

Trinity River Restoration Program Fiscal Year 2015 Preliminary Science Workplan Summary

Program Overview

The Trinity River Restoration Program (TRRP) is seeking to restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels. The Secretary of the Interior signed a Record of Decision (ROD) for the Trinity River Fishery Restoration Final Environmental Impact Statement/Report on December 19, 2000. This Decision adopted a strategy for restoration and maintenance of the Trinity River's fishery resources that requires rehabilitating the river channel and restoring dynamic alluvial processes that maintain aquatic habitats as well as managing flows to meet biological needs of anadromous salmonids. The primary components of the restoration strategy are: mechanical channel rehabilitation, gravel augmentation, a variable flow regime to meet fluvial geomorphic and biological objectives, and watershed restoration. These management actions, in combination, are expected to increase habitat availability for juvenile anadromous salmonids, resulting in increased natural anadromous salmonid production, increased adult recruitment, and increased harvest opportunity in dependent fisheries. The ROD also established an adaptive management program to guide implementation of the restoration strategy. To allow for adaptive management, the TRRP's Integrated Assessment Plan (IAP) (TRRP and ESSA Technologies Ltd. 2009) identifies key assessments to evaluate the river's response to management actions and ultimately the response of fish and wildlife populations that depend on the river. The IAP served as the foundation for the identification of Fiscal Year (FY) 2015 information needs. In addition, refinements to the assessments in the IAP resulting from the May 2013 objectives workshop were also utilized by the Fish Workgroup to develop the FY 2015 prioritized list of projects. Findings from these FY 2015 activities will be used to refine future study designs and restoration actions.

Document Overview

The intent of this document is to provide a concise description of what is being proposed for the FY 2015 science workplan to allow the Scientific Advisory Board (SAB) and Trinity Management Council (TMC) to evaluate the entire body of work. For each discipline, the proposed activities, as well as modifications based on past workplan reviews, are briefly described. Additionally, we express how each proposed activity informs Decision Support System (DSS) development, channel rehabilitation design, flow management, and sediment management (Tables 1-3). We also identify dependencies between proposed activities (see Tables 1-3). Finally, abstracts for proposed activities are included in Appendix A. Full investigation plans are also available for SAB and TMC review.

Fiscal Year 2015 Priorities

Two broad priorities were developed for FY 2014 and continued for FY 2015: (1) monitoring and analysis and (2) DSS implementation. Those priorities are synopsized in the FY 2014 Preliminary Science Workplan Summary from May 2013.

Workplan Development Process

A prioritized list of FY 2015 TRRP projects was developed based on input from individual technical workgroups. Each workgroup developed a list of priorities based on assessments included in the IAP, or refinements to means objectives and metrics resulting from the May 2013 Objectives Workshop, as well as recent learning. The Science Coordinator and Executive Director integrated activities across groups and compiled the results in a single prioritized list (Appendix A of the TRRP FY 2015 investigation plan solicitation). Following distribution of the FY 2015 solicitation, authors submitted their respective investigation plans. All investigation plans are undergoing administrative review. Selected investigation plans will also undergo external scientific review as deemed necessary. The SAB now has the opportunity to evaluate the entire proposed body of work and to provide input to the TMC.

Fish Related Activities

Intent of the Proposed Body of Work

The Fish Workgroup developed a consensus recommendation of prioritized fish and fish habitat monitoring activities to be considered for inclusion in the FY 2015 TRRP science workplan. The FY 2015 prioritized suite of fish related monitoring activities are intended to achieve several purposes that the Fish Workgroup believes are critical for advancement of the TRRP adaptive management program to either 1) assess long term TRRP goals and objectives or 2) provide adaptive management feedback to annual management actions (Table 1).

The Fish Workgroup prioritized FY 2015 recommendation with the consideration of the development and support of a functional DSS, systemic and sites-specific channel rehabilitation assessments, juvenile salmonid assessments, and an integrated comprehensive adult fall Chinook salmon assessment. The Fish Workgroup also recommended comprehensive adult assessments for other priority fish species, including spring Chinook salmon, coho salmon, and steelhead (as prioritized in the IAP), but these assessments were given a lower priority than the above mentioned assessments and projects. In addition, lower priorities such as assessments of Pacific lamprey habitat and juvenile and adult fish disease were also recommended.

As part of the Phase I Review, the SAB has recommended the TRRP develop and implement a DSS. The Fish Workgroup recognizes the potential applications of a DSS, especially the fish production model component. Therefore, we recommend a second year of funding for the fish production model in FY 2015. In accordance with the SAB recommendation and TMC guidance, the first phase of the fish production model will focus on the upper Trinity River from

Lewiston Dam to the North Fork Trinity River confluence. The fully developed fish production component of the TRRP DSS is envisioned to include systemic 2-dimensional fish habitat modeling to provide flow-habitat relationships, adult upstream migration submodel, ocean life history/harvest submodel, multi-species models incorporating variable life history strategies (i.e. ocean vs. stream type Chinook salmon, coho salmon and steelhead for extended freshwater rearing), and models addressing predation and competition.

