within the French Creek drainage and two within the Sugar Creek drainage for a total of 12 transactions. The total amount of water leased during this period was 766.4 acre-ft., which augmented in-stream conditions for at least 16.55 river miles (Table 2). Furthermore, all transactions were implemented in a manner that provided optimal benefit to both

rescue and relocation sites. This 2014 volume was the most that SRWT has leased since it began operations in 2007.

SRWT employed a standard monitoring protocol at each transaction location that tracks water lease amounts (in cfs) on a weekly basis, as well as temperature and salmonid presence (Thamer 2015). Flow and temperature data were collected by its monitoring contractor and used to gauge the overall benefit of each transaction. Fish monitoring was conducted on a sustained basis by CDFW and RCD personnel for the purpose of maintaining continuity during the entire 2014 monitoring and emergency relocation effort.

Table 2. Summer 2014 Lease Transactions by Scott River Water Trust

Stream / Tributary / Diversion No.	Date Began	Date Ended	Flow Leased min-max (cfs)	Est. Volume Leased (acre-feet)	Habitat Distance of benefit (feet)
French Creek					
#20	June 30	Sept. 30	0.58	106.7	7,000
#23	Sept. 10	Sept. 30	0.5	20	7,000+
#33 – Miners Ck	June 18	Sept. 30	0.3-0.6	83.2	7,000
#36 – Miners Ck	July 9	Sept. 30	0.25	41	2,500
#43	July 3	Sept. 30	0.25-1.0	97.9	1,200
#47A	July 1	Sept. 30	0.3-0.9	69.2	4,930
#48	June 16	Sept. 30	0.3-0.76	99.6	5,050
Sugar Creek					
#173A	July 1	Sept. 30	0.2-1.3	49.7	17,400
#173B	July 1	Sept. 30	0.27	13.2	5,000+
Scott River					
#196	July 11	Oct. 15	0.46-1.3	97.9	11,880
#223B	June 30	July 23	2.0	88	18,400
TOTAL	11 leases	20 to 106 days	0.20 to 2.0 cfs	766.4 acre-feet	87,360 ft. 16.6 miles

IV. Action and Assessment

Between June 3rd and August 19th, 2014, an estimated 116,000 juvenile coho from the Scott River watershed were rescued from unsuitable habitat and safely relocated to suitable habitat. CDFW's Director has called this "the largest rescue effort of coho salmon in the Department's history" (Bonham 2014b). Even national TV – ABC Nightline – came out to film the rescue and relocation activities (ABC 2014). How this effort was carried out on the ground and what transpired in the stream is the topic of this chapter.

A. Project Area

The focus area of the juvenile coho rescue effort was essentially determined by the major spawning locations of the adults during the previous November-January (Map 3). As the leader of the 2013-14 coho spawner survey in Scott Valley, the RCD offered the following description of these areas (Magranet 2015):

In late November 2013, flow conditions only allowed adult coho salmon to access Shackleford and Mill Creek for approximately two days (Yokel 2014). From then through mid-February, French Creek was the only tributary accessible to salmonids. As a result coho spawning was confined primarily to the Scott River mainstem, which created temporal and spatial overlap of Chinook and coho spawning. Surveyors along the Scott River documented a total of 354 coho redds, with heavy superimposition observed including coho redds layered on top of Chinook redds. The majority of coho spawning (82%) occurred in reaches 12 through 15 (rkm 63-80), with another 13% documented in Reach 8 (rkm 33-39). Although French Creek was connected to the Scott River throughout most of the spawning season, low flows and the resulting partial passage barriers generally prevented salmon from spawning anywhere other than the lower 0.5 kilometer of French Creek.

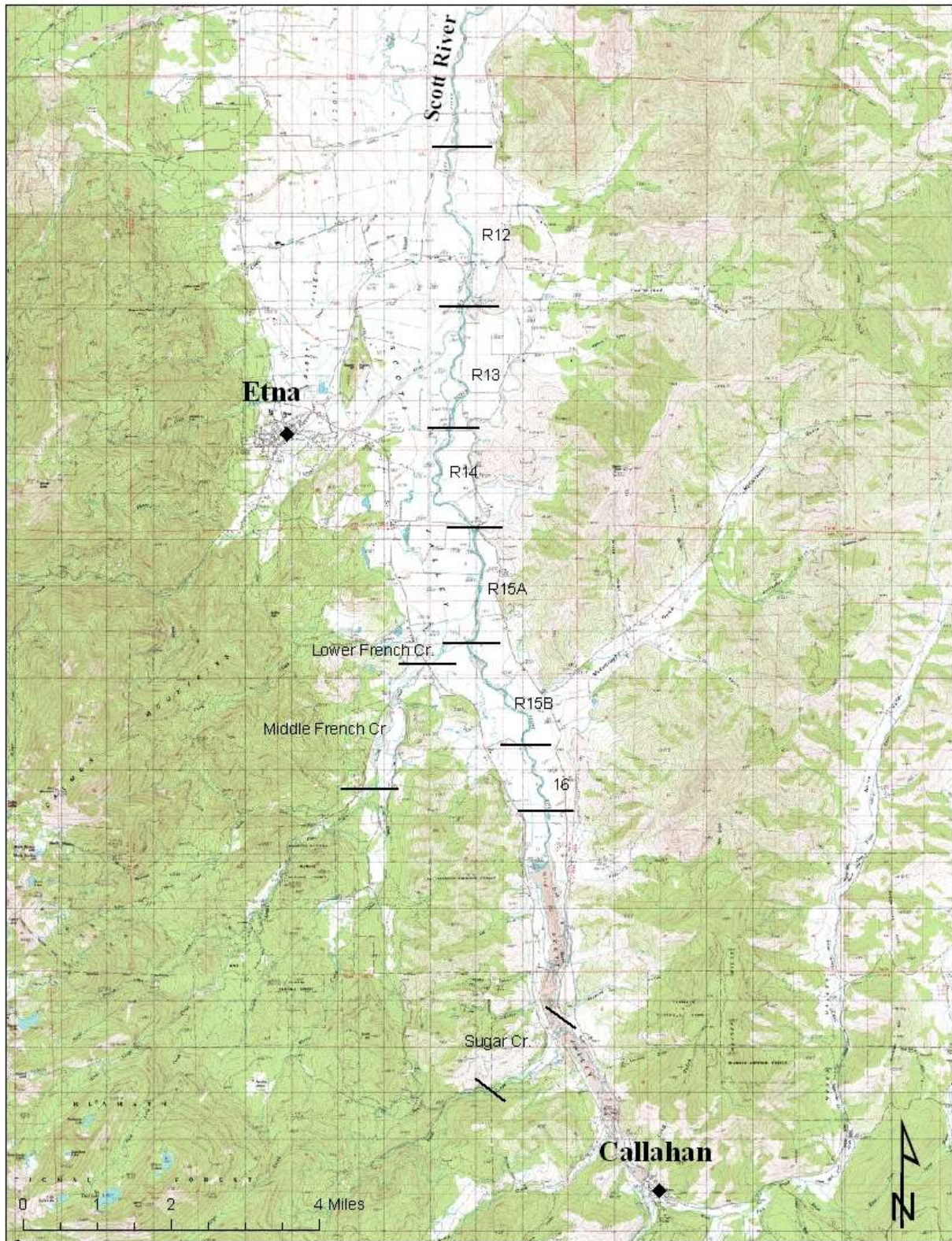
It was this middle to upper section of the mainstem Scott River, reaches 12 through 16 from below Etna Creek up to the dredger tailings, which became targeted as the project area for rescue (Map 5). However, an early step in the process required that potential relocation sites be identified before any rescue could begin. The relocation focus expanded the project area to primarily encompass the western portion of the Scott River watershed.

B. Identifying and Evaluating Potential Relocation Sites

Due to its familiarity with coho spawner locations in previous years, the RCD drew up an initial list of reaches where coho were known to reproduce. A table of the 2010 coho spawning distribution, which represents the natal streams of the 2013 run, showed 25 reaches within a total of 15 different tributaries. Certain stream reaches were recommended as quite suitable in 2014 for coho rearing: South Fork, Sugar Creek, French Creek, upper Kidder Creek, and Shackleford Creek. The remaining reaches needed to be evaluated for their habitat suitability under drought conditions. Other factors needing assessment were CDFW truck and equipment access to potential relocation sites and landowner approval.

To identify potential relocation sites on U.S. Forest Service administered land, Klamath National Forest staff started first with the extent of coho salmon Critical Habitat (CH) in the Scott

Map 5. Monitoring reach boundaries within Project Area (RCD map).



River watershed, as officially designated by NOAA Fisheries. KNF staff explored any sites within CH that were likely to have perennial flow and suitable habitat conditions for juvenile salmonids (given the drought conditions). Sites were evaluated with the following priority: 1) reaches upstream of Scott Valley that typically have spawning/rearing of coho but were not occupied due to low flows, and 2) rearing habitat in canyon tributaries where current densities of fish were sufficiently low.

The KNF Fisheries Program staff identified twelve potential locations within the National Forest that could receive rescued fish with no further coordination. Sites were prioritized if they:

1. were within reaches where coho salmon presence had been previously documented, and
2. had proximity to mainstem spawning grounds where rescued juveniles originated, as every attempt was made to move fish to relocation sites nearest to their location of capture.

Criteria used when selecting relocation sites included:

- general tributary condition;
- stream flow, with perennial, cold water;
- habitat type and gradient known to support coho rearing;
- the length/ of stream that would be available to relocated fish throughout the remainder of the summer/fall low flow season;
- fish transport truck and equipment accessibility.

The first round of sites that were selected for preliminary investigation were all within the KNF boundary on the following tributaries of the Scott River: Etna-Mill Creek, French-Duck Lake Creek, East Fork-Grouse Creek, South Fork Scott River, and Canyon Creek. In early May, CDFW and RCD crews visited these sites to evaluate habitat conditions (Adams 2014c). With the exception of Canyon Creek, these surveys included a flow measurement, deployment of a temperature logger, photographs of the site, and a snorkel survey to assess existing fish abundance and diversity (USFS 2014; Miller 2014). CDFW staff responsible for trucking and releasing fish visited the sites to assess accessibility for fish transport equipment and general stream conditions. Based on the data collected during these visits, each of these tributary reaches was determined to be suitable for receiving relocated coho and did eventually receive them.

A second round of potential relocation sites were evaluated subsequently, which led to the selection of one additional site within the KNF - Kelsey Creek, as well as private property on Sugar Creek (rkm 1.15 and 2.5) and French Creek (rkm 2.9 and North Fork). Portions of Reach 16 (rkm 81) of the upper mainstem Scott River, where favorable flows and water temperatures were documented, became an additional option. Wildcat Creek was also suggested by the RCD after field checking but was not selected. Several other potential stream reaches were visited by KNF biologists but were rejected for not meeting the criteria, including: East Fork tributaries of Rail Creek, Cabin Meadow Creek, Big Mill Creek, Crater Creek, Little Houston Creek, and the East Fork; and South Fork's tributaries of Boulder Creek (including East Fork) and Fox Creek (Miller 2014).

C. Monitoring of Rescue Reaches

The “Scott River Juvenile Coho Rescue and Relocation Monitoring Report: 2014 Drought”, prepared by the RCD, provides a comprehensive description of the juvenile salmonid use and habitat conditions in the Scott River Basin during the project effort (Magranet 2015). Recurring monitoring estimated fish numbers at potential rescue sites and was used by the Working Group to plan and then execute coho rescue and relocation efforts. This information also helped guide the leasing of surface water by the Water Trust during the spring and summer of 2014 in reaches where augmented surface flow provided the maximum benefit to rearing salmonids (see section 3-e for details.)

Monitoring Juvenile Coho Distribution & Abundance Surveys

Juvenile coho salmon population distribution was approximated from snorkel surveys, which were begun in early May by CDFW and RCD. Surface and underwater photo and video documentation was included. At that time, most age-0 coho were found to be in the 35-45 mm size, though newly emerged and larger (>50 mm) were also seen (Adams 2014a, b). It was not clear whether those around 70 mm were age-0 or small age-1 coho, with the latter age generally estimated to be around 100-150 mm. Size variation could be related to the fact that coho spawning was documented over a three month period.

