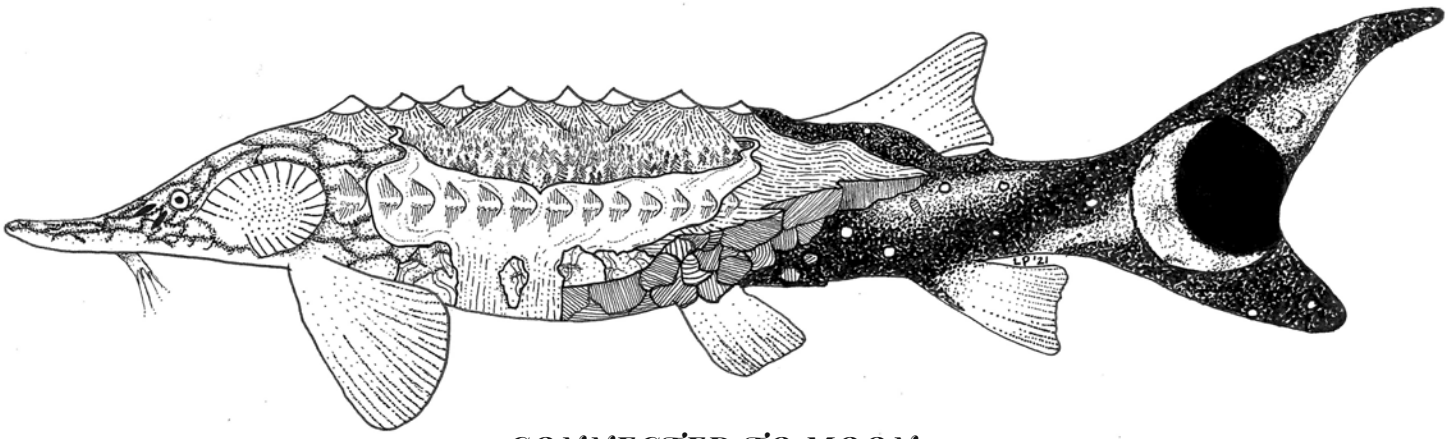
# TRIBUTARY TRIBUNE

STORIES AND ART BY CORPSMEMBERS OF THE CALIFORNIA CONSERVATION CORPS WATERSHED STEWARDS PROGRAM, IN PARTNERSHIP WITH AMERICORPS



***CONNECTED TO MOON***

***WITHIN THE BAY, LOOK UNDER***

***DINOSAURS THREATENED***

"*Tidally Influenced*" by Leanne Pearl, serving at United States Fish and Wildlife Service, Lodi

## In This Issue




San Francisco Bay Regional Water Quality Control Board and Solano California Conservation Corpsmembers at a Watershed Action Volunteer Event (WAVE)
Photo credit: Sophia Troeh

## ABOUT THE WATERSHED STEWARDS PROGRAM

Since 1994, the Watershed Stewards Program (WSP) has been engaged in comprehensive, community-based, watershed restoration and education throughout coastal California.

WSP was created in 1994 by California Department of Fish and Wildlife (CDFW) biologists, educators, and the California Conservation Corps to fill critical gaps in scientific data collection, in-stream restoration, and watershed education. In collaboration with landowners, tribal communities, teachers, community members, nonprofit organizations, and government agencies, WSP works to revitalize watersheds that contain endangered and threatened salmonid species (Chinook Salmon, Coho Salmon, and Steelhead Trout) by using state-of-the-art data collection and watershed restoration techniques. WSP also engages Corpsmembers in education, outreach, and volunteer recruitment efforts to increase the capacity of partner organizations. WSP currently has Corpsmembers working from the Oregon border to the Santa Monica Mountains.

# INTERDEPENDENCE

### WOODWORK PIECE BY BRYANT JEW, SERVING AT UNITED STATES FISH AND WILDLIFE SERVICE, LODI

For this piece, I was inspired by the complex issues surrounding water rights in the Sacramento-San Joaquin Delta. The delta is not only crucial habitat for endangered Delta Smelt and winter-run Chinook Salmon, but also a crucial source of freshwater for agriculture and drinking water throughout California. Throughout my time in Lodi, I've come to learn that the balance between preservation and extraction is a hotly contested topic among those who live in the delta.

