Chinook Salmon
HABITAT QUANTIFICATION TOOL

Increasing the amount and quality of floodplain habitat for young Chinook salmon is key to the success of this ecologically, culturally, and economically important California species.

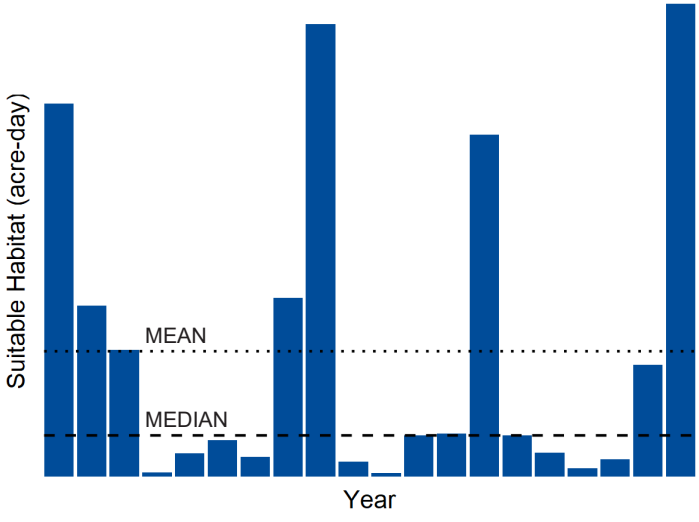
Photo by Carson Jeffres

THE NEED:
FLOODPLAIN HABITAT

Floodplain restoration is essential to the recovery of Chinook salmon populations within the Central Valley of California. Floodplain habitats are feeding grounds for juvenile salmon migrating to the ocean. The fish grow quickly within these highly productive flooded habitats, historically staying for weeks to months in late winter and spring. However, most floodplains are now cut off from rivers or flooded for only short periods of time. Over 95% of salmon rearing habitat in the Central Valley has been lost due to human modifications, including levee building and upstream dams. The Chinook salmon Habitat Quantification Tool (HQT), as part of the Central Valley Habitat Exchange multi-species HQT, evaluates habitat for juvenile rearing salmon with the goal of restoring floodplains for fish and other species.

WHAT IS THE CHINOOK SALMON HQT?

The Chinook salmon HQT is a science-based approach for use by restoration planners to evaluate existing or potential habitat as they plan, design, and implement restoration and management activities. Components of the HQT include assessment of the landscape context, habitat quantification at the site scale, and monitoring. The site assessment estimates total available floodplain habitat measured as "acre-days" (area summed over time). Habitat is quantified for over twenty years to account for year-to-year variability. The tool allows users to assess this variation and estimate the amount of habitat expected at a site on average.



WHAT IS GOOD FLOODPLAIN HABITAT?

Good juvenile salmon habitat is shallow, slow moving water that is connected to rivers or streams and is wet for extended periods of time. Unlike habitat for terrestrial species, floodplain habitat varies based on topography and timing of water moving across the landscape, either through natural inundation or managed flooding. Where and when good habitat is available fluctuates across a site from day-to-day and year-to-year.

Based on the best available science and input from technical experts, site assessment within the HQT uses water depth, water velocity, connectivity to the river, duration of flooding, and time of year that the habitat is available to quantify suitable habitat. Other factors affecting a site's habitat quality, including vegetative cover, water temperature, and dissolved oxygen, are assessed via monitoring.

HABITAT SUITABILITY CRITERIA

- **DEPTH & VELOCITY:** *Are flooded areas within suitable depth and velocity ranges?*
- **DURATION:** *Is flooding duration adequate to produce food?*
- **TIMING:** *Does flooding occur when salmon are expected to be present?*
- **CONNECTIVITY:** *Are flooded areas connected to the river (for fish ingress/egress)?*
- **SIZE:** *Is the flooded area large enough to be ecologically meaningful?*
- **OTHER:** *Does monitoring suggest other criteria are met (e.g. cover, temperature, dissolved oxygen)?*