The age-0 coho appeared to be concentrated in slow moving water associated with woody debris along the stream bank and also on grassy benches in shallow water adjacent to gravel riffles. With a very high number of fish initially present, the snorkel observations were able to only provide a rough estimate of the number of fish in each reach. In addition to age-0 coho, approximately 100 age-1 coho, 32,460 age-0 Chinook, and 15 adult steelhead in four reaches (though older fish may have been undercounted by the snorkel technique) were observed in the early May surveys (Adams 2014b).

As mainstem Scott River surface connectivity became compromised, fish became restricted to limited reaches of the river and isolated pools (Magranet 2015). Dive surveys were undertaken, along Reaches 12 through 16 of the Scott River (rkm 63 through 82) and French Creek, to determine juvenile salmonid distribution, abundance, habitat utilization, and species diversity. Salmonid densities were calculated by dividing the number of young-of-the-year salmonids observed (all age-0 coho, Chinook and steelhead trout) by an estimate of the reach length determined from a path drawn between coordinates which were input into Google Earth.

Table 3. Snorkel survey counts of juvenile coho in Scott River mainstem-Summer 2014 (Magranet 2015; Adams 2014d) [ns=no survey]

rkm	Reach #	Early May	June	July	August	September
	12	ns	5,295	2,373	dry	dry
70-73	13	10,170	11,280	18,355	4,300	1,135
73-76	14	63,050	47,810	10,480	7,200	2,450
76-78	15a	36,550	55,680	16,120	5,430	4,160
78-81	15b	8,480	7,380	9,690	11,480	3,025
81-83	16	ns	ns	14,925	16,750	8,700
	Total	118,250	127,445	71,943	45,160	11,640

The numbers of observed juvenile coho by month and reach are shown in Table 3. The estimated population generally declined through time due to several factors: volitional upstream migration, fish rescue efforts moving them out of the reach, and presumed mortality due to predation. No incidents of fish mortality were observed during the snorkel surveys (Magranet 2015).

Monitoring Habitat Conditions in the Scott River

Concern arose as to how much usable, quality habitat would be available to juvenile coho in the mainstem as flows subsided throughout the summer of 2014 (Magranet 2015). Critical questions included:

- Would drought conditions reduce the wetted channel such that fish would be unable to seek suitable habitats for survival and would those remaining habitats support the quantity of fish in them?
- Would ambient stream temperatures reach lethal thresholds?
- Would such low flows reduce dissolved oxygen levels in some pools to a detrimental or lethal extent?

To help assess these questions, certain habitat measurements were collected by the RCD: connectivity between pools, water temperature, pool depth, and dissolved oxygen (Magranet 2015). During April through June 2014 monitoring, water quality was not considered to be a major concern because juvenile coho still had the ability to move freely between habitat units and were able to avoid areas with inhospitable conditions. However, as connectivity became compromised within the mainstem monitoring area, the RCD installed stationary water quality monitoring equipment at six sites, specifically a staff gage for water level and a temperature logger. Handheld dissolved oxygen measurements were also taken at these sites.

The objective was to select a single location from each reach that had the potential to provide for rearing juvenile coho through the summer season and to document water quality parameters at that site. Some of these locations supported populations of coho through the summer, while others could not after becoming isolated and exhibiting a substantial decline in water quality (Magranet 2015). In general, these locations can be characterized as:

- Stable habitats: Monitoring sites above Young's Dam (rkm 75) maintained much more stable water levels which afforded a greater volume of available habitat.
- Unstable habitats: Monitoring sites below Young's Dam experienced much greater drops in water levels, which led to fish isolation and a decline in water quality.

The data were not measured or downloaded often enough to impact relocation priorities established from detailed weekly dive surveys. However, the data served to document some specific instream conditions through the latter part of the 2014 drought. In hindsight, the RCD recommended that the data would be more valuable if it had been collected for a longer period of time so that a broader perspective on the advancement of drought conditions could have been captured (Magranet 2015).

Loss of surface connectivity was first documented within the monitoring areas in early July, although the highly disturbed tailings reach went dry in early June. Several mainstem Scott River

channels below the tailings and above Fay Lane (rkm 81) were disconnected in the first survey of Reach 16 on July 8th. Within the next two weeks, several riffles near the downstream boundary of reach 12 went dry. Between July 22nd and mid-August, the number of dry riffle crests increased dramatically. Only isolated pools were found below rkm 70 (just downstream of Horn Lane), with 23 disconnected riffles between there and rkm 80 (Fay Lane). Mid-August represented the most fragmented time period for the river. During the next month, some of the dry lengths expanded but the number of disconnections changed little. Map 6 depicts the maximum disconnected sections within each monitored reach, as surveyed on Sept. 8-15, 2014.

In fact, some sections re-watered in this period. Possible explanations for this change include: 1) heavy smoke cover from nearby wildfires during late summer suppressed evapo-transpiration which reduced vegetative water demand in the valley and uplands, and 2) an isolated heavy thunderstorm event in August. With a good rain on Sept. 24th, the mainstem Scott River reconnected through the entire monitoring region. However, the river below did not reconnect completely to the USGS gage (rkm 35) until Oct. 25th following several more storms.

A description of each monitoring site and the water quality data collected can be found in an appendix of the RCD's report (Magranet 2015). Below is a summary of conditions found for each key habitat parameter.

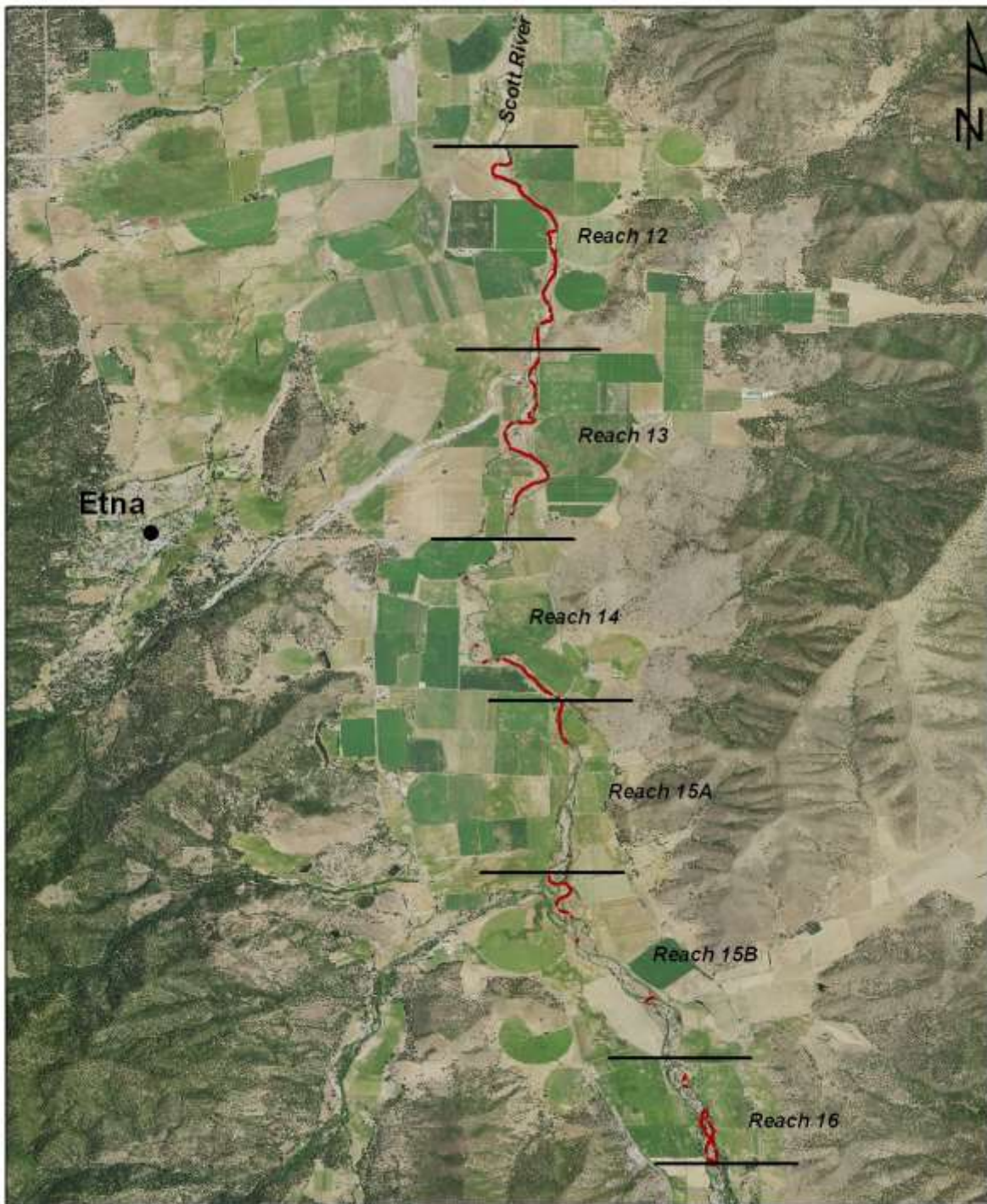
Temperature: On the mainstem Scott River, a variation in water temperatures was found to exist. Two loggers located in well-mixed riffles below French Creek and above Fay Lane recorded maximum weekly average temperatures (MWATs) of 19.79 and 20.73°C respectively and maximum temperatures of 24.07 and 25.21°C respectively. Maximum temperatures were recorded between July 15th and 17th, with MWATs recorded on July 18th or July 19th. There were also habitat units receiving hyporheic flow that exhibited much lower water temperatures. For example, one logger installed in a back-channel pool recorded daily average temperatures between 14.1 and 14.6°C from August through September (after maximum temperatures were recorded through the watershed). Not all locations receiving this type of cold-water seep kept their connection to that source through the summer.

West side tributary water temperatures at the relocation sites (Sugar Creek, Duck Lake Creek, Etna-Mill and the South Fork) recorded MWATs from 14.36 (Duck Lake) to 19.41°C (Sugar Creek) with maximum temperatures ranging from 15.63 (Duck Lake) to 22.25°C (Sugar Creek). Grouse Creek, the south valley tributary to the East Fork, had notably higher temperatures with an MWAT of 21.07°C and a max temperature of 24.75°C; however, this data logger may not be representing well-mixed water. All maximum temperatures were recorded on July 17th and all MWATs on July 20th or 21st.

Pool Depths: Relative changes in water level at six sites on the mainstem of the Scott River were monitored from August 4th through October 1st. The three reaches below Young's Dam experienced steady decreases in surface water levels ranging from 1.6 to 3.3 feet in depth lost over 51 days

Map 6. Scott River mainstem's maximum areas of monitored disconnection, 2014 (Siskiyou RCD)

Disconnected Lengths of the Scott River Mainstem



Cartography Siskiyou RCD - 6/10/15
Surveys completed by the Siskiyou RCD
September 8th - 15th 2014

0 1.25 2.5 5 Kilometers

(until the first significant rains on Sept 24th). In contrast, surface water levels of sites above Young's Dam remained relatively stable only fluctuating within 0.1 foot over the same time frame.

Dissolved Oxygen (DO): Fluctuating diurnally, dissolved oxygen levels increase during the day because of production by aquatic plants but decrease during the night when plant respiration continues in the absence of photosynthesis. As levels tend to be at their lowest before dawn, collecting DO measurements at this time can provide an understanding of the lower limits experienced at a specific location. Pre-dawn DO measurements were taken in mid-September at two locations on the Scott River Mainstem (Magranet and Chesney 2014).

On Sept. 9th, pre-dawn dissolved oxygen readings were taken along several cross sections of a channel habitat unit at rkm 79 (downstream of Fay Lane). Recorded readings ranged from 3.8 to 6.3 mg/L. The lowest DO readings were found to be in the still water of the associated back-channel pool, which measured 1.6 mg/L in the presence of juvenile salmonids that did not show signs of low DO stress. Water temperature ranged from 14.7 to 15.2°C. On Sept. 17th, pre-dawn DO readings were taken at several sites within rkm 81 (upstream of Fay Lane). There was a wide variation in readings. A wide shallow channel with visible water flow measured 3.1 mg/L while isolated pools with no visible flow came in at 0.75 to 2.2 mg/L. A pair of pools with potential subsurface water exchange ranged from 2.5 to 3.8 mg/L in the presence of juvenile salmonids. Water temperatures ranged from 16.0 to 17.8°C.

