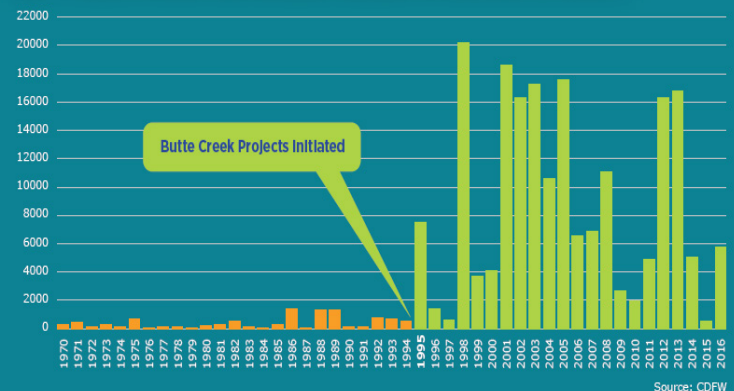


For decades, Sacramento Valley landowners, water agencies, and conservation groups have been recognized for their successful, collaborative work to promote fish and wildlife restoration actions. In the wake of California's recent drought, many of these parties refocused their salmon recovery actions in the face of climatic variation and shifting environmental conditions. Today, our collective understanding and use of the most current science is leading all of us to understand the need for a more broad-based, comprehensive program to promote salmon recovery that includes activation of historical floodplains and new programs to grow food for fish in the region. This awareness, and work, is the result of collaborative partnerships of diverse interests with a shared goal of recovering the runs of Chinook salmon in the Sacramento Valley.

These efforts build upon the knowledge and science produced by the historic success for salmon recovery on Butte Creek. More than 20 years ago, a partnership of local landowners, water managers from throughout the state, federal and state agencies and conservation organizations implemented a program on [Butte Creek](#) that coupled habitat improvements with functional flows and removed barriers to reconnect floodplains in the Sutter Bypass with upstream spawning habitat. This improved habitat and survivability for Chinook salmon, including endangered spring-run, led to an incredible rebound in their numbers. The invaluable lessons from the successful Butte Creek program has helped advance a number of other actions throughout the Sacramento Valley.

BUTTE CREEK SPRING-RUN CHINOOK SALMON POPULATION ESTIMATES



Soon after, in 2000, stakeholders on the American River came together to develop the [Water Forum Agreement](#) to “to provide a reliable and safe water supply for the Sacramento region’s long-term growth and economic health; and to preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.” This agreement was updated in 2015.

Also, more than a decade ago, a group of stakeholders came together on the Yuba River to develop and implement the [Yuba Accord](#), linking functional flows with a monitoring and evaluation program to meet additional beneficial uses through project operations, providing an additional template for modern salmon recovery efforts.

On the American River, [The Lower American River Modified Flow Management Standard](#) has been implemented to provide modified flows to improve habitat, temperature and flows for salmon. [The Lower Feather River Corridor Management Plan](#) includes priority actions for salmon recovery in the Feather River. Multiple stakeholders in the [Yuba Salmon Partnership Initiative](#), which is still

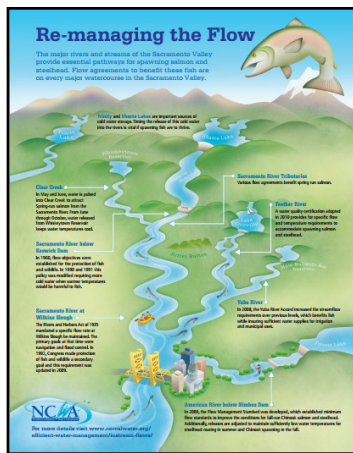
developing, are studying a possible salmon reintroduction program into the upper Yuba River.

It is also important to note that all of the major rivers and streams in the Sacramento Valley have [instream flow requirements](#) that are in place to protect salmon and other fish species.

The following is a summary of the most recent work to promote salmon recovery in the Sacramento Valley.

## Sacramento Valley Salmon Recovery Program

The Sacramento Valley Salmon Recovery Program (SVSRP) is a collaborative partnership of local water management entities, conservation organizations and state and federal fisheries and water management agencies that was created four years ago to provide a venue to work together to complete projects and improve science to promote recovery of salmon and other species of fish in the region. The SVSRP efforts are implementing both the [National Marine Fisheries Service's Recovery Plan for the Sacramento River](#) and the California Natural Resources Agency's [Sacramento Valley Salmon Resiliency Strategy](#).



The program partners identified almost 50 [priority projects](#) to promote salmon recovery in the region. These projects are located throughout the region and are targeted on specific river reaches to ensure that they provide the maximum benefit to the salmon life-cycle stage intended.