The TRRP Adult Salmonid Monitoring Evaluation (Bradford and Hankin 2012) also helped guide the Fish Workgroups recommendations. Bradford and Hankin recommended that an analytical group be established to synthesize adult population information in order to evaluate TRRP hypotheses and IAP objectives and that emphasis should first be placed on synthesis and analyses of fall Chinook salmon populations, due to the robust long-term monitoring data sets that are available. The intent of the comprehensive suite of fall Chinook salmon monitoring activities included in the FY 2015 workplan is to maintain this long-term data set, improve integrative analyses, and encourage evaluation of hypotheses. The Fish Workgroup has also initiated a review of adult run size estimates, and the differences between estimates made at the Willow Creek weir, and redd and carcass surveys in the upper Trinity River.

Response to comments from past workplan reviews

Recommendations were incorporated into the FY 2015 workplan as follows:

1. The need for a fish production model was recommended as a critical part of the adaptive management process and DSS to evaluate different management outcomes and then measure the response of juvenile salmonid production. For the second year in a row, the development of a fish production model was the highest priority project recommended by the Fish Workgroup. The salmonid production model may not have the resolution to estimate changes due to actions at local scales, but will be useful for providing feedback at river reach and annual scales. The SAB recommended that the domain for the fish production model be constrained to the upper 40 miles of river, and as such, any efforts to extend the fish production model downstream of the North Fork Trinity River were not pursued for FY 2015.
2. The review noted that the need for a system wide habitat assessment to evaluate habitat availability over a range of flows. The investigation plan continues the annual systemic estimate of rearing habitat availability by sampling throughout the upper 40 miles of river as well as pre-construction/post-construction habitat assessments of select channel rehabilitation sites. The need for a system wide habitat model is being addressed in FY2014 by developing the 11 400-m 2D habitat models throughout the 40 mile upper river and integrating these models with the 40-mile physical model under development.
3. While the SAB commented on the methods of the juvenile density monitoring project, particularly evaluating the analytical approach, and the project was modified where appropriate, this project was not solicited for FY 2015. This project supported a data need for

the fish production model and data collected in FYs 2013 and 2014 are sufficient for the model.

4. The SAB noted that run size and PNI estimates are duplicative in the Chinook salmon run size estimation using mark-recapture methods and the Chinook salmon mainstem redd/carcass spawning survey projects. However, the Chinook salmon run size estimation using mark-recapture methods produces estimates for the entire Trinity River basin upstream of Willow Creek, while the Chinook salmon mainstem spawning survey produces estimates for the mainstem Trinity River only. The Fish Workgroup has also initiated a review of adult run size estimates, and the differences between estimates made at the Willow Creek weir, and red and carcass surveys in the upper Trinity River.

Wildlife and Riparian Activities

Intent of the proposed body of work

The wildlife and riparian portion of the science workplan has three components: 1) Map and Quantify Riparian Vegetation, 2) Avian Monitoring, and 3) Herpetological Monitoring. Riparian Vegetation Monitoring and Avian Monitoring are similar to the work conducted in previous years, while the Herpetological Monitoring component is fairly new (work commenced in FY 2013).

Map and Quantify Riparian Vegetation involves a riparian monitoring strategy employing multi-disciplinary monitoring efforts to address cause-and-effect relationships between management actions, physical processes, and riparian vegetation response. Proposed tasks include:

- Establishing cross sections at 16 Generalized Random Tessellation Stratified (GRTS) selected exposed bars for basing riparian band transects,
- Censusing riparian seedlings in band transects,
- Quantifying the rate of transition among riparian vegetation patch types and age classes,
- Evaluating changes in large wood storage at 16 GRTS segments,
- Evaluating the recovery of riparian vegetation at channel rehabilitation sites,
- Calibrating, finalizing, and applying a temperature-dependent target hardwood seed dispersal model,
- Identifying the managed flows and design features that best promote target hardwood recruitment, and
- Identifying the plant species that compose the 2014 riparian cover map to estimate optimal habitat.

Results will be used to revise conceptual and quantitative models, link results to management actions, and make adjustments to future management actions.

The Avian Monitoring component includes monitoring temporal changes in riparian bird species performance metrics at the rehabilitation site, local reach, and restoration reach scales and

determining restoration-associated mechanisms that explain variation in riparian bird performance metrics at the rehabilitation site scale. There is no investigation plan for the Avian Monitoring project this year because this is an option year of a multi-year contract.