Density – No fixed density limits were used, only the professional judgment of the CDFW fishery biologist in the context of available observations.

Preparing for Rescue

Loss of surface connectivity and deteriorating habitat conditions restrict the ability of fish to move in response to environmental cues in the mainstem Scott River. Some fish were restricted to single pools, while others maintained access to several river kilometers over the entire summer. However, even access to many contiguous river kilometers of habitat may not ensure conditions suitable for survival: which include available food, cover and water quality.

As stream conditions deteriorated, both the available quantity and quality of Scott River mainstem habitat were evaluated through near daily direct observation, primarily by the RCD field crew. A spreadsheet entitled "Priority Sites for Rescue/Relocation" was developed to inventory sites for potential rescue, and included the following information: date of observations; reach number; GPS coordinates; habitat type/description; counts of age-0 coho and steelhead; approximate water depth; water temperature; ownership/access details; and other comments or links to photographs. An example of such a completed form can be found in **Appendix B**. This spreadsheet information was sent by e-mail to CDFW-Yreka as soon as available and used by CDFW in making daily decisions about when and where rescue efforts should occur. Updates were given to the Working Group at weekly or biweekly conference calls.

D. Rescue and Relocation Operations

In order to help guide rescue efforts, the following general principles were considered:

Guiding Principles for Rescue Decisions:

- Fish were allowed to disperse and use natural life history strategies for as long as the Scott River was hydrologically connected.
- Adequacy of current and potential habitat volume and stream temperature were based on professional judgment at the monitoring site. Depth and handheld temperature data were of utmost significance to allow for an immediate assessment. Sizeable groupings of salmonids, restricted to small and shallow lengths of stream, were given priority for rescue and relocation.
- Salmonids were sometimes removed out of suitable habitats to reduce the overall density in those areas and provide space for those fish migrating upstream out of less suitable habitats, thereby increasing the overall survival of the remaining fish.
- “Refugial” type habitats proved to be very effective locations to capture large quantities of coho in a short period of time, thus maximizing rescue effort efficiency.

Rescue

Beginning on June 3rd and continuing until August 19th, 2014, CDFW captured juvenile salmonids from the mainstem Scott River and two lower tributary reaches (near mouth of French Ck and Etna Ck) where flows were diminishing or where the amount of habitat available was likely to decline over time as stream flows declined. Weekly or bi-weekly meetings of the Working Group updated and adapted the monitoring plan and rescue/relocation effort, in response to changing conditions including: stream connectivity, relocation site evaluations, and staff availability (Magranet 2015).

Two methods were used to capture fish for relocation: incline plane traps and seines. Incline plane traps (i.e., McBain traps) were installed on two landownerships with five sets of traps and were fished three to five days per week during June and July. These traps are designed to capture any fish moving downstream. Seines were used when flows allowed or in pools disconnected within a particular reach. Rescue site locations were also selected by ease of access for rescue trucks and equipment. Species ID and fish numbers were determined either by direct count or by measuring and calculating the number of fish by total weight and applying the ratio to the total weight during each relocation/rescue. A portion of the captured coho salmon was tagged with passive integrated transponders (PIT). Most of the captured fish were transported in aerated transport tanks filled with stream water, although in many locations a fraction of the PIT tagged coho (14%) were left at their captured site for comparative evaluation of survival at the site. Water temperature in tanks was monitored and de-chlorinated ice added as necessary to cool tank water during capture activities. See Map 7 and Photos 1-8 for rescue sites and methods.

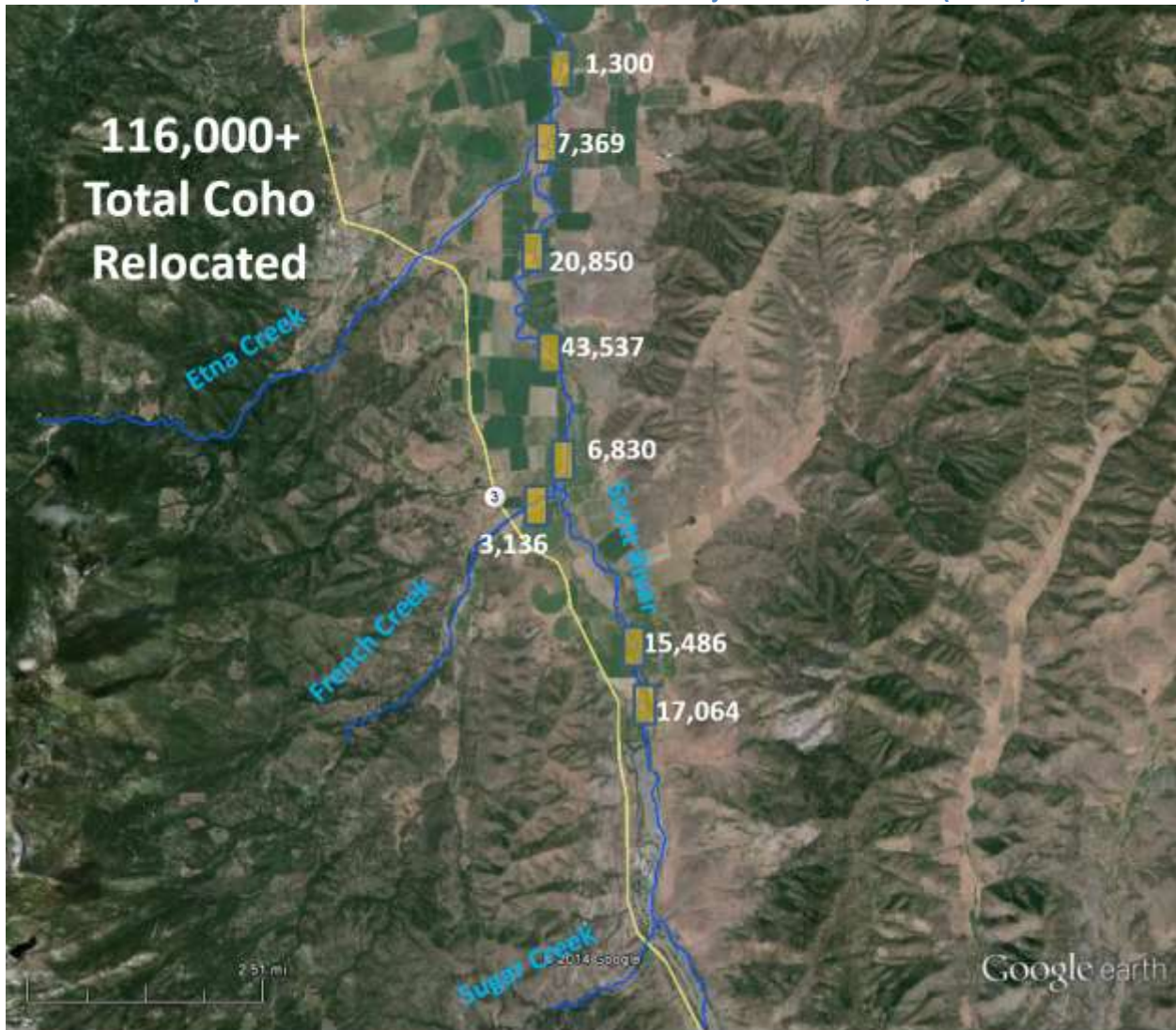
PIT Tagging

When fish were captured, they were placed in ice chests and/or buckets with battery operated aerators. A small number of the fish captured during each event were PIT tagged after they are anesthetized with carbon dioxide and allowed to recover in an aerated bucket or ice chest. Fish

were visually observed to determine when normal behavior resumed. Then they were released at the site of capture or placed into the transport vehicle. Nine-millimeter(mm) PIT tags were used in fish from 60-69 mm in length and 12mm PIT tags are used in fish >70mm. The PIT tags were inserted through a small incision in the abdominal wall and allowed to close. (Photos 9-10.)

Coho salmon held for tagging were measured and weighed. Scale samples were taken with a clean knife blade and scraped from the center side of the fish, above the lateral line. Scales were wiped off the blade with a piece of wax or waterproof paper, then placed in a coin envelope with the PIT tag number, date, length of fish, and capture location noted on the envelope. Tissue samples, when taken, were taken from the tip of the lower caudal fin (approx. 1-2mm x 1-2mm) with sharp scissors, placed on waterproof paper, dried, and placed in the same envelope. These samples were stored at the CDFW Yreka Fisheries office at 1625 S. Main St., Yreka CA 96097.

Map 7. Scott River sites and numbers of rescued juvenile coho, 2014 (CDFW)



During the 2014 emergency rescue-relocation effort, field crews were able to PIT tag 2,640 individual age-0 coho (2,247 for relocation plus 393 for release at capture site), or 2.3% of the total number of rescued coho. When a rescue or relocation event occurred, a portion of the coho salmon was usually tagged with individually coded PIT tags. At sites with low populations, a portion of the coho which were left in the stream was also PIT tagged. It was up to the CDFW biologist to decide when and where to tag and release. Of the total, 360 relocated coho that were transported to IGH for temporary rearing were tagged prior to release back into Scott River tributaries.

Relocation

Over 132,400 juvenile salmonids were relocated during 2014, including an estimated 115,999 coho salmon, 16,292 steelhead and 188 Chinook salmon. As noted in Table 4 below, the majority of the relocated fish were moved to upper Scott River tributaries, with some being relocated downstream into Canyon Creek and Kelsey Creek. Of the total, about 4,447 age-0 coho were transported between mid-July to early August to holding tanks at Iron Gate Hatchery (IGH) on the Klamath River. Juvenile coho salmon taken to IGH were to be returned to the Scott River mainstem and to French Creek as soon as conditions allowed, which occurred in late October.

As mentioned above, relocation sites were chosen based on several criteria. These included presence of perennial cold water, proximity to normal tributary spawning areas, physical accessibility, and landowner permission. Road access for rescue trucks and equipment usually determined the specific relocation site. In general, these sites were upstream of capture locations in tributaries that normally receive spawning adult coho. Release sites were rotated over time in order to avoid overcrowding any given site. The timing of relocation was based on CDFW’s strategy to leave time gaps between moving fish to a particular site to allow observation of densities and then decide whether or not to continue to use that relocation site.

Table 4. Rescue site locations, number coho rescued & tagged for release, and relocation streams

Rescue Site Location	# coho rescued	# tagged and released at capture site	Relocation Streams
Shackleford Ck	427	0	Canyon Ck
French Ck rkm 0	3,136	0	French Ck-North Fork
Scott rkm 67	1,300	46	French-Duck Lake Ck
Scott rkm 68	7,369	14	French-Duck Lake Ck, French-NoFork, South Fork, French Ck
Scott rkm 71	20,850	0	South Fork, French Ck, Etna-Mill Ck, Canyon Ck, IGH
Scott rkm 74	43,537	297	South Fork, French-Duck Lake Ck, Etna-Mill Ck, Sugar Ck, French-NoFk Ck, East Fk-Grouse Ck, IGH
Scott rkm 76	6,830	30	Etna-Mill Ck, East Fk-Grouse Ck, Canyon Ck, Sugar Ck, French-Duck Lake Ck,, French-NoFk Ck
Scott rkm 79	15,486	6	South Fk, Kelsey Ck
Scott rkm 81	17,064	0	French Ck, Sugar Ck, Scott River, IGH
TOTAL	115,999	393	10 streams (+ IGH)

Each of the relocation sites within the Scott River watershed is shown in Map 8 (Magranet 2015). Approximate numbers of coho relocated to each site, based on weight counts, and the number of fish PIT tagged are found in Table 5. In addition to the relocated tagged number of 2,247 coho, 393 more were tagged and released at their capture sites, for a preliminary total of 2,640 PIT tagged coho. Currently, CDFW is operating PIT tag stations in eight locations in the Scott River watershed to evaluate the survival and movement of the tagged coho (see Photo 11 and section V.B.)