The SVSRP partners meet monthly to advance efforts to implement projects and identify

opportunities for collaboration and assistance. These efforts are captured in an [Action Plan](#). This living document lists the projects that are in the process of being implemented and the work that is being conducted on each of them.

In May, the most recent project was completed to construct [spawning habitat](#) on the Sacramento River in Redding near the Market Street Bridge, joining 17 prior projects that have been implemented as part of the SVSRP over a little more than four years. An updated [infographic](#) includes descriptions of the completed projects as well as a description of the program. The most recently completed projects are described in greater detail near the end of this document. These projects join the more than [140 projects](#) that have been completed in the Sacramento Valley since 2000 to benefit salmon.

## Voluntary Agreements / Bay-Delta Water Quality Control Plan

As part of the State Water Resources Control Board's (SRCB) [Bay-Delta Water Quality Control Plan Update](#) process during the past couple of years, Sacramento River Basin water suppliers on the American, Feather, Sacramento and Yuba Rivers have been working to develop "Voluntary Agreements" identifying projects and functional flows that will be implemented over the next 15 years to promote salmon recovery and benefit fish and wildlife species in the Delta. This effort is proposed as an alternative to a [SWRCB staff proposal](#), which exclusively focused on redirecting water used in the Sacramento Valley to "unimpaired flows" out of the region.

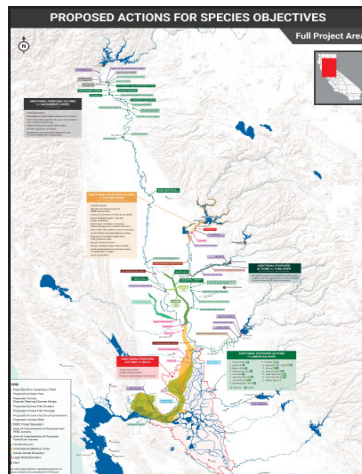
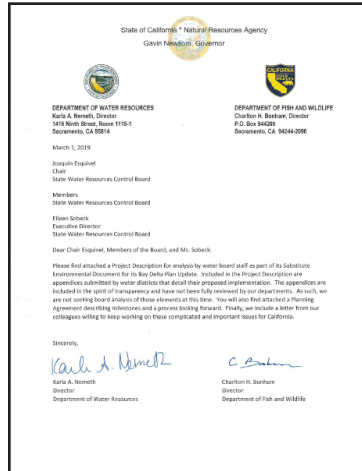
In December 2018, the California Departments of Fish and Wildlife and Water Resources submitted a [Framework Proposal for Voluntary Agreements](#), which outlined the proposed actions to be implemented in both the Sacramento and San Joaquin Valleys for protection of fish and wildlife beneficial uses.

A more detailed proposal was developed for the Sacramento Valley and submitted to the SWRCB on March 1 as part of a package that also included proposals from the San Joaquin Valley and the Delta.

A summary of the Voluntary Agreement efforts is available on the California Natural Resources [website](#).

If Voluntary Agreements are adopted by the SWRCB, they will have considerable influence on the dedication of resources and priority actions taken in the Sacramento Valley for the next 15 years. This will further help to implement the priority projects identified by the Sacramento Valley Salmon Recovery Program and will achieve objectives contained in the National Marine Fisheries Service's Recovery Plan for the Sacramento River and the California Natural Resources Agency's Sacramento Valley Salmon Resiliency Strategy.

The Voluntary Agreements will also provide new opportunities to bring together and catalyze priority salmon recovery projects in the Sacramento Valley, some of which have been stalled for decades.



For more details on these opportunities click on the icon.

The Voluntary Agreements offer a new way forward for water management in the Central Valley.

The Sacramento River Basin water suppliers' statement on the Voluntary Agreements is available on the [NCWA Website](#).



## Science

In April the Sacramento River Settlement Contractors coordinated with the Bureau of Reclamation, National Marine Fisheries Service, California Department of Fish and Wildlife and the US Fish and Wildlife Service to host a workshop “to discuss the state of science on the Upper Sacramento River and how it can inform management decisions.” The all-day workshop was comprised of topic-based panels on monitoring, habitat restoration and engineering and operations, each of which was followed by time allotted for questions. The workshop concluded with a discussion on the opportunity to integrate current science with other efforts on the Sacramento River and to better inform management decisions.

This event is part of a larger effort among the workshop collaborators, known as the [Sacramento River Science Partnership](#), which was formed in 2018 with the mission “to establish and maintain a science enterprise for voluntary collaborative research, modeling, monitoring and synthesis relevant to salmonid and other in-river species recovery and water management on the main stem Sacramento River to facilitate joint learning and fact-finding between and among scientists and managers.”