The Herpetological Monitoring component will implement the long-term monitoring protocols that are currently being developed under an agreement with the USGS. Monitoring focuses on two special-status aquatic species: western pond turtle and foothill yellow-legged frog. The protocols being developed are consistent with the assumptions required for occupancy modeling, in order to provide the TRRP with straightforward metrics for monitoring the status and trends of these populations.

Response to comments from past workplan reviews

The SAB review of the FY 2014 preliminary workplan emphasized three questions important to designing a riparian-oriented science workplan for the TRRP. The questions are:

1. What are the relative rates of erosion and deposition?
2. What are the relative rates of fish habitat creation and loss?
3. What are the patch-wise transitions of the above transitions?

Now that there has been five years of data collection using a standardized, GRTS-based sampling routine, rates-of-change can be estimated. Riparian Task 3, “Quantify the riparian vegetation rate of transition for near channel patch types and age classes at 16 400 m Segment GRTS sites” takes advantage of this dataset to answer these three questions.

The SAB’s review also pointed out potential areas of overlap between Riparian tasks and tasks performed under Avian, Geomorphic, or Environmental Compliance. Reducing redundancies in data collection has the potential to save effort and time in TRRP projects, and the SAB was correct in pointing out potential areas of overlap. To avoid areas of overlap or duplications of effort among projects, existing projects were examined for redundancies, and proposed projects are compared to existing projects to see if existing or ongoing datasets are sufficient.

Three specific areas of potential overlap were examined. Under “Map and Quantify Riparian Vegetation”, there are tasks that potentially overlap with avian monitoring, the plant survival monitoring conducted by Northwind Services for regulatory compliance purposes, and large wood data collected during fish habitat monitoring. In all three cases, the degree of overlap was limited by the specific questions asked by each group. For example, a releve’ sample collected in support of avian monitoring would be centered around or near a point that produces information relevant to avian monitoring such as a point count station or nest; the vegetation data would be related to some aspect of avian ecology. A releve’ sample collected in support of vegetation monitoring would be located as part of a spatially-balanced sampling routine (GRTS); the vegetation data would be related to flow, sediment, channel rehabilitation, or perhaps some other

edaphic factor. To create a single vegetation dataset to answer both suites of questions would either cost more, or be less precise, than having both disciplines collect vegetation data in a way that was tailored to their specific questions. The Wildlife and Riparian workgroup will continue to explore areas of collaboration and cooperation in data collection.

Physical Activities

Intent of the proposed body of work

The intent of the proposed body of work is to document and understand the channel response to management actions and inform future management actions. Specifically, 1) inform development of the peak magnitude and duration of the spring flow releases and 2) inform decisions on how much gravel augmentation is needed. The heart of the physical program of work for FY 2015 is two recurring projects: sediment monitoring and gravel implementation monitoring. These projects operate independently from one another.

Sediment monitoring consists of measuring bedload and suspended sediment transport rates at four locations along the river. These data are subsequently used by program scientists in a variety of analyses that track progress toward program objectives and inform management actions. Some of these analyses include: 1) compute sediment budgets needed to evaluate progress toward coarse and fine sediment storage objectives; 2) assess bed mobility and the effects of past gravel augmentation at the system scale; and 3) evaluate long-term gravel augmentation needs. Gravel implementation monitoring consists primarily of topographic data collection and analysis that identifies and quantifies changes in channel morphology, such as bar formation and pool dynamics. These data and analyses provide a direct link between management actions and physical riverine conditions, and complement the sediment monitoring information by investigating the combined effects of gravel additions and flow managements at a more local scale.

In past years, the physical science program also included a reoccurring scour and mobility monitoring task used to track progress towards program objectives and inform on-going riparian studies. This task has been put on hold in FY 2015 while past data is synthesized and analyzed to determine spatial and temporal trends. Results from this analysis will inform future monitoring needs.

Response to comments from past workplan reviews

The FY 2013 workplan review (managed by Atkins with SAB oversight; Atkins 2012) identified updating the conceptual model for gravel routing and transport as one of the top three program priorities to be addressed. The updated conceptual model is needed to build a long-term operational plan for flow and gravel augmentation. The review stipulated the long-term plan must be built on more specific, testable estimates of how gravel moves through the system. To implement the recommendation, the Atkins review recommended that each component of the

physical program of work be revised and refocused into an integrated whole that directly supports the field monitoring and analytical work to update the conceptual model, build the long-term operational plan, and implement adaptive management.