Table 5. Summary of 2014 release locations of rescued coho salmon

Release Location (north to south)	Total Coho Relocated (Approximate)	% of total	# PIT Tagged	% of location PIT tagged
Iron Gate Hatchery (Released in French Creek)	1,013	0.9%	180	17.8%
Iron Gate Hatchery (Released in Scott River rkm 71)	3,434	3.0%	180	5.2%
Kelsey Creek (at FS 6E001)	11,046	9.5%	114	1%
Canyon Creek (at FS 44N45 & 6E003)	15,434	13.3%	275	1.8%
Etna Creek rkm 12 (Mill Ck)	22,531	19.4%	258	1.1%
French Creek	7,868	6.8%	65	0.1%
North Fork French Creek	3,266	2.8%	90	2.8%
Duck Lake Creek	3,388	2.9%	210	6.2%
Scott River mainstem (rkm 81)	933	0.8%	60	6.4%
Sugar Creek (rkm 1)	3,321	2.9%	74	2.2%
Sugar Creek (rkm 2)	4,709	4.1%	90	1.9%
South Fork Scott River (at FS 40N21Y)	33,391	28.8%	532	1.6%
East Fork -- Grouse Creek (at FS 40N03)	5,665	4.9%	119	2.1%
Totals	115,999	100%	2,247	1.9%

Map 8. Location of juvenile coho relocation sites, Scott River watershed, 2014 (Siskiyou RCD).

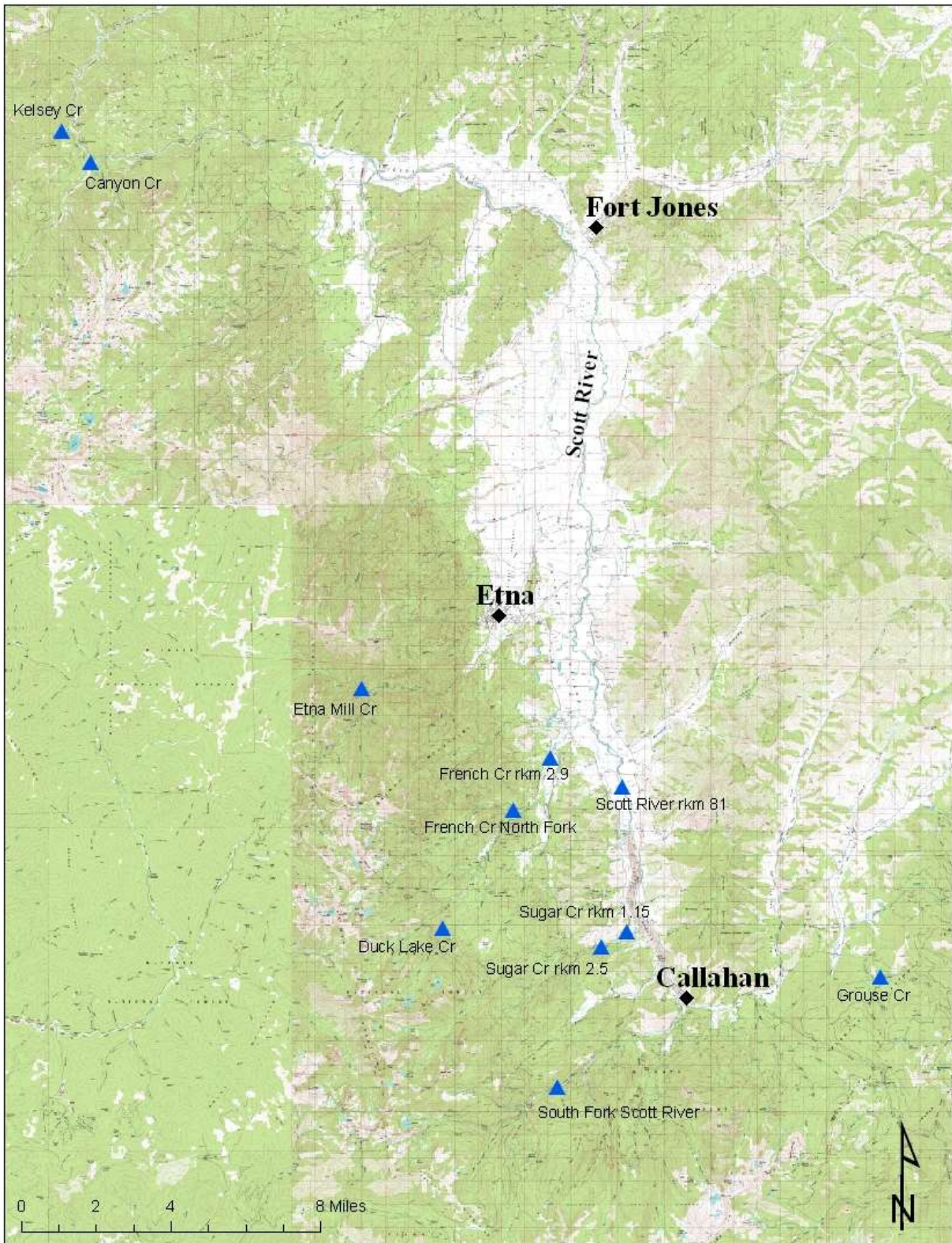




Photo 1. Scott River Reach 15B, rkm 79 back-channel thermal refugia showing dense juvenile salmonid usage, 7/2/14 (RCD).



Photo 2. Scott River Reach 15A, small back-channel habitat with overhanging willow vegetation and cold-water seep, 7/2/14 (RCD).



Photo 3. Scott River Reach 14 routine snorkel survey, 8/12/14 (RCD).



Photo 4. Scott River Reach 16, pool supporting rearing juvenile salmonids, 7/31/14 (RCD).



Photo 5. Scott River Reach 14 existing wetted channel at the time of survey, 8/12/14 (RCD).



Photo 6. Scott River Reach 15A, water quality monitoring site, stable deep pool, 9/18/14 (RCD).



Photo 7. Capturing fish with a seine net (CDFW).



Photo 8. Moving captured fish from nets into aerated buckets for counting and/or weighing (CDFW).



Photo 9. PIT tagging process at the mouth of French Creek, 5/28/14 (RCD).



Photo 10. Juvenile coho captured in lower French Creek being measured after PIT tag insertion: pre-rescue, 5/28/14 (RCD).



Photo 11. PIT tag antenna array spanning the Scott River just upstream of the mouth of French Creek, 6/19/14 (RCD).



Photo 12. CDFW truck equipped with aerated, cooled tank for fish relocation (CDFW).



Photo 13. Rescued fish being released at Etna-Mill Creek relocation site by CDFW (CDFW).



Photo 14. Grouse Creek (tributary to the East Fork) relocation site flow monitoring, 6/23/14 (RCD).



Photo 15. Etna-Mill Creek relocation site snorkel survey monitoring, post-release of juvenile coho (KNF).



Photo 16. Sugar Creek post-relocation snorkel survey of site, 9/22/14 (RCD).



Photo 17. South Fork Scott River relocation site (KNF).

E. Monitoring of Post-Relocation Sites

Juvenile salmonids in the mainstem Scott River were relocated (from south to north) to: South Fork Scott River, East Fork Scott River tributary of Grouse Creek, Sugar Creek, French Creek and its tributaries (North Fork French Creek, Duck Lake Creek), Etna Creek’s tributary of Mill Creek, Canyon Creek, Kelsey Creek, and also Iron Gate Hatchery. Monitoring of relocation sites (except for the hatchery) was conducted by snorkel sampling upstream and downstream of where fish were relocated. For KNF, surveys would start upstream of the relocation site, usually at a possible juvenile barrier where the upper natural extent may be. Snorkel surveys would continue downstream until fish densities thinned out or coho became absent. For the RCD, snorkel surveys began downstream of the relocation site and moved up in order to minimize any turbidity.

Monitoring assessments at relocation sites were completed by the RCD and KNF staff, as noted in Tables 6 and 7 (Magranet 2015; USFS 2014). For the USFS, the “2014 Juvenile Coho Distribution Project: Upper Extent Observations- Daily Log” data sheet was used to record observed salmonids for monitoring fish populations in relocation tributaries. The RCD assessed fish densities as well as water quality and flow conditions during their surveys, which began in early May and ended in early October. (See Photos 12-17.)

Table 6. Monitoring assessment dates of each relocation site in Scott River watershed - 2014

Relocation Site	Dates Fish Relocated	Who Monitored	Dates Monitored
South Fork Scott	6/9, 6/11, 6/17, 7/1, 7/10, 7/15, 7/22, 7/31, 8/7	RCD, USFS	5/9, 6/23, 7/18, 8/5, 9/29
East Fork – Grouse Creek	6/9, 6/26	RCD, USFS	5/9, 6/23, 7/18, 7/25, 8/5, 9/29
Sugar Creek	7/3, 7/10, 8/12	RCD	6/23, 7/17, 9/4, 9/22
French Creek	7/25, 8/1, 8/8	RCD	6/26, 7/24, 8/19, 9/19
French Creek – North Fork	7/11, 7/16		No survey
French Creek – Duck Lake Creek	6/4, 6/11, 7/9, 7/15, 7/24	RCD	5/9, 6/16, 7/3, 7/18, 9/30,
Etna-Mill Creek	6/3, 6/16, 6/18, 6/24, 7/8, 7/23, 7/30	RCD, USFS	5/7, 6/20, 7/3, 7/17, 8/6, 9/5, 9/30
Canyon Creek	6/5, 6/25, 6/27, 7/2, 7/29	USFS	7/30, 8/14
Kelsey Creek	8/5, 8/6	USFS	8/13
Scott River – RKM 81	8/19	RCD & CDFW	7/8, 7/31, 8/15, 9/11

Relocation ceased in tributaries that were judged to be adversely affected by high densities of fish in surveyed units or were otherwise deemed inadequate to support the addition of more fish due to fish stress or mortality, low water levels, poor water quality and elevated temperatures, or unsuitable habitat. By July 25th, the RCD recommended that fish relocation be discontinued into East Fork Scott River’s Grouse Creek due to low flows, lack of deep pools with cover, and limited habitat length (Magranet 2015). KNF crews also found it to be unsuitable in their August 5th survey. While the South Fork’s habitat was declared suitable in early August for more coho due to its low temperatures, big pools, and adequate flow, the KNF surveyors found that the Mill Creek tributary of upper Etna Creek was overcrowded with salmonids, which were also stressed due to recreational

use of the pools near the road. High fish densities and about 30 coho mortalities were seen in the upper Canyon Creek reach in early August, halting further relocations there (USFS 2014).

Table 7: Post-relocation fish assessment of 3 tributary reaches by KNF on Aug. 5-6, 2014 (USFS 2014)

Species /Age	South Fork	Grouse Ck (East Fk)	Etna-Mill Ck	Total
Age-0 coho	1,054	679	4,950	6,683
Age-1 coho	0	0	0	0
Age-0 Chinook	19	1	30	50
Age-1 Chinook	13	0	0	13
Age-0 Trout	145	611	236	992
Age-1 Trout	28	76	132	236
Age-2 Trout	12	10	43	65
Total Fish	1,271	1,377	5,391	8,039
Water Temp. °C	16.5-16.9	17.6-19.0	16.7-17.8	--
Suitability for more coho	Yes	No	No	1- yes 2- no

Monitoring was not completed for all relocation sites due to the extensive 2014 wildfires on the Klamath National Forest (Whites Complex and Happy Camp Complex) that began on July 30th, with access becoming restricted to some of the survey locations. The final KNF surveys conducted were in Kelsey Creek on August 13th and in Canyon Creek on August 14th.

F. Iron Gate Hatchery Relocation and Return to the Scott

An estimated 110,619 juvenile salmonids (88% coho, 12% steelhead and 0.1% Chinook) were relocated to upper Scott River tributaries at 10 different pre-determined sites, while an estimated 4,447 coho salmon were transported to holding tanks at IGH on the Klamath River (for later relocation to the Scott River). CDFW had determined that it was necessary to remove a certain number to the hatchery, with relocations occurring on three dates: July 17, August 1, and August 8th (Table 8). Their initial size ranged from 160/lb to 272/lb at those times.