## Predation

In 2017 and 2018, NCWA sponsored work by California State University, Chico graduate student Dylan Stompe to determine the extent to which Sacramento pikeminnow and striped bass predation is impacting the survivability of out-migrating juvenile salmon, if flow-altering structures in the Sacramento River are providing advantages to these predators and if hatchery produced salmon were more susceptible to predation. The completion of the project resulted in Stompe’s [Master of Science thesis](#). In it, Stompe determines that both species of fish prey upon juvenile salmon but they are opportunistic and switch prey based upon what is available. Turbidity also influenced the rate of consumption of juvenile salmon, with predation decreasing in more turbid water. The role that man-made structures play in providing predator habitat varies based upon the availability of natural flow barriers in the reach of the river. In areas without natural barriers (large woody debris, etc.), predators are more likely to utilize man-made structures to ambush prey.

Stompe’s work confirms that predators are impacting the survivability of juvenile salmon. More importantly, this data will help advance future studies into actions that can be used to decrease predation rates of juvenile salmon.



In early August, the California Fish and Wildlife Commission heard comments on proposed amendments to its 1996 Striped Bass Policy. The 1996 policy established a long-term target of restoring the striped bass population in the Sacramento – San Joaquin Estuary to 3 million fish. The proposed revised policy does not include a population target and contains language stating that “Based on current best available science and evaluations of past management of Delta fisheries, the Commission and Department shall not develop or enhance fisheries in the Delta which may pose a direct threat to the survival or, or significantly limit, recovery of a listed species.” The Commission did not act on the proposed amendments at the August meeting other than to approve taking them up at its December meeting. NCWA signed on to a [letter](#) supporting continued work on proposed amendments by parties on both sides of the issue before the December meeting.

## Flows

The management of water resources in the Sacramento Valley to provide [multiple benefits](#) results in efficient use that relies upon the same water being used to address multiple needs as it moves downstream through

**Why Spring Diversions on the Sacramento River are Important to Serve Multiple Benefits**

**Overview**

In the Sacramento Valley, water systems including rivers, streams, reservoirs and diversions are carefully managed to serve multiple benefits. To effectively serve multiple benefits, water resources must be managed in an efficient manner, with the same block of water often used to address several beneficial uses as it moves through the region’s watersheds. As such, any proposal to change water management operations will result in enhanced impacts to the environment, species, farming, groundwater, and local communities in the Sacramento Valley.

During the dry years in 2014-15 and again in early 2018, National Marine Fisheries Service, the State Water Resources Control Board and others were recommending that water be held back in Shasta Lake to protect cold water for winter-run Chinook salmon. To do this, water releases out of Keswick Reservoir below Shasta would be limited during the spring to as low as 1,200 cubic feet per second (cfs), potentially limiting Sacramento River diversions until June 1. Cold water management is important for anchovy habitat below Shasta Lake. But, it is also important that water management decisions be made with understanding and consideration of the tradeoffs involved and how the disruption to water diversions and supply would impact Sacramento River diversions and all of the beneficial uses they support. To the extent possible, decisions should be made to maximize multiple benefits for all parts of the environment, farming and local communities. This proposed action would have the following impacts:

- Decreasing farmed and terrestrial habitat acreage
- Hampering ability of juvenile spring-run Chinook salmon to emigrate out of tributaries to the Sacramento River
- Limiting access to drinking water by local communities diverting from the Sacramento River
- Negatively impacting local economies
- Undermining the achievement of sustainability under SEMA

The following synopsis describes these impacts in more detail.

the region's rivers and streams. While this level of efficiency is desirable, it creates an environment where water management disruptions can have considerable and wide-ranging repercussions. Recently, the National Marine Fisheries Service proposed decreasing flows in the Sacramento River in the spring to hold water in Shasta for winter-run Chinook salmon. An analysis of this proposal shows that it would have negatively impacted much of the Sacramento Valley, including terrestrial habitat, agriculture, spring-run Chinook salmon, community access to drinking water, local economies and Sustainable Groundwater Management Act Implementation. For additional information on the impacts, click the icon on page 4.

## Communications

An important aspect of the efforts that have been undertaken in the Sacramento Valley to promote salmon recovery is being able to inform those in the Valley and throughout California about the work that is being done and our collective results. As such, NCWA, its members and partners are engaged in a coordinated effort to effectively share information about this salmon recovery work in the region, through an updated [website](#), [blogs](#), [infographics](#), and podcasts ([Rice Radio](#) and [A Story You Haven't Heard](#)).