Progress towards implementing the Atkins recommendations includes formation of a multi-disciplinary gravel augmentation workgroup, an updated sediment budget that indicates the short-term gravel deficit has largely been addressed, and development of a 40-mile long hydraulic model to support renewal of the 5-year gravel augmentation permit. The gravel workgroup is currently developing quantitative gravel augmentation recommendations based on site specific physical and biological needs. Recommendations from the Atkins review yet to be addressed include updating the conceptual model, developing testable estimates of how the gravel is moving through the system, and revamping the physical science workplan into an integrated whole. The gravel workgroup will continue to make progress towards addressing these recommendations in FY 2015.

General activities

In addition to the discipline specific activities listed in Tables 1-3, the FY 2015 preliminary science workplan also includes the following general activities: stream gage monitoring, temperature monitoring, and a water-year specific fund.

Summary

The suite of projects presented here meets the TRRP's priorities for restoring the Trinity River's fishery resources. Activities or sub-tasks may be modified based on the administrative review, SAB input, budgetary constraints, and TMC deliberations. Findings from FY 2015 activities will be used to refine future study designs and restoration actions.

References

Atkins. 2012. Peer Review Report: Trinity River Restoration Program Preliminary Fiscal Year 2013 Science Workplan. Prepared for the TRRP – October 2012.

Bradford and Hankin. 2012. Trinity River Restoration Program Adult Salmonid Monitoring Evaluation. Prepared for the TRRP – March 26, 2012.

Scientific Advisory Board (SAB). 2013. Draft Appendix H Review of the Trinity River Restoration Program's Channel Rehabilitation Strategy, Phase 1: Decision Support System Framework. Draft March 22, 2013. Prepared by Anchor QEA, LLC for Trinity River Restoration Program's Scientific Advisory Board.

TRRP and ESSA Technologies Ltd. 2009. Trinity River Restoration Program: Integrated Assessment Plan. Version 1.0 – September 22, 2009.

Table 1. Proposed fish activities for the FY 2015 preliminary science workplan. Activities are listed in order from highest to lowest priority.

Activity	Informs DSS development	Informs rehab design	Informs flow release	Informs sediment management	Tracks accomplishments of program goals	Dependences between projects within this discipline or with other disciplines
Fish Population Dynamics Model	Primary sub-model in proposed TRRP DSS structure.	If evaluating design alternatives.	Can be used to evaluate different flow releases.	Not as currently proposed. Another DSS component sediment model may feed into future fish prod model.	Yes - will be capable of modeling salmonid production with under varying restoration actions and relate these data to restoration goals.	Fish Habitat modeling, fry density monitoring, Chinook salmon outmigrant monitoring, Chinook salmon run-size estimation, redd and carcass surveys.
Rearing Habitat Assessment (see tasks below)						
<i>Channel Rehabilitation Site Rearing Habitat Assessment</i>	Possibly - could be used in conjunction with 2D habitat modeling to improve the habitat submodels of the fish production model of DSS.	Assesses pre and post construction function and quantity of habitat change resulting from construction.	Documents physical change from flow releases.		Assesses changes in available fry/juvenile rearing habitat.	
<i>Systemic Habitat Estimate</i>	Possibly - could be used in conjunction with 2D habitat modeling to improve the habitat submodels of the fish production model of DSS.	Assesses systemic changes in quantity of habitat resulting from construction and flow management.	Documents physical change from flow releases.	Documents physical change from sediment management.	Assess changes in available fry/juvenile rearing habitat.	
<i>Support for Salmon Production model</i>	Needed as the habitat basis for the fish production model.		Model changes in available rearing habitat at various managed flows.			Fish production modeling is dependent on the habitat framework.
<i>Large Wood Monitoring at new Rehab sites</i>		Yes.				

Activity	Informs DSS development	Informs rehab design	Informs flow release	Informs sediment management	Tracks accomplishments of program goals	Dependences between projects within this discipline or with other disciplines
Trinity River Juvenile Salmonid Outmigration Monitoring Program			Relates outmigrant timing to flow management.		Assesses changes in juvenile Chinook salmon in relation to channel rehabilitation and flow management.	Dependent on Chinook CWT at TRH.
Mainstem Chinook Spawning Survey		Provides data that can be overlaid with restoration site habitat data to evaluate changes in spawning areas and used to evaluate specific areas where spawning habitat is prioritized (i.e. hatchery reach).	Documents redd desiccation issues.	Can be used to evaluate coarse and fine sediment management effects on spawner distribution.	Redd data used to estimate total inriver spawning escapement in conjunction with weir generated data.	CWT recovery/tag recovery for separating hatchery/natural and spring and fall Chinook salmon spawning in the river, and spawning habitat assessment.
Chinook Run-size Estimation Using Mark-recapture Methods in the Trinity River basin					Provides estimates adult Chinook salmon escapement to be evaluated against programmatic goals.	TRH Chinook CWT tagging, Klam-Trin fall-run scale age analysis, sport and tribal harvest monitoring.
Trinity River Hatchery Chinook Coded Wire Tagging					Tagging data necessary to separate hatchery and naturally produced fish.	Chinook run-size estimates, outmigration monitoring, Klam-Trin fall-run scale age analysis, cohort analysis, sport and tribal harvest monitoring.
Klamath-Trinity River Fall Run Scale Age Analysis					Age composition data allows for separation of run into age classes to allow for cohort analysis.	Contributes to sport and tribal harvest management, cohort reconstruction analyses, dependent on scale collections at TRH, weirs and carcass surveys.