This bowl is meant to represent this struggle to maintain balance. It is a composite of two different types of wood, Torrey Pine and Coast Live Oak, and both woods were obtained from trees removed for construction. The top layer of pine represents agriculture and human interest while the bottom represents endangered fishes that utilize the delta. Just as both are intimately connected to the water of the delta, both pieces of pine are connected to the oak that represents the water of the delta. This particular piece of oak was chosen for its swirling grain pattern, representing the twists and turns water takes on its journey to the ocean.

The bowl itself would not exist without any of these three pieces. If the bottom were gone, any items placed there would fall right through, and if the top piece of pine were gone, the bowl would have reduced capacity. All three are needed to maintain functionality, as a reminder that we cannot remove a factor from the system without drastic consequences. Balance is key.

# REAL LIFE POKÉMON GO: HOW BIOBLITZES CONNECT PEOPLE TO THEIR LOCAL ENVIRONMENTS

BY MILES BROOKS, SERVING AT GRASSROOTS ECOLOGY

Left: A Variable Checkerspot caterpillar (Euphydryas chalcedona) hangs out on the leaf of a Sticky Monkeyflower (Diplacus aurantiacus) in Alum Rock Park, San Jose, CA.
Photo Credit: Miles Brooks

Right: A miniature lupin (Lupinus bicolor) caught the eyes of many BioBlitz attendees at Almaden Quicksilver Park in San Jose, CA.
Photo Credit: Miles Brooks

**"I want to be the very best**

**Like no one ever was.**

**To photograph them is my test,**

**To share them is my cause!**

**I will travel across the land,**

**Searching far and wide.**

**Each organism to understand**

**Wherever they may hide!**

**Native species! Gotta catch 'em all!"**

**-Based on the Pokémon Theme Song**

Growing up, I loved Pokémon. I watched the TV show, played the video games, and collected the trading cards. All the different creatures fascinated me with their unique appearances that reflected their environment. However, as I grew older, my interest in Pokémon waned. Instead of turning to games to find new creatures, I began to look outside to find new plant and animal species. It is now my goal to impart other people with a similar level of fascination and curiosity for the natural ecosystem.

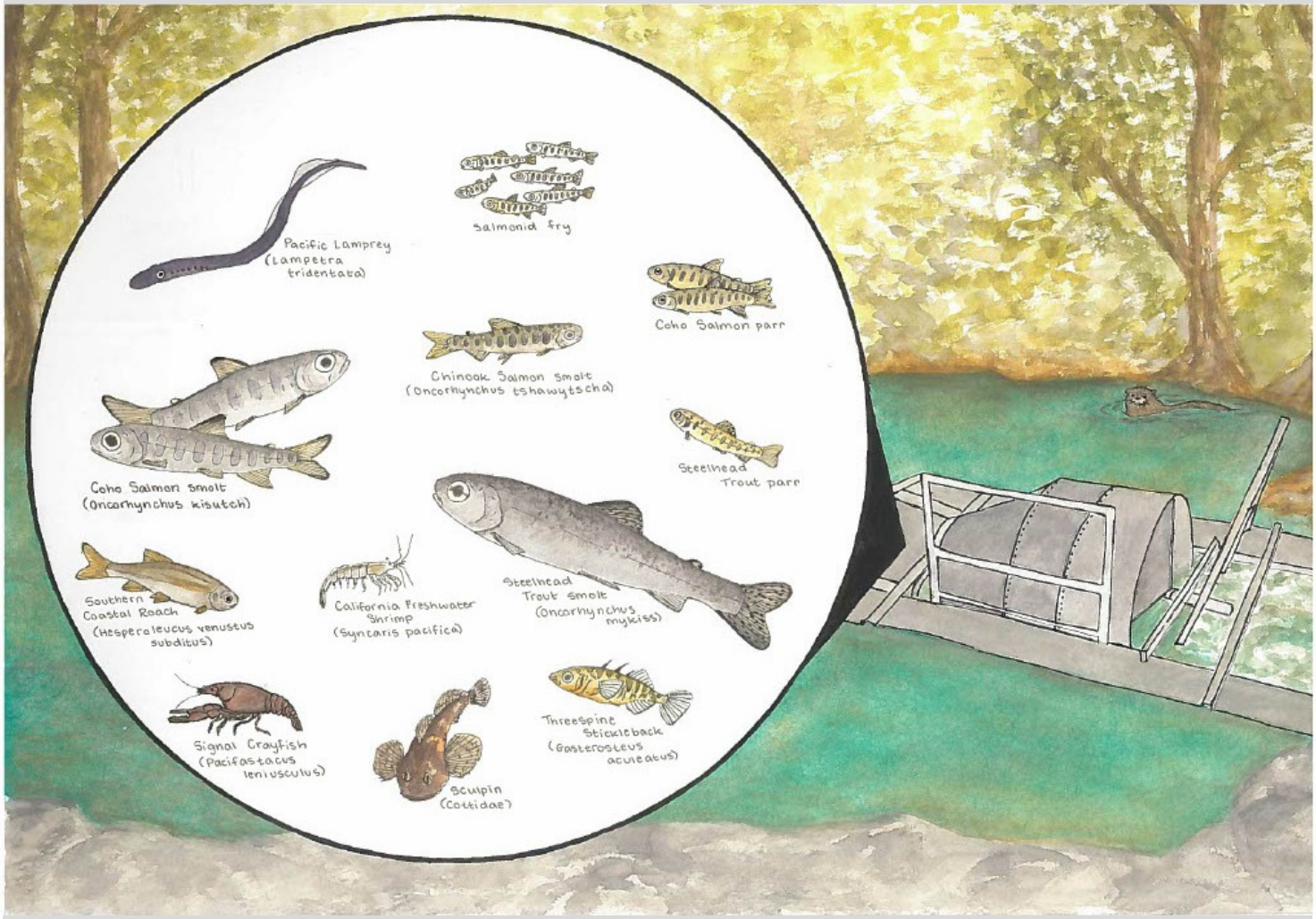
My Site Partner, Siena, and I connect folks to their local environments through BioBlitz Events. A BioBlitz is a period of biological surveying, where people try to identify all the biological species (bio) in a place over a short period of time (blitz). BioBlitzes not only catalogue the biodiversity in a specific area, but they also engage local communities to look closer at the wildlife that surrounds them.