Before any wild coho salmon were relocated to IGH, live chill boxes, bio-filtration and isolated UV-treated circulation tanks were purchased by CDFW and installed at the hatchery. Three tanks were available, but only two were utilized. Fish were chemically treated for potential parasitic and bacterial diseases and carefully monitored (see also “Fish Health” below). While this treatment precluded some coho salmon mortality while in captivity at IGH, approximately 435 (or 9%) of the 4,447 rescued coho salmon died. The remaining 4,012 juvenile coho salmon were successfully released back into the Scott River (rkm 71) and its French Creek tributary on October 23-24. Their size at the time of release ranged from 94/lb (N~975) to 139/lb (N~3,202) (Kwak, 2014).

Table 8. Estimated numbers of Scott River coho rescued, relocated to IGH, released and tagged.

Tank	Date of rescue	# transported (estimate)	Date of release	# released (estimate)	Release location	# PIT tagged
1	7-17-14	510	10-23-14	957	French Ck	180
1	8-1-14	503	10-23-14			
2	8-8-14	3,434	10-24-14	3,055	Scott River –RKM 71	180
Total		4,447		4,012		360

G. Fish Health

Of great initial concern was the risk of disease and mortality due to the high concentration of juvenile coho within diminishing mainstem conditions. Visual assessments of fish health conditions were continually made during the summer, as documented in snorkel surveys by CDFW and RCD, yet no fish health or mortality problems were noted (Magranet 2015). The only negative observations were made by KNF crews who saw stressed fish due to overcrowding from relocations in Etna-Mill Creek and Canyon Creek, with about 30 dead coho found in Canyon Creek (USFS 2014). A special instream survey was conducted by CDFW on July 2nd to look for aquatic invasive species to avoid any introduction from the anticipated coho relocations to IGH: no New Zealand mudsnails or Dreissenid mussels were detected at the two surveyed sites on the mainstem Scott River (McAlexander 2014).

Official fish health assessments were made on several dates by pathologists from CDFW and the U.S. Fish and Wildlife Service (USFWS) for the purposes of the IGH relocation. On July 1st, 60 coho and 22 steelhead were collected from the Scott River as samples for testing and sent to CDFW's Fish Health Lab in Rancho Cordova. The results were: no confirmed pathogenic bacteria were present, virology was negative, and no parasites were observed (Bamberger 2014). In addition, the USFWS's CA-NV Fish Health Center performed a health screening of 60 coho from the Scott River on July 9th (Foote 2014.) No significant infections or conditions were observed at the time of sampling. Light infections of *Ceratomyxa shasta* and *Parvicapsula minibicornis* were observed; the investigator thought that those would possibly progress to the point where they could eventually become a health concern.

A week after the first Scott River coho were transplanted to IGH, a CDFW pathology report recommended that these fish be treated for *Flavobacterium columnare* (columnaris), which was found on several dead fish. Mortality rate was about 5 per day (Adkinson 2014). Treatment involved an oxytetracycline antibiotic bath. At that time, the fish were being fed insects and also a small amount of artificial feed. On August 20, after all of the transplants were completed, another fish pathologist found that all fish had a visible fungus (*Saprolegnia sp.*) on the caudal peduncle (Maret 2014). He recommended decreasing the feeding rate and cleaning the tanks daily of rotting feed to reduce infection. Treatment included 170 ppm formalin bath for 3-5 days. In anticipation of relocating the coho back to the Scott River, a fish pathologist re-evaluated their health on Oct. 21st (Kwak 2014). A few mortalities at that time were noted, with "drop-out" due to reduced fitness as indicated by atrophied organs. The populations in both tanks were determined to be "as a whole-healthy" and suitable for release within the next month. Overall, the transplanted coho population had a 9% mortality rate while at IGH (table 8).

V. Evaluation, Research and Recommendations for the Future

Following up on the extensive and intensive 2014 effort is essential. Expectations of “success” also include what happens to the next life stages of this brood year in 2015 and 2016. A wealth of new information was gleaned from the many monitored habitat sites. The rescue and relocation experience offered all of those involved some insights into what went well and what could be done better, if or when such extreme emergency conditions occur again.

A. Population & Distribution Monitoring

Juvenile Outmigration

Juvenile salmonid production as measured by outmigration is estimated by CDFW through the use of rotary screw traps (RST) and daily data collection near the mouth of the Scott River, usually from February through June. Rapidly fluctuating or very high river flows can reduce the efficiency of the traps and lower the relative accuracy of the results. Concern was raised during the 2014 effort over the ability for the age-1coho outmigrants to move out of the Scott that spring, as well as for the age-0 coho to freely move upstream or downstream to their desired habitat. CDFW has produced the spring 2014 outmigrant results (Debrick and Stenhouse 2014).

During the 13 week period from Feb. 19th to May 20th, 2014, CDFW’s Scott River sampling indicated an estimated emigration of 5,708 coho age-1 and 16,962 coho age-0. Outmigration peaked for the age-1cohort during Feb. 26 to March 4 (mean size was 99 mm), while the age-0 cohort peaked during April 30 to May 6 (mean size was 35 mm). However, the age-1 continued to move out until the week of May 28th, while the age-0 were still moving out when the RSTs were removed on July 1.

How the 2014 timing and numbers of coho age-0 and age-1 outmigrants compare to those of previous years, and to the average since data collection began in 2004, remains to be assessed. For this same brood year, the number of smolts has ranged from 62,207 (in 2009) to 50,315 (in 2012). Outmigrant data collected for age-1 coho during February to July 2015 will be another metric to help assess the successful survival of the 2013 run’s progeny.

Adult Escapement

The number of returning adults in the 2016 coho run may be one measure of success for the 2014 effort to save the progeny of the 2013 spawning run, though there are confounding effects each year (e.g., ocean conditions, extreme flows). CDFW currently monitors the adult coho run in the Scott River from late September and into January, using its video weir counting facility and spawning ground surveys of the mainstem and selected tributaries. Since the facility began operations in 2007, the estimate of this strong cohort population has ranged from 927 (2010) to 1,622 (2007) to 2,752 for the 2013 brood year (Knechtle and Chesney 2014). Beyond total numbers, interest will also lie in the distribution of returning coho spawners to the Scott River sub-basin to see if they became more imprinted on their relocation or their rescue sites. Future flow conditions in the Scott River may also again affect their access to spawning grounds, while external factors to the Scott watershed can affect the returning numbers.

Ratio of Smolts per Adult

Another measure of fresh water survival is the ratio of the number of outmigrant smolts produced per returning adult by brood year (Knechtle and Chesney 2014). For adult coho brood years 2007 through 2011, the ratio has varied greatly, ranging from a low of 3.4 to a high of 54.3. (Note that the low ratio of 3.4 may have reflected the high flow conditions during spring of 2011 when trapping efficiencies were low and the number of smolts would have been relatively low due to the small 2009 adult estimate of 81.)

How this 2013 brood year's smolt:adult ratio compares can be determined after the 2015 age-1 outmigrant data is available. In spring 2015, trap efficiency has likely been affected by the above average discharges that occurred in the Scott River for the period from Feb. 2nd to Feb. 28th, with a peak flood flow of over 14,000 cfs on Feb. 7th that may have affected age-0 and age-1 juvenile coho distribution and movement. Flows have been steadily below average since Feb. 28, 2015, reflecting drought conditions for the 4th year in a row (USGS 2015).

► Evaluation questions to assess for coho population and distribution:

1. How was the strong 2013 cohort's production affected by the 2014 rescue and relocation efforts? What is the survival estimate?
2. How do the 2014 and 2015 outmigration estimates of juvenile coho compare with past years in numbers and timing?
3. Did some coho juveniles have a 2 year residency due to drought conditions?
4. How does the ratio of coho smolts produced per adult from the 2013 brood year compare to past years for which there is data?
5. How does the 2016 adult return of the large 2013 cohort compare to past years?
6. Will the returning adults seek their species' "traditional" spawning reaches, the relocation sites, or become concentrated in the 2013 rescue reaches?
7. Did the rate of flow (including disconnections) appear to have affected the timing of outmigration in 2014 and 2015 or the timing and distribution of the 2016 spawning run?

B. PIT Tag Monitoring of Coho Locations and Movement

The use of Passive Integrated Transponder (PIT) tags, together with instream detection antenna stations, is a relatively recent tool to monitor juvenile salmonids in the Scott River. CDFW biologist Mary Olswang applied PIT tagging to study juvenile salmonid movement in the upper Scott River and Sugar Creek in 2010-2012. Building on that effort and one he began in the Shasta River in 2006, CDFW's Chris Adams had proposed and undertook a PIT Tag Monitoring Plan for the Scott River as a method for identifying rearing locations and documenting movement patterns (Adams 2013a, b). This PIT tag program began in 2013 before the 2014 drought emergency, though the latter required a significantly more intensive and extensive short-term tagging effort. Data collected from both of these PIT tagging efforts will complement each other.

Protocol and Study Design

The protocol used for PIT tagging individual fish in 2014 is recommended for use in the future (AFS 2014; Adams 2013b) as well as the Scott River PIT Tag Monitoring Plan (Adams 2013a). The 2014 tagged fish are to be tracked, as described below.

PIT Tag Data Collection and Analysis

PIT tag antenna arrays were strategically located within the Scott River to detect movement and timing of salmonids even prior to the 2014 emergency effort. In addition to ongoing CDFW juvenile coho and steelhead population studies in the Scott River incorporating PIT tags, additional antenna arrays and logging stations were installed at key sites throughout the watershed to help evaluate the survival and efficacy of the 2014 rescue/relocation program. These antenna array sites are listed in Table 9.

Table 9. Scott River PIT Tag Antenna Station Locations – 2014-15

	Stream Location (upstream to downstream)	Station Location
1	Sugar Creek	RKM 0
2	French Creek	RKM 4
3	French Creek	RKM 3
4	French Creek	RKM 0
5	Scott River	RKM 76
6	Scott River	RKM 68
7	Scott River	RKM 29 (video weir)
8	Scott River	RKM 8 (RST station)

The multiple stations on French Creek were installed to achieve higher resolution of fish movements, particularly because of the number of relocated coho that were placed between the stations. The willingness of landowners also helped. High water events require that the antenna stations be removed to avoid their damage or destruction, such as during the peak runoff period in February 2015. As a result, the arrays will not be able to track movement for the entire freshwater life history of the tagged coho.

Salmonids are checked with handheld readers at the out-migrant RST location in the lower Scott River and at IGH, as well as during routine sampling. Length, weight and scale samples are collected from PIT tagged fish detected in the RST sampling. These data can then be compared with data collected at the time of rescue to calculate growth rates. Other PIT tag arrays in the mid- and lower Klamath River and tributaries are operated by the Karuk Tribe and others which can help monitor the timing of migrations. These efforts will allow for the evaluation of tagged coho salmon responses to drought conditions and relocation activities. Data will be available after the outmigrant period.

► Evaluation questions to assess for PIT tag results:

1. Will relocated tagged juvenile coho salmon imprint on their new location rather than the mainstem Scott River where they were born?

2. Where and when do the tagged juvenile fish move? What is the timing of their outmigration? Do they move outside the timing of operation of the CDFW outmigrant trap facility (RST)?
3. What is the survival over space and time of the tagged coho salmon? How many of the tagged rescued fish were detected leaving the system?
4. Where are the juvenile coho salmon rearing locations throughout the year, including in the Klamath River?
5. What is the adult return rate of all tagged Scott River sub-basin coho salmon?
6. What were the survival and growth of the IGH tagged coho salmon after their release back into the Scott River sub-basin?
7. When did the IGH tagged coho released back to the Scott River leave the watershed in relation to fish kept in the wild? If any return as spawners in 2015, where do they spawn?