Activity	Informs DSS development	Informs rehab design	Informs flow release	Informs sediment management	Tracks accomplishments of program goals	Dependences between projects within this discipline or with other disciplines
Yurok Tribal Fisheries Monitoring					Assesses Program goal to "to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities".	Contributes to CWT recovery, fall Chinook salmon age composition analysis, and cohort reconstruction analyses.
Hoopa Tribal Harvest Survey of Trinity River Fall Chinook					Assesses Program goal to "to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities."	Contributes to CWT recovery, fall Chinook salmon age composition analysis, and cohort reconstruction analyses.
Lower Trinity River Sport Harvest Survey					Assesses Program goal to "to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities".	Contributes to CWT recovery, fall Chinook salmon age composition analysis, and cohort reconstruction analyses.
Lower Klamath Creel Census					Assesses Program goal to "to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities".	Contributes to CWT recovery, fall Chinook salmon age composition analysis, and cohort reconstruction analyses.

Table 2. Proposed wildlife and riparian activities for the FY 2015 preliminary science workplan. Activities are listed in order from highest to lowest priority.

Activity	Informs DSS development	Informs rehab design	Informs flow release	Informs sediment management	Tracks accomplishments of program goals	Dependences between projects within this discipline or with other disciplines
Map and Quantify Riparian Vegetation (see tasks below)						
<i>Cross-section Surveys</i>						Provides topographic and flow-inundation information for evaluating riparian vegetation dynamics
<i>Systemic Riparian Seedling Response to Managed Streamflows</i>	Informs models (TARGETS) and flow scheduling at short time intervals.		Scour and establishment inform flow releases.	Rates of berm formation checks sediment augmentation and fine sediment reduction.	Measures progress towards bed mobilization and vegetation establishment objectives.	Geomorphic monitoring and assessment of bed scour and mobility; Potential to further integrate flow and sediment modeling to predict planform dynamics.
<i>Quantify the Riparian Vegetation Rate of Transition for near Channel Patch Types and Age Classes</i>	Informs models (TARGETS) and flow scheduling at longer time intervals.		Patch transition informs flow releases	Rates of berm formation checks sediment augmentation and fine sediment reduction.	Measures progress towards channel migration objectives	This project ties the annual systemic riparian seedling response monitoring to longer-term, planform-level changes
<i>Evaluate Changes in Large Wood Storage and Structural Characteristics of Abundant Riparian Vegetation Patches</i>	Informs models (e.g., CASIMIR).	Informs progress towards LWD targets; floodplain lowering and disturbance design elements.			Measures progress towards LWD objectives and wildlife habitat objectives.	
<i>Evaluate Riparian Vegetation Recovery at Channel Rehabilitation Sites</i>		Informs constructed floodplain and disturbance feature designs.			Measures progress towards environmental compliance objectives (1:1 replacement of impacted riparian vegetation).	
<i>Cross-section Surveys</i>						Provides topographic and flow-inundation information for evaluating riparian vegetation dynamics
Avian Monitoring	High-level indicators of ecosystem health.	Avian habitat use influences revegetation designs.			Measures progress towards wildlife objectives.	Evaluates use of vegetation placed or impacted during channel rehabilitation.

Activity	Informs DSS development	Informs rehab design	Informs flow release	Informs sediment management	Tracks accomplishments of program goals	Dependences between projects within this discipline or with other disciplines
Herpetological Monitoring	Long-term indicators of ecosystem health; used in flow scheduling.	FYLF and WPT occupancy influences design feature placement.	FYLF breeding chronology indicates degree synchronicity between tributaries and mainstem.	FYLF require bars for breeding; informs sediment augmentation.	Measures progress towards wildlife objectives.	

Table 3. Proposed physical activities for the FY 2015 preliminary science workplan. Activities are listed in order from highest to lowest priority.

Activity	Informs DSS development	Informs rehab design	Informs flow release	Informs sediment management	Tracks accomplishments of program goals	Dependences between projects within this discipline or with other disciplines (list item #)
Gravel Implementation Monitoring		Evaluates past augmentation and Informs future augmentation.		Evaluates past augmentation and Informs future augmentation.		
Sediment Monitoring	Informs models (transport / morph dynamics) and sediment budget.		Transport rates and dynamics inform high flow releases.	Transport rates inform sediment budget and gravel augmentation requirements.	Transport rates inform sediment budget i.e. quantifies sediment storage goals.	