At recent BioBlitz events hosted by our Placement Site, Grassroots Ecology, in partnership with Keep Coyote Creek Beautiful, people of all ages came to find and learn about the species in their neighborhoods. As a docent for these events, I informed people about the benefits and ecological roles of the species that people observed. It was thrilling to hear people say they had never noticed *that* plant before, or that they had never been able to identify *this* one!

For the BioBlitzes we used an app called iNaturalist, which is like real - life Pokémon Go. You capture (take a picture of) an organism, record the location and time, and save the picture to your 'observations' (sort of like a Pokédex). iNaturalist will recommend species identification, but other observers in your area can also help to identify your observation. iNaturalist has proved to be a great educational tool to familiarize people with their local environment. I use iNaturalist to identify plants and animals everywhere I go, and it allows me to "catch ' em all ! " just like in Pokémon.

# SPRINGTIME ON THE ROTARY SCREW TRAP

**BY: ANNABELLE HOWE, SERVING AT MARIN WATER FISHERIES MONITORING PROGRAM**




Every spring, Marin Water operates a rotary screw trap to sample a portion of migratory salmon and steelhead smolts leaving Lagunitas Creek. Young salmonids are caught in the trap on their journey downstream to the ocean after spending up to three years in freshwater. Lagunitas is a stronghold for endangered Coho Salmon (*Oncorhychus kisutch*), and supports populations of Chinook Salmon (*O. tshawytscha*) and threatened Steelhead Trout (*O. mykiss*). Sampling on the rotary screw trap allows biologists to estimate abundances, freshwater growth, and survival rates of these salmonids.

The rotary screw trap is designed to sample a portion of the smolts migrating out into the ocean, but also catches young of the year salmonids and other species found in the creek, including endangered California Freshwater Shrimp (*Syncaris pacifica*), Pacific Lamprey (*Lampetra tridentata*), Threespine Stickleback (*Gasterosteus aculeatus*), Southern Coastal Roach (*Hesperoleucus venustus subditus*), sculpin spp. (*Cottidae*), and the invasive Signal Crayfish (*Pacifastacus leniusculus*). This ink and watercolor painting by Annabelle Howe depicts the different life stages of salmonids and other aquatic species frequently caught in the rotary screw trap this year.