C. Habitat Information for Potential Restoration and Monitoring Opportunities

As surface flows diminished and water temperature rose during the spring and summer of 2014, juvenile salmonid presence, including coho salmon, was monitored in the mainstem Scott River and six of its tributaries. This recurring monitoring identified locations where salmonids were present and their changing distribution and abundance. Monitoring information was then used by the Working Group to plan and execute their actions from June through September. Monitoring information also helped to guide real-time leasing of surface water by the Scott River Water Trust during the summer of 2014, pinpointing locations/reaches where augmented surface flow provided the maximum benefit to rearing salmonids.

As mentioned above, twelve areas on KNF-managed land were initially selected for evaluation as potential receiving sites for rescued fish. Along with areas subsequently evaluated on private land along Sugar and French creeks, eight areas were ultimately selected to receive rescued salmonids. They included: Sugar Creek, French Creek (including Duck Lake Creek and North Fork French Creek), Etna Creek's Mill Creek tributary, East Fork Scott River's Grouse Creek tributary, South Fork Scott River, Canyon Creek, Kelsey Creek, and the mainstem Scott River at rkm 81. Known coho salmon distribution within each of these areas is described below, while 2014 relocation of rescued coho salmon is summarized for each. Due to the urgent need, some relocation sites ended up being upstream of the upper extent of known coho rearing habitat: upper South Fork, Duck Lake Creek (French Ck), Mill Creek (Etna Ck), and upper Canyon Creek. Changing climate, precipitation, and snowpack will affect rearing habitat conditions in these areas in years to come, but these "refugia" all merit continued monitoring and possible consideration for future salmonid rearing habitat restoration efforts.

Sugar Creek: When summer flows are sufficient, the lower 4.75 rkm of Sugar Creek (from 1 km above the Sugar Creek - Tiger Fork confluence down to the mouth) has the potential to sustain rearing juvenile salmonids, including coho salmon (Yokel 2006). Over 8,000 rescued coho were released at rkm 1.15 and 2.5 along Sugar Creek. It is noteworthy that two beaver dam analogue structures were constructed on lower Sugar Creek during the summer and fall of 2014, expanding wetland habitat beyond the existing large beaver dam that will be available for salmonid rearing in the future.

French Creek: The lower reach of French Creek (mouth to Highway 3, rkm 1.1), the middle reach of French Creek (rkm 1.1 to 4.5), and the North Fork of French Creek consistently provide summer rearing habitat for salmonids, even when surface flow is interrupted at the mouth of French Creek. Approximately 7,800 rescued coho salmon were released at rkm 2.9 of French Creek, while about 3,200 were released in the North Fork of French Creek. Duck Lake Creek, a tributary to upper French Creek, is within designated coho salmon critical habitat but well upstream of where coho salmon rearing has been observed. This tributary is routinely occupied by juvenile steelhead and resident trout, and did receive and sustain nearly 3,400 rescued coho salmon in 2014. As no post-relocation monitoring occurred in Duck Lake Creek, no conclusions can be made about how successful or prudent it is to relocated fish into this high gradient stream.

Etna Creek - Mill Creek: Both juvenile coho salmon and coho salmon redds have been documented up to the Etna City Water Diversion Dam (rkm 8.9), which has a fish passage structure, but not further upstream (Yokel 2006). Approximately four miles of lower Etna Creek routinely become disconnected from the Scott River by late spring, and often dry up completely. Mill Creek, a tributary joining Etna Creek at rkm 13.4, is routinely occupied by steelhead and resident trout but above the upper known extent of coho distribution. It did receive and sustain 22,500 rescued coho salmon in 2014, although USFS post-relocation survey noted fish stress associated with overcrowding and recreational use of the pools at the road crossing.

East Fork Scott River -- Grouse Creek: The lower 3 km of Grouse Creek, above its confluence with the East Fork Scott River, contains habitat where rearing juvenile coho salmon have been observed and also where some previous salmonid rescue relocations have occurred by CDFW. Approximately 5,600 rescued coho salmon were relocated to rkm 2.6 in Grouse Creek during June 2014. Water temperature became diurnally elevated and algae bloomed when flows receded by mid-July, leaving only deeper pool habitat available for rearing salmonids through the remainder of the summer. The site did not have the capacity to receive for further rescued fish transfers.

South Fork Scott River: Coho salmon spawning and rearing have been observed in the lower 8.1 rkm of the South Fork of the Scott River, and it was at this upper limit of their distribution where approximately 33,400 rescued juvenile coho salmon were relocated between June and early August 2014. These fish were blocked from moving further upstream by a natural cascade complex adjacent to the release site, but did redistribute an unknown distance downstream onto private land.

Canyon Creek & Kelsey Creek: These two tributaries in the Scott River canyon received about 15,400 and 11,000, respectively, of the rescued coho salmon, or 22% of the total. The upper relocation site on Canyon Creek was found to be overpopulated at this level, with some stress and mortality observed. Limited coho salmon spawning and rearing has been observed in previous surveys in these tributaries; however, previous CDFW rescue efforts have relocated salmonids captured in Scott Valley to these streams (CDFG 2012.) The upper relocation site on Canyon Creek is within designated coho salmon critical habitat per current KNF fisheries program data layers, yet it is well upstream of where coho salmon have been observed. Due to the problems observed in 2014, relocation of salmonids only at reduced levels would be recommended.

Scott River - rkm 81: A small number (933) of rescued coho were also released upstream at rkm 81 of the mainstem Scott River (near boundary between reach 15b and 16), where sufficient flows, temperatures and dissolved oxygen levels to sustain salmonids were documented on August 15th. Based on population distributions gathered through snorkel surveys, juvenile salmonids seemed to be naturally migrating upstream into this area just downstream of where cold water from the tailings reemerges.

Preferred Rearing Habitats & Movement:

Juvenile salmonids were observed utilizing nearly any and all available cover (Adams 2014; Magranet 2015.) As their swimming ability developed, they became very skittish, actively avoiding disturbances in the water. They were repeatedly observed clustered in root wads and woody debris, thick aquatic vegetation, undercut banks or holes, spaces between rip-rap and boulders. While young-of-the-year steelhead juveniles were frequently observed in riffles, coho tended to be found in more sheltered environments.

One example of a refugial meso-habitat on the Scott River mainstem that exhibited many favorable qualities to juvenile salmonids was the rkm 79 monitoring site, a back-channel pool located downstream of Fay Lane (Magranet 2015). It provided slow moving water, ample cover and a preferred temperature regime (MWAT of 14.5°C) likely influenced by a cold water seep from a source within the thick vegetation of the river right stream bank. The highest densities of salmonids that survey crews encountered were consistently at this location. From August 4th (day of data logger deployment) onward, no temperatures were recorded at this depth over 16.1°C and the maximum daily fluctuation was 2.3°C. This site exemplifies a relatively stable rearing habitat available to support a viable summer population of juvenile salmon within the mainstem.

The RCD crews noticed that as the riverbed drying advanced upstream in the valley, so did the fish. The environmental conditions (e.g., shallowing and subsequent warming of the water) appeared to trigger their movement upstream from those areas so that, by the time pools had become isolated, there were far fewer fish to be rescued than initially anticipated. Furthermore, although there were thousands of fish that did become isolated as flows diminished, no fish kills were observed. Natural predation in isolated pools, such as by fish-eating birds, may have reduced fish numbers or eliminated evidence of mortality. It seems that, in the face of extreme drought conditions, large quantities of juvenile coho instinctually moved into the best available habitat (Magranet 2015).

D. Recommendations for Future Efforts

Many of the planning, coordination, and implementation actions taken during this unprecedented coho salmon rescue and relocation effort deserve to be reviewed and repeated if similar circumstances – where the bulk of the coho spawning takes place in a short stretch of the mainstem river—recur. As with any complicated project, there is always room for improvement. Below are some recommendations by the partners that should be considered for future efforts.

Analysis and Coordination

- 1. The Voluntary Drought Initiative by CDFW and NOAA, which provided “take” coverage under CESA and special considerations under ESA for participating landowners, was a fundamental contribution to achieving the magnitude of the effort. In the future, explore “take” assurances, aligned with existing codes and authorities, which increase the willingness of landowners to receive a threatened species on their property as part of relocation efforts.*

In all, a total of 11 landowners covering rescue or relocation sites signed the CESA MOU and NOAA’s Voluntary Drought Agreement, which allowed access to many critical miles of stream (CDFW 2014). However, permission was not granted on a significant property ownership that extended across the middle elevations of about 5 tributaries. This lack of legal access constrained the number and location of relocation opportunities in key coho habitat areas.

- 2. Developing a draft strategy collaboratively helped focus participants on common objectives, methods, and options in the initial phases of the effort. A revised rescue and relocation strategy for drought emergencies should be developed to reflect the lessons learned from the 2014 effort, so future participants will not have to start from scratch.*

Two drafts of a strategy paper, “Drought Planning & Potential Need to Relocate Juvenile Salmonids in the Scott River in 2014”, were prepared in February and April. Using the firsthand knowledge gained during the 2014 rescue/relocation effort, update drought-related fish rescue policies and plans as needed, in response to changing future conditions.

Action and Monitoring

- 1. Criteria for triggering rescue at individual sites should be refined and clarified based on empirical, local data. These criteria should then be communicated with interested and affected individuals and organizations during future fish rescue and relocation operations.*

Valid concerns were raised over “suitable” habitat quality in the rescue and relocation areas, but the criteria “thresholds” or “triggers” for making decisions about suitability were not made explicit in large part because of insufficient watershed-specific information. Professional, implicit judgements were necessarily used instead when making real-time decisions on fish rescue and relocation. Monitoring data and observations are modifying understanding about the levels of flow, density, temperature and dissolved oxygen that can sustain juvenile salmonids in the Scott River watershed. Seeking to make the criteria explicit, based on local evidence, would be helpful for developing rescue-related criteria, acknowledging that site specificity must always be considered.

- 2. Monitoring data should be collected earlier and evaluated more frequently during the rescue and relocation operation.*

The two months of water quality data collected at each of the monitoring sites were only a small interval in the progression of drought conditions during the low flow season. However, the monitoring data captured some of the more rapid changes experienced by rearing juvenile salmonids along the mainstem Scott River. These data were not measured or downloaded often

enough to inform relocation priorities established from detailed weekly dive surveys. . In hindsight, the Siskiyou RCD recommends that these data be collected earlier and for a longer period of time so that a broader perspective on the advancement of drought conditions can be captured (Magranet 2015). The evaluation of tagged fish, once complete, may shed light on whether or not fish survived under the monitored conditions.

3. Close monitoring coordination among all of the players was especially important and should definitely be repeated.

Monitoring efforts by the RCD and SRWT involved close communication with CDFW relocation crews to address areas of concern. Close coordination with KNF was also necessary with respect to relocation habitat on the USFS-managed lands. Of particular help for communication were the weekly or bi-weekly conference calls among the Working Group. Most importantly, the overall effort illustrated the extent that concerned landowners, local watershed organizations, and agency personnel can cooperate to support the fishery when a potential crisis arises (Magranet 2015).

4. Relocation of rescued Scott River coho juveniles to Iron Gate Hatchery for temporary rearing should only be triggered by specific criteria. A report describing the methods of the 2014 rearing effort at the hatchery would be helpful for future reference.

The IGH relocation option was the lowest priority under the draft strategy for the 2014 effort. However, over 4,400 coho (3.8% of total) were relocated to IGH between July 17 and August 8. Several factors led to the decision to place fish in IGH. There was concern by CDFW that a sufficient density of fish at some fish relocation sites may have been reached, as well as concern that not all relocation sites would maintain suitable conditions for fish throughout the late summer and early fall. The IGH option provided for an additional site over which conditions could be controlled and closely monitored. Once the overall success of the rescue effort is better understood, we can determine if this option is viable or desirable, and future use should be evaluated in the context of the conditions existing at the time.

