

# MESM 2016-2017 Group Project Proposal

Project Title: *Return on Investment: Quantifying the benefit of restoring the Lower Yuba River for Chinook salmon, steelhead, and other ecosystem services.*

## Proposers:

Alyssa Obester, MESM 2017, (650) 678-2695, aobester@bren.ucsb.edu

Jayne Ohlhaver, MESM 2017, (949) 933-0917, johlhaver@bren.ucsb.edu

## Client:

South Yuba River Citizens League (SYRCL)

Rachel Hutchinson, (530) 265-5961 x205, rachel@syrcl.org

## Project Objectives

1. Identify ecosystem benefits associated with potential restoration actions on the Lower Yuba River, specifically focusing on actions that would benefit spring and fall-run Chinook salmon and steelhead trout.
2. Determine which restoration strategies by river reach will maximize short and long-term benefits for the three fish species while providing other ecosystem benefits.

## Significance

The Yuba River is one of the last strongholds for wild, self-sustaining salmon and steelhead runs in the whole of California's Central Valley. The historic impact of placer and hydraulic mining during the 19th century resulted in a radically altered, diverted and devastated river system.

Since the mid-1800s, populations of anadromous salmonid fish in the Yuba River have been adversely affected by anthropogenic factors, including hydraulic gold mining, channel manipulation (including dam construction), water diversion, and regulation of the flow regime. As is the case for all rivers draining into California's Central Valley, populations of native Chinook salmon and steelhead in the Yuba River have declined dramatically since European settlement of the area. It has been estimated that about 2 million fall-run Chinook salmon returned annually to Central Valley rivers and streams before the Gold Rush, of which about 15%, or up to 300,000 fish, returned to the Yuba River (Yoshiyama et al. 2001; CDFG 1993). Over the last 30 years, an average of about 15,000 fall-run Chinook salmon have returned to the Yuba River to spawn annually, a substantial reduction from historical numbers (CDFW 2015). Central Valley steelhead were listed by the National Marine Fisheries Service (NMFS) as a threatened species in 1998, and spring-run Chinook salmon were listed by NMFS as a threatened species a year later.

NMFS's Recovery Plan for spring-run Chinook salmon and steelhead identifies specific recovery actions for these species. Priority actions in the Plan include: developing and implementing a

program to reintroduce spring-run Chinook salmon and steelhead to historical habitats upstream of Englebright Dam; developing and implementing programs to promote natural river processes, including adding riparian habitat and instream cover; and improving spawning habitat in the river canyon below Englebright Dam (NMFS 2014). Constructed in 1941, the 280-foot Englebright Dam blocks fish migration to the upper watershed. As a result, spawning and rearing habitat for Yuba River salmonids is constrained to the Lower Yuba River (LYR), a 24-mile stretch of river channel below the dam and above the confluence with the Feather River in Marysville. The primary purpose of the dam was to trap mine waste that would result from the resumption of hydraulic gold mining activities in the upper watershed, which had been curtailed by the Sawyer decision of 1884. Although no significant hydraulic mining occurred after its construction, the dam has nevertheless acted to block the downstream transport of coarse sediment to the LYR. Cobble, gravel, and sand in the bedrock canyon just below the dam have been washed out during mobilizing flows through time, leading to a lack of suitable spawning substrate within the 2-3 reaches proximal to the dam. Downstream of these reaches, the river is impacted by a legacy of dredger mining activity and demonstrates need for enhanced riparian and floodplain habitat.

While the return on investment study will be developed to guide SYRCL's future restoration activities, several other key stakeholders from the Yuba River Management Team (RMT) will benefit from this information generated by this exercise. RMT members include: Yuba County Water Agency, California Department of Fish & Game, NMFS, US Fish & Wildlife Service, The Bay Institute, Friends of the River, Trout Unlimited, Pacific Gas & Electric, and the Department of Water Resources.

## **Background**

In 2012, SYRCL completed the largest restoration project to date in the Lower Yuba River, planting over 6500 willows and cottonwoods on Hammon Bar. In 2013, SYRCL and cbec engineering produced a report titled, *Hydrologic and Geomorphic Analysis to Support Rehabilitation Planning for the Lower Yuba River*, which described 18 potential sites for habitat enhancement using methods of grading, riparian planting and placement of woody structure. Today, SYRCL is working to implement a number of these projects and is in the planning phase to place gravel for spawning habitat, regrade floodplain habitat, and create new side channels. In addition, the Army Corps of Engineers is in the process of creating a Yuba River Ecosystem Restoration Feasibility Study, to identify projects to restore the watershed.

Presently, we have only a limited understanding of the direct or indirect benefits of proposed restoration actions identified in the 2013 rehabilitation planning report. Additionally, the 24 miles of river from Englebright Dam to the Feather River contains eight distinct geomorphic reaches, each with its own set of environmental conditions and constraints to support fish habitat (Pasternack et al. 2010). This project will allow SYRCL to have a better understanding of both direct and indirect benefits associated with these proposed implementation projects and potential

alternatives as the Lower Yuba River is rehabilitated to help support salmonid and floodplain habitat. The outcomes of this study will allow SYRCL to prioritize which types of restoration treatments should be applied within the 24 mile stretch of river to maximize benefits to salmon and steelhead and provide additional ecosystem benefits.