*Be sure to follow WSP on Facebook and Instagram!*

@americorpswsp

Watershed Stewards Program

# MERCURY MESS: ONE OF MARINE LIFE'S MOST TOXIC CONTAMINANTS IN THE SAN FRANCISCO BAY

**BY: MORGAN WILLIAMS, SERVING AT SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD**

**"Warning: Contaminated Fish."** This is a familiar site if you live near wetlands or reservoirs in the San Francisco Bay Area. While waterways may be plagued by a variety of pollutants, methylmercury is the primary reason why California fish are unsafe for human consumption. Despite its toxicity and prevalence, little is known about the mechanics of its formation and biomagnification.

What we are certain of is that when metallic mercury enters waterbodies and settles on the bottom, it can be transformed by bacteria into its most toxic form: methylmercury. Unlike regular mercury, this version is a powerful neurotoxin with an affinity for accumulating in fish. When contaminated seafood is ingested, methylmercury enters and attacks the brain, causing debilitating loss of sensory and motor functions in both humans and wildlife [1].

In the San Francisco Bay, local agencies have collaborated with the Regional Water Board for decades to determine the dynamics of methylmercury contamination in seafood and what can be done to prevent it.

**CONTINUED ON PG. 8**


The remediated mine waste site at Gambonini Mine. Photo Credit: San Franscico Bay Regional Water Quality Control Board

# RECENT SUCCESSES OF THE SAN JOAQUIN RIVER RESTORATION PROGRAM PROVIDE HOPE FOR CENTRAL VALLEY SPRING-RUN CHINOOK SALMON

**BY: SEBASTIAN GONZALES, SERVING AT UNITED STATES FISH AND WILDLIFE SERVICE, LODI**

The main stem of the San Joaquin River (SJR) and its upper tributaries historically supported an annual return of approximately 500,000 Chinook Salmon [2,3,7]. The geographic orientation and topography of the SJR watershed allowed spring-run Chinook Salmon to proliferate. Spring-run Chinook Salmon (SRCS) are a race of salmon that enter freshwater in the spring, hold in the river system over the summer, and spawn in the fall [6]. The snowmelt conveyed from the southern high-elevation peaks of the Sierra Nevada Mountains maintained cool river temperatures throughout the year and provided habitat for SRCS [6].

These conditions supported the southernmost population of SRCS in North America in the SJR [2,3,7]. Unfortunately, suitable habitat provided by the SJR began to deteriorate in the 1940's as water diversions increased and Friant Dam was constructed [2,8,9]. These alterations to the watershed, paired with other factors such as mining and the introduction of non-native predators [10], had such an impact on the salmon that the once prolific runs of the upper SJR were extirpated by 1960 [2,3,7]. Recently, efforts to recover this population have been made through the San Joaquin River Restoration Program (SJRRP).

The program was initiated in 2009 following a multi-agency settlement aimed at returning SRCS populations in the SJR to 'good condition' [4]. In order to achieve the production goals set by the program, the SJRRP has prioritized "maintaining river connectivity with dedicated restoration flows, restoring volitional passage, and establishing a broodstock population of SRCS," [1].

> **ADULT SRCS WERE ABLE TO BYPASS NORMAL BARRIERS TO FISH PASSAGE AND REACH THE GRAVEL SPAWNING BEDS... FOR THE FIRST TIME IN DECADES.**

Methods to initiate recovery include developing a broodstock population, releasing hatchery produced juveniles, tagging and translocating returning adults above migration barriers, and continuous monitoring of habitat availability, spawning success, and survival below Friant Dam [5]. In 2014, the program began releasing juvenile SRCS in the river and, in 2019, began capturing and tagging returning hatchery adults and releasing them above fish passage barriers [1]. However, during 2019 carcass surveys, the program documented untagged adult carcasses in addition to translocated carcasses [1]. This suggested that during the high seasonal precipitation of 2019, adult SRCS were able to bypass normal barriers to fish passage and reach the gravel spawning beds below Friant Dam naturally for the first time in decades. Spring-run Chinook Salmon still face many obstacles on their way to complete recovery in the SJR, but it is clear the SJRRP has made major strides in there introduction process and the future of SRCS in the SJR is brighter than it has been for generations.