Evaluation & Research

- 1. Continue to implement CDFW's Scott River PIT Tag Monitoring Plan. Document the PIT tag results in a written report that assesses the efficacy of the 2014 effort.***
- 2. Evaluate future rescue efforts of similar size and scope and document results and lessons learned. Make information and insights available for use as a reference and guidance in any future emergency rescue/relocation efforts of similar magnitude to the 2014 effort.***

E. Conclusions

Despite reasonable fears, a potentially large fish kill did not materialize during the extreme 2014 drought conditions in the Scott River. A collaborative effort by diverse local community and agency participants cooperatively accomplished the successful rescue of approximately 116,000 juvenile coho salmon from shrinking habitats in the mainstem Scott River and relocated them to more

suitable rearing habitat at 11 different sites in 8 stream reaches within the Scott River watershed. This rescue effort was the largest for juvenile coho salmon in CDFW's history (Bonham 2014b).

Monitoring efforts over the course of April to October 2014 documented the widespread juvenile salmonid response, including the natural upstream redistribution of fish towards preferable habitats and the identification of thermal refugia within the mainstem Scott River. This information can be used to guide future planning and implementation of fish rescue and relocation efforts in the Scott River sub-basin, as and when the need arises.

The results and effects of this large-scale relocation effort will really begin to come into focus over the next couple of years. Comparing the results to a "no action" alternative can only be speculative. However, much of the progeny of the 2013 brood year were provided the opportunity to complete their life cycle near their natal streams and face the "normal" drought constraints after relocation efforts ended.

This effort also illustrated the extent that concerned landowners, local watershed organizations, and agency personnel can successfully cooperate to support the fishery. Hopefully, we can all look back on this effort as a constructive example of the successful interface between natural resilience and human assistance.

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Appendix A: Chronology of 2014 Events

Date	Action	Who
Jan. 1	Scott River Gage (USGS) @ RKM 35 = 55 cfs daily mean	USGS
Jan. 9	Scott Valley Drought Planning Work Group -- initial meeting	SRWC, RCD, SRWT, County, landowners
Jan. 17	State Drought Emergency Proclamation	Governor Brown
Jan. 22	Initial coho relocation meeting Notice of Possible Future Curtailment of Junior Water Rights in Scott River sent to water users	RCD, SRWT, CDFW SWRCB
Feb. 1	Scott River Gage (USGS) = 85 cfs; Snow level (EWC)=2.8% average	USGS / USFS
Feb. 3	Drought Emergency Proclamation	Town of Fort Jones
Feb. 4	News article "Scott River Salmon Face Possible Relocation"	Siskiyou Daily News
Feb. 12	CDFW Coordinated Fish Rescue Planning meeting	CDFW, RCD, SRWT, Karuk
Feb. 25	Draft "Fish Rescue Strategy for Scott River Juvenile Salmonids" issued	CDFW
Feb. 26	CDFW Coordinated Fish Rescue Planning meeting – conference call	CDFW, RCD, SRWT, USFS, Karuk
Mar. 1	Scott River Gage (USGS) = 267 cfs; Snow level (EWC)= 8% average; Precipitation (Oct-Feb) = 4.4" (28%) at Fort Jones	USGS / USFS DWR
Mar. 3	Scott Valley Drought Planning Work Group meeting	SRWC, RCD, SRWT, County, landowners
Mar. 5	CDFW Coordinated Fish Rescue Planning meeting	CDFW, RCD, SRWT, USFS, Karuk
Mar. 11	County Drought Emergency Proclamation	Siskiyou Co. BOS
Mar. 12	CDFW Coordinated Fish Rescue Planning meeting Revised Draft "Fish Rescue Strategy for Scott River Juvenile Salmonids" issued	CDFW, SRWT, USFS, Karuk CDFW
Mar. 18	CDFW Coordinated Fish Rescue Planning meeting	CDFW, SRWT, USFS, Karuk
Mar. 21	Letter sent to CDFW and NOAA managers seeking regulatory assurances under CESA/ESA for landowners participating in rescue/relocation effort in Scott	RCD Board
Mar. 26	CDFW Coordinated Fish Rescue Planning meeting – conference call	CDFW, RCD, SRWT, USFS, Karuk
Apr. 1	Scott River Gage (USGS) = 521 cfs; Snow level (EWC)= 9% average	USGS/USFS
Apr. 3	CDFW Coordinated Fish Rescue Planning meeting – conference call	CDFW, RCD, SRWT, USFS, Karuk
Apr. 17	CDFW Coordinated Fish Rescue Planning meeting – conference call	CDFW, RCD, SRWT, USFS, Karuk
Apr. 17	"Interagency Anadromous Fish Rescue Strategy" for California issued	CDFW, NOAA, USFWS
Apr. 24	USFS map of potential coho relocation sites on USFS land	USFS
Apr. 25	Executive Order to Redouble State Drought Actions: including ordering CDFW to work with others for relocation of listed species	Governor Brown
Apr. 30	Lease began on upper Scott River @ RM 55 (RKM 88) for ~20 cfs	SRWT
May 1	CDFW Coordinated Fish Rescue Planning meeting – conference call Scott River Gage (USGS) = 154 cfs; Snow level (EWC)= 0% average	CDFW, RCD, SRWT, USFS, Karuk USGS / USFS
May 2	Survey of Scott River reach 14: 63,050 age-0 coho.	CDFW, RCD
May 6	Survey of Scott River reach 13: 10,170 age-0 coho; of reach 15a: 36,550 coho	CDFW, RCD
May 7	Survey of upper Etna Ck on USFS to assess as potential coho release site	CDFW, RCD

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May 8	CDFW Coordinated Fish Rescue Planning meeting – conference call Survey of reach 15b: 8,480 age-0 coho. Total for all 4 reaches=118,250 age-0 coho.	CDFW, RCD, SRWT, USFS, Karuk CDFW, RCD
May 9	Survey of upper French Ck, South Fk Scott, and Grouse Ck (East Fk) on USFS to assess as potential coho release sites	CDFW, RCD
May 13	“California Voluntary Drought Initiative” issued to provide improved regulatory certainty for enrolling landowners involved with fish rescue and relocation	CDFW & NMFS (NOAA)
May 14	CESA MOU for landowners issued to provide for ‘take’ associated with actions taken by CDFW to rescue and relocate coho. Press Release issued by Water Trust re: Spring Lease	CDFW – Regional Mgr. Manji SRWT
May 15	CDFW Coordinated Fish Rescue Planning meeting – conference call First MOU signed by Scott River landowner	CDFW, RCD, SRWT, USFS, Karuk Landowner
May 16	Curtailment Notice issued to Junior Water Rights for Scott River Decree to protect instream flows allocated to the USFS	SWRCB
May 22	CDFW Coordinated Fish Rescue Planning meeting – conference call	CDFW, RCD, SRWT, USFS, Karuk
May 28	Training session in Scott River for survey and rescue crews	CDFW
May 29	CDFW Coordinated Fish Rescue Planning meeting – conference call Last MOU signed by Scott River landowner	CDFW, RCD, SRWT, USFS, Karuk Landowner
May 30	News article re: Farmers Ditch Co. lease by SRWT	Siskiyou Daily News
June 1	Scott River Gage = 98 cfs	USGS
June 2	Scott River tailings reach disconnected (RM 52-56)(RKM 84-91)	SRWT
June 3	First coho rescue of the season on mainstem: 1,300 relocated from RKM 67 to upper Etna Ck; Survey of reach 14: 47,810 age-0 coho	CDFW
June 4	Coho rescue on mainstem: 1,082 from RKM 74 to Duck Lake Ck (French)	CDFW
June 5	Coho rescue from Shackelford: 272 relocated to Canyon Ck	CDFW
June 6	Lease ended on upper Scott River due to low flow Coho rescue from Shackelford: 122 relocated to Canyon Ck	SRWT CDFW
June 9	Coho rescue on mainstem: 3,988 from RKM 74, with 2,296 relocated to South Fk and 1,692 to Grouse Ck (East Fk)	CDFW
June 10	Approval of letter to state and federal officials seeking better language in agreements for landowners receiving relocated coho.	County BOS
June 11	Coho rescue on mainstem: 3,859 from RKM74, with 3,043 relocated to South Fk and 816 to Duck Lake Ck (French)	CDFW
June 12	CDFW Coordinated Fish Rescue Planning meeting – conference call Survey of Scott River’s reach 15a: 55,680 age-0 coho	CDFW, RCD, SRWT, USFS, Karuk CDFW, RCD
June 16	Lease began on lower French Ck for 0.76 cfs Coho rescue on mainstem: 1,422 from RKM 76, all sent to Etna Ck	SRWT CDFW
June 17	Coho rescue on mainstem: 4,781 from RKM 74, with all to South Fk	CDFW
June 18	Lease began on French Ck-Miners Ck for 0.6 cfs Coho rescue on mainstem: 3,178 from RKM 76, with all to Etna Ck Survey of Scott River’s reach 13: 11,280 age-0 coho	SRWT CDFW CDFW, RCD
June 19	Survey of Scott River’s reach 15b: 7,380 age-0 coho	CDFW, RCD
June 24	Coho rescue on mainstem: 5,866 from RKM 74, with all to Etna Ck; 694 from RKM 76, with all to Etna Ck.	CDFW
June 25	Coho rescue on mainstem: 3,068 from RKM 74, with all to Canyon Ck; 348 from RKM 76, with all to Canyon Ck. Coho rescue from Shackelford Ck: 7, with all to Canyon Ck	CDFW
June 26	Trib Flows: East Fork=3.4 cfs; South Fk=8.0 cfs; Sugar Ck=3.0 cfs;	DWR

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	French Ck=2.45 cfs; Shackelford Ck=3.56 cfs(disconnected) Coho rescue from mainstem: 3,523 from RKM 74, with all to Grouse Ck (East Fk); 450 from RKM 76, with all to Grouse Ck (East Fk).	CDFW
June 27	Coho rescue on mainstem: 1,870 from RKM 74, with all to Canyon Ck; 432 from RKM 76, with all to Canyon Ck	CDFW
June 30	Lease began on upper French Ck for 0.58 cfs Lease began on Scott River at RM 47 (RKM 75) for 1-2 cfs Survey of Scott River reach 13: 18,355 age-0 coho	SRWT SRWT CDFW, RCD
July 1	Lease began on French Ck for 0.3-0.9 cfs; on Sugar Ck for 0.2-1.3 cfs Scott River Gage = 12 cfs Coho rescue on mainstem: 2,750 from RKM 74, and 90 from RKM 76, with all to South Fork; rescue from Shackelford: 2, to South Fk Survey of Scott River reach 14: 10,480 age-0 coho	SRWT USGS CDFW CDFW, RCD
July 2	CDFW Coordinated Fish Rescue Planning meeting – conference call Coho rescue on mainstem: 2,085 from RKM 74, and 168 from RKM 76, with all to Canyon Ck. Rescue from Shackelford: 4, to Canyon Ck Survey of Scott River reach 15 a: 16,120 age-0 coho	CDFW, RCD, SRWT, USFS, Karuk CDFW CDFW, RCD
July 3	Lease began on mid-French Ck for 0.25 cfs Coho rescue on mainstem: 285 from RKM 74, and 25 from RKM 76, with all to Sugar Ck. Rescue from Shackelford: 3, all to Sugar Ck.	SRWT CDFW
July 8	Coho rescue on mainstem: 1,288 from RKM 74, and 3 from RKM 76, with all to Etna Ck. Rescue from Shackelford: 2, all to Etna Ck. Survey of Scott River reach 16: 14,925 age-0 coho	CDFW CDFW, RCD
July 9	Lease began on French Ck-Miners Ck for 0.25+ cfs Coho rescue on mainstem: 246 from RKM 74, and 13 from RKM 76, and 10 from RKM 68, with all to Duck Lake Ck (French). Rescue from Shackelford: 1, to Duck Lake Ck (French). Survey of Scott River reach 15b: 9,690 age-0 coho	SRWT CDFW CDFW, RCD
July 10	CDFW Coordinated Fish Rescue Planning meeting – conference call Coho rescue on mainstem: 133 from RKM 74, and 6 from RKM 76, and 38 from RKM 68, with all to South Fork; plus 3,008 from RKM 81 (seine), to Sugar Ck. Rescue from Shackelford: 6, all to South Fk	CDFW, RCD, SRWT, USFS, NOAA CDFW
July 11	Lease began on Scott River @ RM 52 (RKM 83) for 0.4-1.3 cfs Coho rescue on mainstem: 57 from RKM 74, 1 from RKM 76, and 68 from RKM 68, with all to North Fork French. Rescue from Shackelford: 4, to N. Fk French	SRWT CDFW
July 14	Letter to County BOS re: Fish Rescue MOU in Scott River	CDFW Director Bonham
July 15	Coho rescue on mainstem: 8,196 from RKM 74, with 7,380 to South Fork and 816 to Duck Lake Ck (French Ck)	CDFW
July 16	Coho rescue from French Ck mouth: 3,136, all to No. Fork French	CDFW
July 17	CDFW Coordinated Fish Rescue Planning meeting – conference call Coho rescue on mainstem: 510 from RKM 74, all sent to IGH tanks	CDFW, RCD, SRWT, USFS, Karuk CDFW
July 22	Scott River dry at SVID/Youngs Dam (RM 47)(RKM 75); lease ends; USGS gage=12 cfs Coho rescue on mainstem: 3,276 from RKM 68, all to South Fork	SRWT USGS CDFW
July 23	Coho rescue on mainstem: 1,837 from RKM 68, all sent to Etna Ck	CDFW
July 24	Coho rescue on mainstem: 404 from RKM 68, all to Duck Lake Ck (French)	CDFW
July 25	Coho rescue on mainstem: 1,736 from RKM 68, with all to French Ck	CDFW
July 29	Coho rescue on mainstem: 7,104 from RKM 71, all to Canyon Ck	CDFW
July 30	Wildfires from lightning encompass western mountains; smoke begins Trib Flows at DWR gages: East Fk=1.4 cfs; South Fk=3.22 cfs; Sugar	USFS DWR