Photo by Carson Jeffres

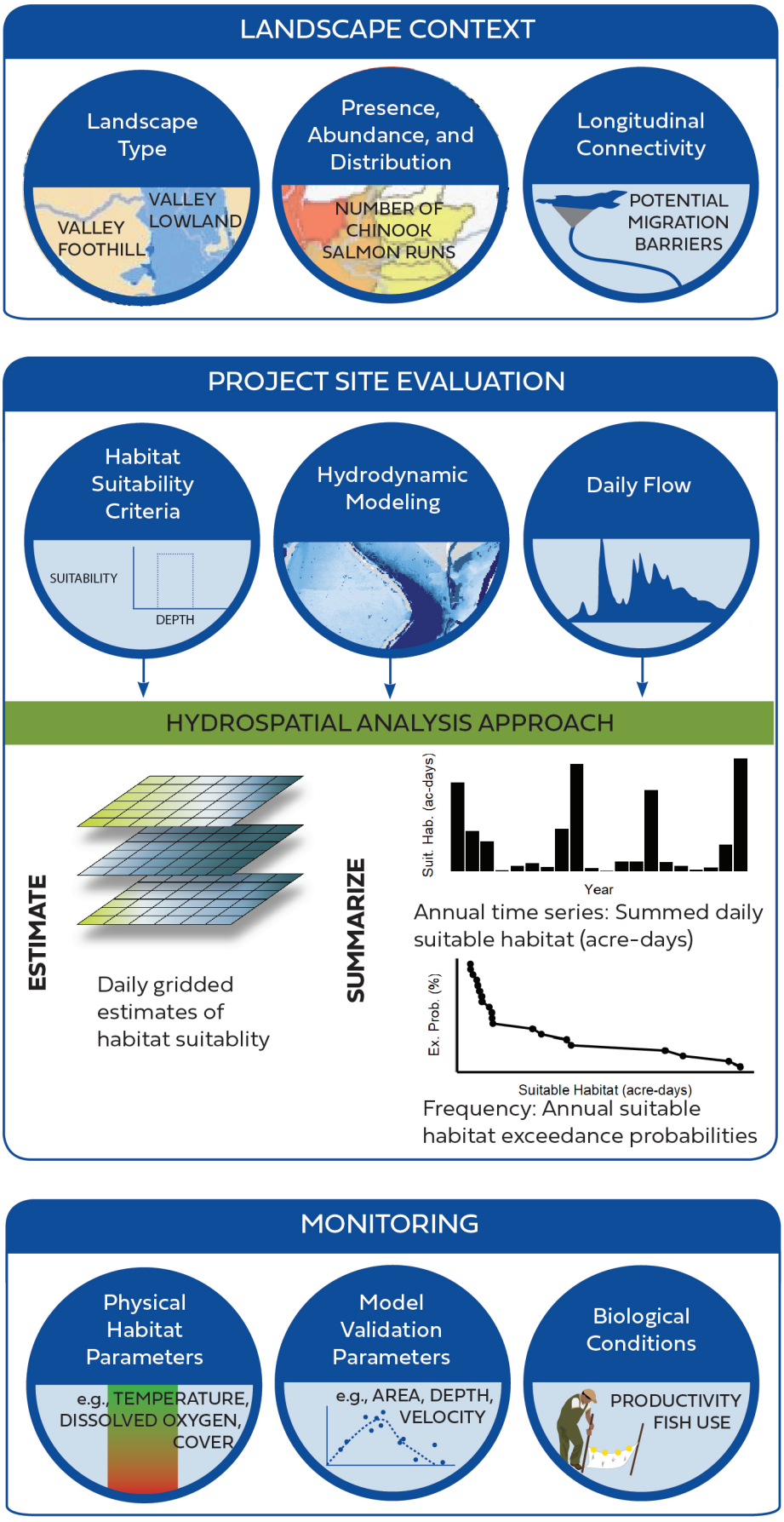
HOW DOES THE HQT WORK?