## **Proposed Approaches**

Objective I: A thorough literature review will be conducted to determine the expected impact to ecosystem services for proposed restoration actions on the Lower Yuba River. These ecosystem services might include: increased salmon spawning and rearing habitat, salmon populations, overall biodiversity, carbon sequestration from tree planting, water quality improvements, flood mitigation etc.

Objective II: Complete a detailed return on investment study for spring and fall-run Chinook salmon and steelhead for different restoration strategies. Analytic methods will be informed by the literature review and concurrent planning processes on the Yuba River. The study will provide recommendations for restoration actions by river reach that will maximize the benefits for each of the three species. We will analyze the direct benefit of proposed restoration actions (gravel augmentation, floodplain lowering, tree planting, side-channel construction, etc.) to either salmon spawning or rearing activities. Specifically, the group will ask what the return on investment will be for salmon spawning (redd density), salmon rearing, and salmon return. At least one of the restoration projects currently proposed by SYRCL will be used as a test case within this study.

## **Available Data**

Data that can be made available to the Bren School that SYRCL currently holds includes salmon redd density data, salmon return data from the fish counter at Daguerre Point Dam, reach outlines, data, flow data, restoration location and planning information, and vegetation data. SYRCL is a member of the Yuba River Management Team, and thus has access to a wide variety of data relevant to the proposed project.

## **Deliverables**

Students will deliver a return on investment study for steelhead and spring and fall-run Chinook salmon habitat restoration in eight reaches of the Lower Yuba River. Students will develop a management plan with recommendations for different restoration priorities by river reach based on the return on investment for prioritized salmonid species.

## **Internships and Budget**

The provided \$1,300 from the Bren School is expected to be sufficient budget to complete the project. Additionally, \$3,000-\$5,000 can be made available for internships at SYRCL to assist with SYRCL's Salmon Restoration and Meadow Restoration Programs.

# Client Letter of Support

See attached.

## References

California Department of Fish and Game (CDFG). 1993. Restoring Central Valley streams: a plan for action. Sacramento (CA). Available from:

<https://www.dfg.ca.gov/fish/documents/Resources/RestoringCentralVallyStreams.pdf> [Accessed: 3 December 2015.]

California Department of Fish and Wildlife (CDFW). 2015. GrandTab 2015.04.15: California Central Valley Chinook population database report. Sacramento (CA): CDFW, Fisheries Branch. Available from: <https://www.dfg.ca.gov/fish/Resources/Chinook/CValleyAssessment.asp> [Accessed: 2 December 2015.]

Cbec ecoengineering inc. 2014. Hydraulic and geomorphic analysis to support rehabilitation planning for the lower Yuba River, Marysville to Parks Bar. Prepared for SYRCL and the U.S. Fish and Wildlife Service.

National Marine Fisheries Service (NMFS). 2014. Recovery plan for the Evolutionarily Significant Units of Sacramento River winter-run Chinook salmon and Central Valley spring-run Chinook salmon and the Distinct Population Segment of California Central Valley steelhead. Sacramento (CA): NMFS West Coast Region office. Available from:

[http://www.westcoast.fisheries.noaa.gov/publications/recovery\\_planning/salmon\\_steelhead/domains/california\\_central\\_valley/final\\_recovery\\_plan\\_07-11-2014.pdf](http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/california_central_valley/final_recovery_plan_07-11-2014.pdf) [Accessed: 2 October 2015.]

Pasternack GB, Fulton AA, Morford SL. 2010. Yuba River analysis aims to aid spring-run Chinook salmon habitat rehabilitation. California Agriculture 64(2): 69-77.

Yoshiyama RM, Gerstund ER, Fisher FW, Moyle PB. 2001. Historical and present distribution of Chinook salmon in the Central Valley drainage of California. Contributions to the Biology of Central Valley salmonids, Fish Bulletin, 179: 71-176.

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January 20, 2016

Dear Proposal Review Committee,

The South Yuba River Citizens League (SYRCL) supports the proposal being submitted entitled “Quantifying the benefit of restoring the Lower Yuba River for Chinook salmon, steelhead, and other ecosystem services.”

SYRCL has been working on fish restoration and habitat issues in the Lower Yuba River for over 15 years. Our strategic plan lists habitat restoration in the Lower Yuba River for the benefit of salmon and steelhead as one of our key organizational goals. The Lower Yuba River has been heavily impacted by hydraulic and then dredger mining activities, leaving both the river channel and floodplain habitats significantly impaired for use as habitat by salmonid species. While salmonids are the target species within this study, the proposed project will also allow SYRCL to prioritize which types of restoration strategies will maximize benefits for the overall ecosystem health of the Lower Yuba River.

SYRCL is a 501(c)(3) non-profit organization, which has been protecting the Yuba River for over 30 years. We formed in 1983 to prevent dams being built on the South Yuba River, a goal we reached in 1999 when we achieved State Wild and Scenic status for the river. We are widely recognized as the leading advocates for restoring the Yuba’s streams and rivers. Motivated by our love for this watershed, we advocate powerfully, engage in active stewardship, educate the public, conduct science, and inspire activism from the Sierra to the sea. The thousands of SYRCL members and hundreds of volunteers who join us again and again in our work are the source of our collective strength and power.

SYRCL will work closely with Bren School students to complete this project, providing students with data and feedback on work plans and draft reports. In addition, we will be happy to host two Bren School students to assist with SYRCL’s restoration program in the summer of 2016.

We are proud to support this application, and hope you will prioritize this project. Please feel free to call me if you have any questions about the proposal.

Sincerely,

Rachel Hutchinson  
River Science Director