The recently updated [salmon webpage](#) on the Northern California Water Association (NCWA) website provides a compilation of the substantial and comprehensive efforts underway to promote recovery of the four distinct runs of Chinook salmon. Our webpage provides an overview of the species and their life cycle stages that occur in fresh water as well as descriptions of the various efforts underway in the Sacramento Valley to provide habitat and food for salmon and other fish species in the region.

The webpage also includes links to all of the infographics and other materials produced by NCWA, our members and our partners related to salmon recovery in the region.

## Projects

Over the past year, several projects were completed to advance the Sacramento Valley Salmon Recovery Program. These projects are part of the 18 that have been [completed in the last four years](#) and join the more than 140 salmon projects that have been implemented [since 2000](#). The completed projects are located throughout the Sacramento Valley and were designed to provide benefits to specific life-cycle stages that occur in fresh water.



### *Upper River*

In the upper reaches of the river, projects completed to benefit spawning and rearing salmon include [informative panels installed in Redding](#) to let those entering the river know about the potential harm they could cause if they step on salmon redds, the [removal of a barrier to spawning adult salmon](#) on Little Cow Creek that has opened up over six miles of habitat, the creation of a [habitat project in Redding](#) for recently spawned juvenile salmon, the [reopening of a side-channel in Anderson](#) to provide juvenile habitat in the upper reach of the Sacramento River, and the most recent project at Market Street Bridge in Redding to [improve spawning habitat](#).

### [Middle River](#)

As juvenile salmon move down to the middle part of the river, they now will benefit from a [side channel project](#) completed in [Tehama County](#) to provide refuge and food, and a [pulse flow](#) on the Feather River to benefit out-migrating juvenile salmon.

### [Lower River](#)

On the lower reach of the river, the [Fremont Weir](#) notch project to benefit adult salmon migrating upstream to spawn was initiated and completed in 2018. In addition, the [Wallace Weir](#) project to improve adult salmon passage in the Yolo Bypass and improve water management was also completed in 2018.

Two additional programmatic efforts are also underway in the lower river to benefit salmon:

### [Floodplain Reactivation](#)

Several pilot programs and studies in the Sacramento Valley are helping to confirm that reactivation of historic floodplains provides food and habitat to Chinook salmon and other fish that contribute to their recovery. The fact that nearly all of the Sacramento Valley is part of the historic floodplain was the basis for the scientific work to determine if disconnecting the region's rivers from the floodplain was a major contributor to species' population crashes. Historical records support this assertion – the decline of Chinook salmon and other species of fish began after the development of the Sacramento Valley's leveed flood control system, but prior to the construction of the rim dams. Now, this historic habitat can be reactivated through water and land management actions in the regions' bypasses, fields and river side channels.

The role of floodplain reactivation as the key element to improve conditions for fish within the Sacramento Valley, and other areas with similar managed water systems, is evaluated in great

detail in [Floodplains: Processes and Management for Ecosystem Services](#), which was published by University of California Press in 2018.

Floodplain reactivation is also the topic of several new infographics, including an [overview of floodplain reactivation](#) in the region, a description of the interrelationship between [modern functional flows](#) and floodplain reactivation and how [Managing Water in the Sacramento Valley for Multiple Benefits](#) includes actions to reactivate the floodplains.

Floodplain reactivation has also been the topic of recent blogs, including one covering the [various floodplain actions](#) underway in the Sacramento Valley and guest blog on the research showing the drive to find floodplain rearing habitat is leading juvenile winter-run Chinook salmon to [travel back up multiple Sacramento River tributaries](#) as they migrate out to the ocean.

River Garden Farms has produced a video on the value of floodplains to fish, birds and other species that includes interviews with Audubon California's Meghan Hertel, Jacob Katz and Jacob Montgomery with CalTrout, Cason Jeffres with the UC Davis Center for Watershed Sciences, Reclamation District 108's Lewis Bair and Roger Cornwell with River Garden Farms. The video can be viewed by clicking the icon.

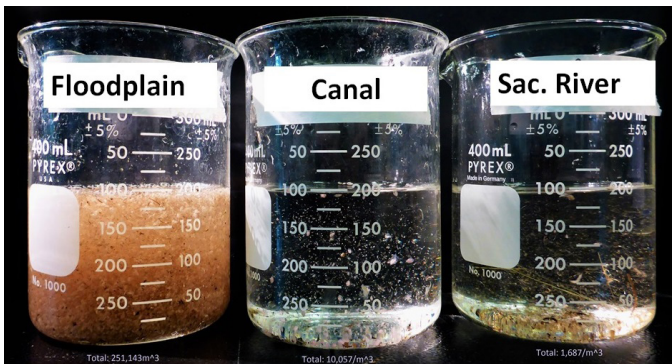


For an informative summary on floodplain reactivation, a video of the recent presentation on floodplains convened by Natural Resources Secretary Wade Crowfoot is available [here](#).