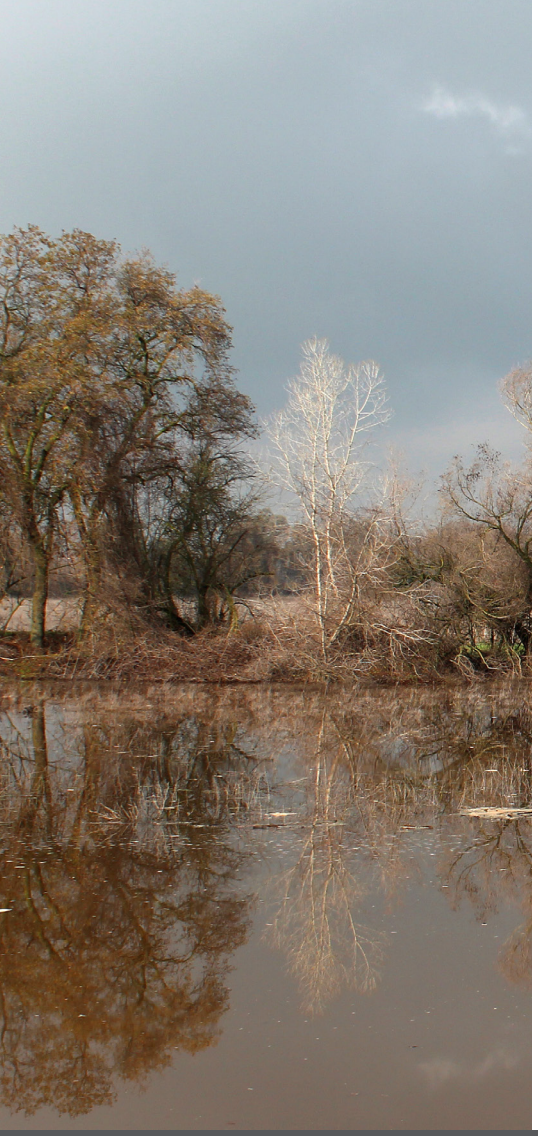
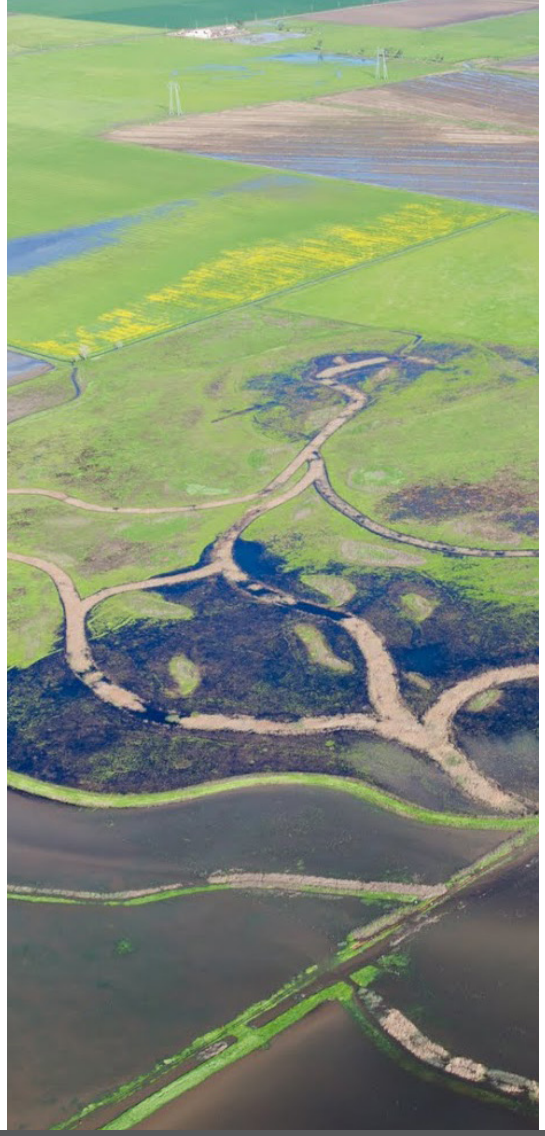
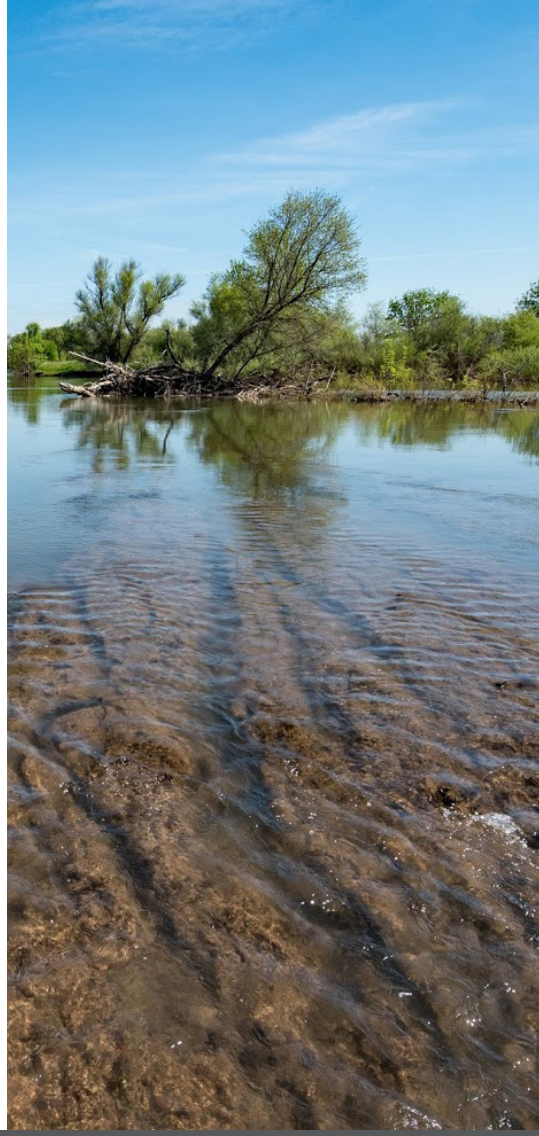
The primary components of the HQT are:

1. Landscape context assessment provides a measure of the habitat potential for a site based on its landscape position within the Central Valley, Chinook salmon presence and abundance, and longitudinal connectivity.

2. Project site evaluation uses the hydrospatial analysis approach to estimate daily floodplain inundation patterns based on output from hydrodynamic modeling and a daily flow record, assesses physical parameters, applies habitat suitability criteria, and quantifies suitable habitat over space and time. Daily inundation is represented as gridded estimates of water depth and velocity. For each day of flooding, the HQT assesses suitable habitat area using the habitat suitability criteria applied to each grid cell. To estimate daily suitable acres of habitat, all areas meeting the criteria are added together, weighted by their 0-1 suitability index. These daily estimates are then summed for each year, giving total annual acre-days of suitable habitat.

3. Monitoring assesses conditions affecting habitat quality, particularly those that are not readily available through modeling (e.g., cover, water quality). Biological monitoring and monitoring to support model validation are also recommended.



Photos by Alison Whipple (left) and Carson Jeffres (middle and right)

HOW THE HQT WAS DEVELOPED

The Chinook salmon HQT is one of the technical products of the Central Valley Habitat Exchange and part of the multi-species HQT. The suitability criteria applied in the tool were established by Stillwater Sciences and the Technical Advisory Committee (TAC) and the Chinook salmon HQT habitat evaluation and User Guide (2019) development was led by American Rivers and the San Francisco Estuary Institute. The approach uses commonly-applied concepts for evaluating suitable habitat based on modeling, with methods adapted from the hydrospatial analysis approach developed by Alison Whipple (2018). See www.cvhe.org for additional background on the Central Valley Habitat Exchange.

CITATIONS

Whipple A., T. Grantham, G. Desanker, L. Hunt, A. Merrill, B. Hackenjos, R. Askevold. 2019. Chinook Salmon Habitat Quantification Tool: User Guide (Version 1.0). Prepared for American Rivers. Funded by the Natural Resources Conservation Service Conservation Innovation Grant (#69-3A75-17-40), Water Foundation and Environmental Defense Fund. A report of SFEI-ASC's Resilient Landscapes Program, Publication #953. San Francisco Estuary Institute, Richmond, CA.

Whipple, AA. 2018. Managing flow regimes and landscapes together: Hydrospatial Analysis for Evaluating Spatiotemporal Floodplain Inundation Patterns with Restoration and Climate Change Implications. Dissertation. University of California, Davis.

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