APPENDIX A

TRINITY RIVER RESTORATION PROGRAM FISCAL YEAR 2015 INVESTIGATION PLAN ABSTRACTS

Klamath-Trinity River fall run Chinook scale age analysis

Kautsky, George (PI); Logan, Eric; Matilton, Bill; Williams, Desma

This project is dependent upon partnering with fishery managers responsible for monitoring the harvest and escapement of fall Chinook within the Klamath-Trinity Basin. Scales collected from these field efforts are catalogued, cleaned, impressed on acetate slides, and aged by the proposers. Age structure data complements general totals estimated for the Klamath Basin fall run Chinook stratified by recovery sector (e.g. fishery, hatchery, or natural spawning areas). This project contributes invaluable information to related efforts such as the annual Chinook harvest management process of the PFMC and the development of cohort reconstructions to assess performance of subsequent broods of Klamath-Trinity Chinook. This project evaluates long-term progress toward achieving TRRP goals and objectives. An Adult Fish PITA in the IAP summarizes: "What is the effect of TRRP habitat improvements on recruits per spawner and harvest, after removing effects of ocean conditions, temperatures, in-river flows, etc.?" One method for probing this question is the completion of cohort analyses based upon age-structured assessments of river returns by run and their specific contributions to fisheries. Cohort reconstructions are dependent upon age-structured run and fishery recovery data that are developed by the activity proposed herein.

Lower Trinity River Sport Harvest Survey

Kautsky, George (PI); Matilton, Bill

The overall project goal is to estimate total angler harvest of Chinook and steelhead from Willow Creek Weir (WCW) downstream to the confluence of Trinity River with Klamath River. This project evaluates the hypothesis that by restoring natural production of the Trinity River, dependent fisheries will be restored. The project monitors harvest by non-tribal fishers participating in annual recreational harvest of fish produced in the Trinity River. Complementary investigations assessing contribution of naturally produced Trinity River origin fish are also conducted within the Tribal harvest sector. Analysis comprises mathematical expansion of sample data values to generate estimates of total harvest within sample strata, and summing to season totals. A useful metric will be calculated estimates of uncertainty, or confidence intervals, for stratum and season total estimates. Developing methods for estimating uncertainty in results of the Lower Trinity River Sport Harvest Survey is a work-in-progress.

Hoopa Tribal harvest survey of Trinity River fall Chinook

Kautsky, George (PI); Matilton, Bill

The primary goal of this study is to provide a total estimate of Hoopa Tribal harvest of fall Chinook. CWT recovery and analysis is necessary to determine the contribution of Trinity Hatchery fish to the over-all harvest. CWT data are also useful for correcting bias in the estimates of scale-based age structures for fall Chinook. Further, hatchery/natural composition for fall Chinook is estimated through expansion of CWTs recovered in this fishery. This provides the Program with a tool to assess the potential confounding influence of hatchery stock on the naturally produced fall Chinook target. Net

harvest sampling methods include field acquisition of catch and biological data and samples in a two-stage sampling schedule. Net harvest analyses include two-stage calculations of harvest estimates for sampling strata and season totals, calculations of statistical confidence intervals, proportions of hatchery and natural -origin fish of each species. Reporting metrics include timely generation of catch estimates, and magnitudes of statistical uncertainty. For tribal hook and line fishing, sampling is carried out in week-day and week-end strata. Types of biological data acquired are similar to those from net harvest sampling. Estimation of total harvest involves sample data for total anglers, angler fishing hours, and catch per hour fished on sampled days within strata. Stratum estimates are summed to week estimates. Development of methods to calculate measures of uncertainty of estimates are in progress.

Trinity River Hatchery Chinook Coded Wire Tagging

Kautsky, George (PI); Matilton, Bill

The project objective is to apply a 25% constant fractional mark (CFM) of all Chinook production at Trinity River Hatchery (TRH) using Coded Wire Tags (CWT). This project applies CWTs and Ad fin clips to spring- and fall-run Chinook salmon reared at TRH. Twenty-five percent of each race (spring/fall) and each release strategy within race (smolt or yearling) are to be marked. An automated tagging trailer constructed by Northwest Marine Technology will be used for in 2015. Representative marking will be ensured by the automated tagging trailer as well ensuring that 25 percent Ad CWT is assigned to each rearing pond sub-population. The marks subsequently recovered in juvenile and adult monitoring projects in river are used to estimate contributions of hatchery and natural populations in mixed stock marine and river fisheries and adult spawning escapements. Population estimates are used to assess juvenile and adult production by brood year, run, and rearing type. Brood tables constructed for hatchery and wild fish, based on Ad CWT results, may be used to model performance of hatchery and naturally spawned fish.