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	Ck=1.01cfs; French Ck=0.63 cfs; Shackelford Ck=0.89 cfs Coho rescue on mainstem: 6,941 from RKM 71, with all to Etna Ck	CDFW
July 31	Coho rescue on mainstem: 5,150 from RKM 71, all to South Fork	CDFW
Aug. 1	Scott River Gage = 6 cfs Coho rescue on mainstem: 1,655 from RKM 71, with 1,152 sent to French Ck and 503 sent to IGH tanks. ABC Nightline crew filmed and interviewed those in effort.	USGS CDFW CDFW/SRWT/ABC
Aug. 5	KNF survey of relocated coho in Grouse Ck: unsuitable for more fish KNF survey of relocated coho in So. Fk. Scott: suitable for more coho Coho rescue on mainstem: 6,360 from RKM 79, all sent to Kelsey Ck	USFS USFS CDFW
Aug. 6	KNF survey of relocated coho in Etna/Mill Ck: pools at capacity Coho rescue on mainstem: 4,686 from RKM 79, all sent to Kelsey Ck	USFS CDFW
Aug. 7	CDFW Coordinated Fish Rescue Planning meeting – conference call Coho rescue on mainstem: 4,440 from RKM 79, all to South Fork	CDFW, RCD, SRWT, USFS, Karuk CDFW
Aug. 8	Coho rescue on mainstem: 8,414 from RKM 81, with 4,980 to French Ck and 3,434 to IGH tanks	CDFW
Aug. 11	Survey of Scott River reach 13: 4,300 age-0 coho	CDFW, RCD
Aug. 12	Coho rescue on mainstem: 4,709 from RKM 81, all to mid-Sugar Ck. Survey of Scott River reach 14: 7,200 age-0 coho	CDFW CDFW, RCD
Aug. 13	Survey of Scott River reach 15a: 5,430 age-0 coho	CDFW, RCD
Aug. 14	CDFW Coordinated Fish Rescue Planning meeting – conference call Survey of Scott River reach 15b: 11,480 age-0 coho	CDFW, RCD, SRWT, USFS, Karuk CDFW, RCD
Aug. 15	Survey of Scott River reach 16: 16,750 age-0 coho	CDFW, RCD
Aug. 17	Rain and lightning storm: 1" to 5" reported, mainly eastside valley	
Aug. 19	Last coho rescue: 933 from mainstem at RKM 81, relocated upstream. Total = 116,000 juvenile coho relocated, of which 1,827 PIT tagged.	CDFW
Aug. 29	ABC Nightline show aired about the Scott coho rescue & relocation effort interviewing CDFW and SRWT staff	ABC Nightline
Sept. 1	Wildfires nearest Scott Valley declared contained: Whites Fire=33,700 acres, Log Fire = 3,632 acres; Happy Camp fire into lower Scott continues w/smoke Scott River Gage = 7.8 cfs	USFS USGS
Sept. 8	Survey of Scott River reach14: 2,450 age-0 coho	CDFW, RCD
Sept. 9	Survey of DO levels in upper Scott River's isolated pools Survey of Scott River reach 15a: 4,160 age-0 coho	CDFW, RCD CDFW, RCD
Sept. 10	Lease began on mid-French Ck for 0.5 cfs Survey of Scott River reach 15b: 3,025 age-0 coho	SRWT CDFW, RCD
Sept. 11	Survey of Scott River reach 16: 8,700 age-0 coho	CDFW, RCD
Sept. 12	Survey of Scott River reach 13: 1,135 age-0 coho	CDFW, RCD
Sept.17	CDFW Coordinated Fish Rescue Planning meeting – conference call	CDFW, RCD, SRWT, USFS, Karuk
Sept. 27	Wildfire at Happy Camp/lower Scott 97% contained: 132,740 acres burned	USFS
Sept. 30	2014 Water Year precipitation total = 12.06" (55% ave.)at Fort Jones; 12.63" (63% ave.) at Callahan	USFS & DWR
Oct. 1	Leases end on French Ck & Sugar Ck (end of Irrigation Season) Scott River Gage = 6.3 cfs	SRWT USGS
Oct. 2	First Chinook adult of the season recorded at CDFW weir @ RKM29;	CDFW
Oct. 20	Chinook adult return at CDFW weir to date = 515 ; gage at 6-12 cfs	CDFW / USGS
Oct. 21	Fish Pathology report recommends IGH coho from Scott are suitable for release back to the Scott	CDFW

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Oct. 23	CDFW Coordinated Fish Rescue Planning meeting – conference call Rain brings up tributary flows, but river disconnected below RM 39 (RKM 63) First coho adults of season return at CDFW weir=6; gage @11-19 cfs	CDFW, RCD, SRWT, NOAA SRWT CDFW
Oct. 23-24	Coho juveniles (~4,000) relocated initially to IGH are returned to upper Scott River (RKM 71) and mid-French Ck.	CDFW
Oct. 24	Scott River continues connection downstream of Fort Jones	
Oct. 25	Scott River flow fully reconnected about 4 a.m.; USGS gage increased to 54 cfs	USGS
Oct. 26	Scott River gage peaks at 210 cfs	USGS
Nov. 1	Scott River gage = 87 cfs	USGS
Nov. 3	CDFW adult weir count (partial): Chinook = 6,683; Coho = 111	CDFW
Dec. 1	Scott River gage = 314 cfs; tribs fully connected to Scott River (or sooner)	USGS
Dec. 3	Curtailment lifted temporarily of junior water rights	SWRCB
Dec. 7	CDFW weir closed due to high flows; prelim. weir count: Chinook=9,052; Coho = 524	CDFW
Dec. 9	Trib. Flows: South Fk = 116 cfs; East Fk = 291 cfs; Sugar Ck = 19 cfs; French Ck = 49 cfs; Shackelford Ck = 100 cfs	DWR
Dec. 12	Scott River gage peaks at 4,790 cfs	USGS
Dec. 31	Scott River gage = 560 cfs	USGS

Abbreviations: CDFW = Calif. Dept. of Fish & Wildlife; DWR = (Calif.) Dept. of Water Resources; NOAA = National Oceanic & Atmospheric Admin. (Fisheries); RCD = Siskiyou Resource Conservation District; SRWT = Scott River Water Trust; SWRCB = State Water Resources Control Board; USFS = US Forest Service, Klamath National Forest; USGS = US Geological Survey

Scott River Reach Locations: 13 (RKM 70-73); 14 (RKM 73-76); 15a (RKM 76-78); 15b (RKM 76-81); 16 (RKM 81-81).

Appendix B – “Priority Sites for Rescue and Relocation” Spreadsheet Example

Prepared by Siskiyou RCD for CDFW for the period July 15 to July 31, 2014, Scott River.

[Note: Specific names and locations were changed to protect the privacy of the landowners.]

Priority Sites for Rescue/Relocation									
Date	Reach	Coordinates	Habitat Type/ Description	COHO 0+	SH/RT 0+	Approx. Depth	Temperature	Ownership/Access	Comments, Photo ID
7/15/2014	Etna Creek	Mouth of Etna Creek	Two Pools-ISOLATED	10 lower pool, 700 upper pool		1 ft lower pool, 2.5 ft upper pool	15.5 -18 C	Ranch A, access from Eastside Rd.	As of 7/21/14 the two pools have disconnected from each other
7/21/2014	Reach 13	N 41 ----W 122 ------	back-channel River Right	300	150	3 ft	21.5 C	Ranch A, access from Eastside Rd.	Possibly losing cold-water source, fish moving to deeper "mouth" of channel, 5 chinook sighted
7/21/2014	Reach 13		Side-Channel - ISOLATED	150	0	2 ft	18 C	Property B, access through the Eastside or through Property Q Ranch C, just upstream of ford accessible from Island Rd.	DSCN7110, thick aquatic plants-fish estimates likely low, cold water also seeping into rip-rap length below which has at least another 200 COHO DSCN7138-40, poor visibility-full of algae, fish estimates are likely low
7/22/2014	Reach 12		Pool-ISOLATED	50	0	3 ft	24 C	Property D, just north of hill	DSCN7177, DSCN7179, fish in root cover
7/22/2014	Reach 12		Pool/Length	250	100	3 ft	23.5 C	Property D, probably accessible from either side of the hill	DSCN7181, 5 Chinook also observed. Heavy aquatic plant cover, fish estimates are likely low
7/22/2014	Reach 12		Back-channel River Left	50	150	2 ft	19 C	Property E, located right at the mouth of French Creek	pool surrounding the antennas, two small pools downstream of small beaver dam
7/24/2014	French Creek		3 small pools - ISOLATED	71	2	2 to 2.5 ft	16 C	Property E, located just upstream of the mouth	just upstream of the small beaver dam, coordinates estimated from Google Earth
7/24/2014	Sugar Creek		channel/pool - ISOLATED	75	225	1 ft	17 C	Property F, easy road access Property G, located downstream of their pond.	located just above the antennas, not likely to last Cold-water back-channel that could provide habitat for other fish.
7/28/2014	Reach 15A		back-channel River Right	2,000	500	3 ft	15 C	Property E, access through the road by the granary then head downstream.	This is a very small pool underneath a tree, hardly a "back-channel" but it has very cold-water that could provide habitat for other fish.
7/28/2014	Reach 15A		small back-channel pool River Right	450	750	2 ft	14 C	Property H, access from SVID	located below the fish ladder, there were also 10 trout over 10 cm and 4 adults observed here
7/29/2014	Reach 14		Pool-ISOLATED	75	75	3	N/A	Property H, access from SVID, located just beneath the upper set of metal fish traps	this small pool/length is nearly isolated due to the metal fish traps, removing them could provide these fish with access to a deep pool upstream.
7/29/2014	Reach 14		small pool	300	350	2 to 2.5 ft	N/A	Property H, access from SVID, located not far downstream from the lower set of metal fish traps	channel with decent fish densities, these fish are confined to Property H
7/29/2014	Reach 14		rip-rap length River Left	750	450	2.5 ft	N/A	Property J, access from the west side of the river at the POD	
7/31/2014	Reach 16		Pool-ISOLATED	25	25	2.5 ft	24.5 C	Property J, access from the west side of the river at the POD	
7/31/2014	Reach 16		Pool-ISOLATED	150	100	2 ft	21 C	Property J, access from the west side of the river at the POD	
7/31/2014	Reach 16		Pool-ISOLATED	100	100	1 ft	21 C	Property J, access from the west side of the river at the POD	culvert spills into pool, poor visibility