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Two FWS employees collecting data and assessing a salmon redd in the San Joaquin River just below Friant Dam (Photo Credit; Geoffrey Steinhart of the USFWS)

# MARVELOUS MAYFLIES

## BY: SIENA WATSON, SERVING AT GRASSROOTS ECOLOGY

Siena Watson, a Corpsmember serving with Grassroots Ecology in Palo Alto, used watercolor to capture the life of a mayfly and highlight this fascinating order of invertebrates that lives in our creeks! Mayflies spend most of their lives underwater as nymphs (bottom left) feeding on algae and decaying organic matter. Mayfly nymphs are a favorite food of baby fish, like juvenile salmon and trout, similar to how caterpillars of butterflies and moths are great food for baby birds. When the nymph is ready, it sheds its outer skin on a rock and emerges as an adult mayfly with wings, leaving behind an exuvia (middle right) which you can often find on plants or rocks in or nearby creeks. Adult mayflies often emerge all at once, providing lots of food for birds and bats. Each mayfly's life stage was painted based on a separate photo taken by Siena out in the field, so each one is likely a different species of mayfly.

Corpsmember Jaclyn Sherman conducting a spawner survey on Lagunitas Creek (Photo Credit: Annabelle Howe)

# SUPERIMPOSITIONS, SPAWNING, AND SALMONIDS IN LAGUNITAS CREEK

## BY: JACLYN SHERMAN, SERVING AT MARIN WATER FISHERIES MONITORING PROGRAM

Lagunitas Creek begins on the north slope of Mt. Tamalpais and flows 40 kilometers to the mouth of Tomales Bay. While only the lower 19 kilometers of Lagunitas is accessible to anadromous salmonids, the creek is connected to the bay year round with no impediments or sandbars [2]. These factors alone deem this watershed an esteemed environment for spawning salmonids, and sometimes too exceptional, to the point at which fish contest for premier spawning real estate. At the start of the spawner season in November, Chinook Salmon (Oncorhynchus tshawytscha) are typically the first species of salmonids to dig their redds in the bed of Lagunitas Creek.

CONTINUED ON PG. 10

# SAVING THE WETLANDS: DEVELOPING A REGION-WIDE MONITORING PLAN FOR WETLAND RESTORATION IN THE BAY AREA

**BY: ERIN FAIRLEY, SERVING AT SAN FRANSCICO BAY REGIONAL WATER QUALITY CONTROL BOARD**

The San Francisco Bay Estuary is the largest estuary on the West Coast of the United States and its watershed spans almost 60,000 square miles. For thousands of years, it has housed diverse populations of migratory birds, juvenile fish, shellfish, plants, and other animals, as well as the indigenous groups of the Ohlone, Miwok, Southern Pomo, Wappo, and Patwin peoples [1]. This estuary has tidal wetlands, which are some of the most productive ecosystems in the world, ranking against rainforests and coral reefs! With their shallow water and high concentrations of nutrients, wetlands play a vital part in many species' life cycles. Many different organisms could not live without a wetland habitat [3]. So, why do we care about a highly urbanized area such as San Francisco, where 95% of wetlands have already been lost [2]?

**CONTINUED ON PG. 9**

An egret in the San Francisco Bay estuary (photo obtained from San Francisco Estuary Partnership website)

Individual collecting water samples to measure how much mercury the creek was transporting to the bay. Photo obtained from the San Franscico Bay Regional Water Quality control Board.

## MERCURY MESS, CONTINUED FROM PG. 5

The most recent data from waterways surrounding Gambonini Mine, an old mercury processing facility in the East Bay, projects effective remediation methods and new directions for forthcoming research. In the early 2000's, state and federal agencies joined forces on a massive regrading and revegetation project to secure approximately 700,000 tons of mining waste dumped on the hillside by the mine. The project was incredibly successful, reducing the volume of mercury entering the bay by a measured 90% [2]! Furthermore, 2018 monitoring revealed waste leaving the site has continued to decrease [3].