Chinook run-size estimation using mark-recapture methods in the Trinity River basin.

Kier, Mary Claire (PI); Kautsky, George; Matilton, Bill

The purpose of this study is to produce run-size estimates on the Trinity River primarily for naturally-produced Chinook. The run-size and escapement estimates aid in the status and trend monitoring needed to evaluate short- and long-term progress toward achieving Trinity River Restoration Program goals and objectives. Run-size estimates for natural- and hatchery-components of coho, and adult fall-run steelhead will be produced as well. The current goal for Trinity River naturally-produced fall-run Chinook salmon is 62,000 adults; 6,000 naturally-produced spring Chinook; 1,400 naturally-produced coho; and 40,000 naturally-produced steelhead. Additionally, the harvest estimate component of this study addresses the stated goal in the Record of Decision (ROD 2000) of increasing harvest opportunity for dependent fisheries. Run estimates and associated 95% CI will be estimated using Chapman's version of the Peterson single census mark-recapture method (as modified by Ricker, 1975).

Yurok Tribal Fisheries Monitoring 2015

Williams, Desma (PI); Nova, Arnold; Ray, Robert

The goal of this project is to gather information from the Yurok Tribal fall fishery to assess the harvest of Klamath/Trinity fish stocks by the Yurok Tribe. This information is critical to determine the abundance of particular broods of fall-run Chinook from the Klamath and Trinity Basins, as well as their hatchery or natural origin. The companion age composition project then allows this information to be apportioned to each brood. The Tribal harvest numbers, and in river run data from other areas/fisheries combined with

the age composition, and coded wire tag recoveries, can be used to develop a cohort reconstruction for ocean escapement of Trinity River fall Chinook; both hatchery and natural origin fish. This project will not conduct this cohort reconstruction analysis, but will provide information from the Yurok harvest that is necessary to conduct this analysis. The cohort reconstruction modeling will provide the number of ocean recruits (pre-harvest adult fish) per brood, which can then allow for an evaluation of brood year success relative to environmental factors (such as flow regimes), as well as an evaluation of the success of the Trinity River Restoration Program (TRRP). The Tribe's harvest information is also used for the management of Klamath/Trinity fall Chinook fisheries. This project also allows the tracking of progress toward meeting long-term TRRP goals as identified in the IAP, such as restoring and sustaining natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels, to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities. .

2015 Lower Klamath Creel Census

Borok, Sara (PI); Cannata, Steve

The California Department of Fish and Wildlife proposes to continue creel census data collections to monitor the number of Chinook salmon harvested by sport anglers in the lower Klamath River. The main objectives of the creel census are to estimate the sport harvest and sport angling effort for Chinook salmon, estimate the harvest of naturally produced Chinook and estimate the contribution from TRH and Iron Gate hatchery stocks to the Chinook harvests. Access point creel census design and analysis are used to develop quantitative data describing the sport fishery. The sport harvest statistics are used to evaluate a fundamental objective of the Trinity River Restoration Program (TRRP); to facilitate and expand salmonid harvest opportunities. We will use trend analysis techniques to determine if harvest are changing over time. In addition, scales collected from all fish and coded-wire-tag data collected from hatchery fish during creel census are integrated into cohort reconstruction efforts needed to estimate the harvest of naturally produced Trinity River Chinook salmon from the lower Klamath River. The budget for this Investigation Plan is for support of field crew activities. A California Department of Fish and Wildlife funded Biologist is the project manager not funded by this IP or by TRRP. .

Mainstem Chinook salmon spawning survey

Chamberlain, Charles (PI); Hill, Andy; Kautsky, George; Quinn, Shane; Wiseman, Eric

This study targets spring and fall Chinook salmon spawning in the mainstem Trinity River. Trinity River Chinook salmon spawning begins in early September and continues through mid-December. Monitoring salmon redd and carcass abundance and distribution will inform estimates of total natural mainstem spawning escapement, and reveal temporal and spatial response of mainstem spawning to restoration through time. We postulate that the spatial distribution of returning spawners (hatchery fish excluded) is influenced not only by the spatial distribution of spawning habitat, but by the distribution of habitats that specific to other life history stages that facilitate successful emergence, rearing, and recruitment to adulthood. The mainstem spawning distribution of natural origin Trinity River Chinook salmon upstream of the Burnt Ranch Gorge is currently skewed toward Lewiston Dam; the distribution of hatchery origin fish much more so (Sinnen 2004, Knechtle and Sinnen 2006, Hill 2009, Chamberlain et al 2012). As the success of fish born from gravels in the mainstem increases in response to improved rearing habitat conditions, we expect spawning distribution to be driven increasingly by distribution of habitat, rather than proximity to the hatchery. .