In addition to the habitat values reactivated floodplains provide, science is also confirming the incredible contribution they make to food production for juvenile fish.

## Fish Food

It is a fairly straightforward concept, but one that had been largely missing from the discussion surrounding Chinook salmon recovery – fish must eat to survive. For decades, salmon recovery efforts were focused on the quantity of water in California’s rivers and creeks. But, scientific efforts, driven largely by UC Davis and the California Department of Water Resources are confirming the important role that food production plays in the recovery of salmon and other fish and the promising ability to grow food in Sacramento Valley bypasses and fields.



## Growing Salmon in Fields

In the Yolo Bypass, the multi-year [Nigiri Project](#), continues to show the value winter-flooded fields provide in rearing and feeding juvenile Chinook salmon. This collaboration of Knaggs Ranch, UC Davis and California Trout has consistently shown the value bypasses provide to juvenile salmon and has been the basis for more recent fish food studies.

A [pilot project](#) is being spearheaded by the California Rice Commission, in collaboration with UC Davis, California Trout and local landowners to test and refine rice farming practices to grow salmon on winter-flooded rice fields and determine the survivability of fish reared on those fields.

## Growing Food for Salmon

Building upon the science developed with the Nigiri project, UC Davis and California Trout are collaborating with water management entities, landowners in the Sacramento Valley and state and federal agencies, and water management entities on a [Fish Food Program](#) to study and refine the ability to grow food for fish on fields outside of the bypasses. This program, which began its third year with a [kickoff event in October](#) at [River Garden Farms](#), has been successful in proving that winter-flooded fields can grow the bugs that provide food for juvenile fish and that those bugs can survive being drained off of the fields and into irrigation drains. This year, the program evaluated the ability to get the food into the river at a quantity and concentration that will benefit juvenile fish.

In addition to the salmon food efforts in the Valley, which occur mostly during the winter months, a [summertime food program](#) is also being implemented to benefit Delta smelt. This program, led by the Department of Water Resources in coordination with state and federal agencies and water management entities, routes agricultural drain water down the Colusa Basin Drain and into the Yolo bypass, where it grows phytoplankton that is then flushed into the North Delta to feed smelt. In 2016 and [again in 2018](#), the program has been extremely successful in creating a wave of phytoplankton into the Delta.

These projects are part of the comprehensive effort in the Sacramento Valley to promote salmon recovery. In 2019, more projects will be implemented and completed as part of this ongoing effort.

*If you have any questions on salmon recovery or have ideas for a project to help salmon in the Sacramento Valley, please call Todd Manley at (916) 442-8333, or email at [tmanley@norcalwater.org](mailto:tmanley@norcalwater.org).*

# Restoring the Salmon Runs - a Time for Action

Sacramento Valley water resources managers are partnering with federal and state agencies and conservation organizations to improve migratory corridors and habitat for salmon. The measures taken and the money spent – more than \$1 billion over the past two decades – have been helpful but there is still more work ahead to restore the salmon runs.

**Fish screens** More than 80 percent of the water diverted from the Sacramento River system for wildlife refuges, farms, cities and rural communities is pumped through state-of-the-art fish screens, while the fish stay safe, healthy and in the river.

**Spawning gravel** is reintroduced to rivers and streams to improve spawning habitat. Over 200,000 tons of gravel has been added to the Sacramento River since 1997.

**Flow agreements** to benefit salmon and other fish are on every major watercourse in the Sacramento Valley. Get the details at [www.norcalwater.org/efficient-water-management/instream-flows/](http://www.norcalwater.org/efficient-water-management/instream-flows/)

**Migration corridors** are important to help young salmon [smolts] avoid predators in their migration from the Valley to the ocean. Water managers in the Sacramento Valley are currently building a Salmon Smolt Escapement Plan to time pulses of water with fish releases.

Our thanks to California Fisheries biologist Dave Vogel, who made these recommendations as part of his report, *Insights into the Problems, Progress and Potential Solutions for Sacramento River Basin Native Anadromous Fish Restoration*  
[www.norcalwater.org/efficient-water-management/fisheries-enhancements/](http://www.norcalwater.org/efficient-water-management/fisheries-enhancements/)



f /SacValleyCA