Habitat assessment

Goodman, Damon (PI); Alvarez, Justin; Kautsky, George; Martin, Aaron

The Trinity River is the focus of a restoration effort designed to improve riverine function as a means for increasing anadromous fish populations. Anadromous fish populations are limited by habitat area which is the primary focus of the restoration effort. This project focuses on evaluating changes in habitat availability due to restoration actions in the Trinity River. These observations are then leveraged to develop tools for decision makers to improve the impact restoration actions have on increasing freshwater habitat quantity and quality. The primary components of this proposal include before and after comparisons of channel rehabilitation actions across a range of flows, an assessment of status and trends in habitat quantity and quality throughout the restoration reach, an assessment of temperature variability within rehabilitation sites, as well as support for the development of the fish production model. .

Gravel Implementation Monitoring

Gaeuman, David (PI); Krause, Andreas

This proposal integrates monitoring activities needed to evaluate the transport and deposition of gravel introduced into the channel via high-flow injection or low-flow placement, and to support the planning and design of future gravel augmentation activities. These monitoring activities will also help to evaluate the performance of individual rehabilitation design elements and rehabilitation strategies. The proposed monitoring builds upon similar activities initiated in FY2011 and continued in FY2013. In FY2013, the work focused on assessing how gravel additions and channel rehabilitation actions have affected pool depths at both the local and system-wide scales in response to questions regarding the potential filling of adult holding habitat raised by certain stakeholder groups. Although the tracking of pool depth changes remains an important component of this monitoring effort, it is proposed that the scope of the FY2014 work will be expanded to address a wider range of questions regarding the fate of augmented gravel and how it interacts with other management actions to alter geomorphic complexity at the reach scale. .

Gravel Implementation Tracer Experiment

Gaeuman, David (PI); Bandrowski, David

This proposal is intended to demonstrate the extent to which gravel injected into the channel during high flow events is transported downstream. This investigation will complement a related investigation into the behavior of gravel additions and their effects on the river system (Gravel Implementation Monitoring). While Implementation Monitoring focusses on the topographic and substrate changes that result from gravel additions, this tracer experiment addressed gravel mobility and transport at the particle scale. Tracking individual particles from their point of insertion into the river to their ultimate resting locations downstream provides unambiguous information about how far gravel particles move and the frequency distribution of different travel distances. Topographic monitoring alone lacks this specificity. Instead, it is more closely linked to the habitat value gained by gravel additions. .

Map and Quantify Riparian Vegetation

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This riparian investigation plan (IP) proposes assessments to evaluate riparian related program hypotheses and objectives (TRRP 2005, TRRP and ESSA 2009). The riparian monitoring strategy employs multi-disciplinary monitoring efforts, where appropriate and possible, to address cause-and-effect relationships

between management actions, physical processes, and riparian vegetation response. Riparian vegetation response prediction will be evaluated along the mainstem Trinity River at sites selected using a Generalized Random Tesselation Stratified (GRTS) survey design. Additional sites will be selected for evaluating systemic various riparian vegetation transition states as a response to bank erosion and accretion or instream gravel storage and large wood storage utilizing the systemic GRTS 400 m segment based sub-sampling strategy that was developed and used since 2009 (Goodman et al 2012). The evaluation of large wood and the characterization of riparian vegetation transition states will be collocated with the fish habitat assessment sample sites. A second sampling design was developed in 2013 to include a census of exposed bars between Lewiston Dam and the North Fork Trinity River. A sub-sample of exposed bars will be selected using the GRTS method to evaluate riparian related objectives (Pickard 2012) and to evaluate systemic predictions of riparian vegetation response. Many of the methods, analyses, and metrics proposed in this IP have been previously used in Trinity River geomorphic and riparian monitoring (McBain and Trush 2004, McBain and Trush 2006, McBain and Trush 2007). Band transects will be used to document changes in woody plant demographics resulting from managed spring streamflows and results from the GRTS sample sites will be expanded to describe systemic response to water year (WY) 2014 high flow event(s). A complete census of channel rehabilitation sites will be conducted as part of evaluating the riparian vegetation recovery. Riparian vegetation recruitment and revegetation response will be related to topographic variability of specific design elements (alcoves, side channels, constructed benches, constructed gravel bars, etc.), inundation frequency and duration, groundwater proximity where feasible, and substrate texture. A predictive model of seed release timing for cottonwoods and large tree willow species will be developed using new phenology data and the existing degree day model developed in 2013. Results will be used to revise conceptual models, link riparian vegetation responses to management actions, direct the timing of annual managed streamflows, and adjust channel designs to future management actions.