Downstream of Gambonini Mine, stakeholders collaborated with the Water Board to gauge how methylmercury has changed in aquatic life since the mine's remediation. Recent data from this effort has raised many questions. Over the last twenty years, concentrations of the neurotoxin increased in a wide variety of species, from commercial oysters to local leopard sharks, while other predatory fish and bottom feeding species have seen significant decreases in their tissue concentrations [4]. The inconsistent trends suggest methylmercury accumulation in Bay Area seafood is driven by factors beyond the mercury ore entering the ecosystems. Potential biochemical and ecological variables for this phenomenon are yet to be identified. Thus, highlighting areas where further research is needed to uncover the underlying dynamics of methylmercury contamination. Ultimately, methylmercury is a widespread, complicated toxicant found in watersheds and marine life across the globe. Its potent toxicity poses health risks to humans and wildlife. No one agency or academic institution can tackle a problem this big alone, as aspects of methylmercury remain a mystery. The continued collaborative efforts of the San Francisco Water Board to understand and control this contaminant will create a safety blueprint for the bay, its inhabitants, and future wildlife.

References:

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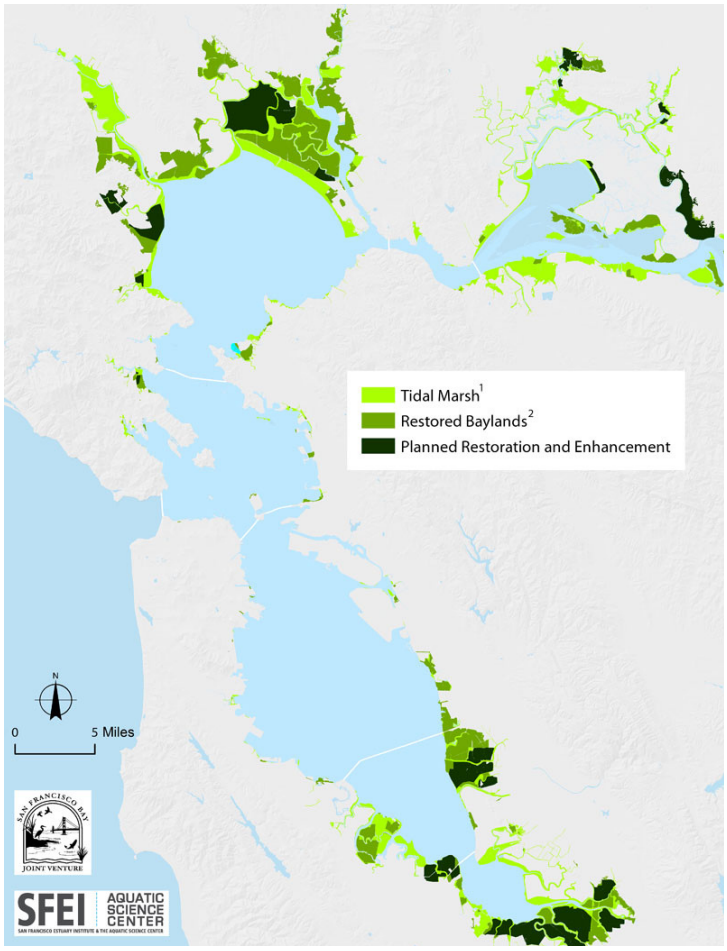


These maps show the decrease in wetland acreage (labeled as tidal marsh) when comparing historical area to recent years, as well as restored baylands and plans for further future restoration. Source: San Francisco Bay Joint Venture

With climate change threatening our livelihoods, research has been done to indicate wetlands are essential to sustaining human life as well. They act as sponges for runoff from cemented cities, providing flood and erosion control that help combat climate change and sea level rise. Furthermore, the productivity of wetlands is important for our economy; we thank the wetlands for the fish, shellfish, and many crops that fuel industries[2]. The EPA provided funds for wetland restoration in California, creating the Wetland Regional Monitoring Program (WRMP). A region-wide program requires collaboration between different stakeholders. There are a number of local, state, and federal environmental agencies, non-governmental organizations (NGOs), and universities involved in the decision-making and development of the program. This communal effort will create a comprehensive, science-based plan for assessing wetland restoration projects. Context and comparison are key when it comes to evaluating restoration: where are our wetlands, which restoration projects have been successful, what species have been targeted, what survey methods were used, and what biotic and abiotic indicators were measured?

These questions and more can be addressed through in-depth meetings between these stakeholder groups, extensive literature reviews, mapping data, and other efforts. Ultimately, the WRMP will have a network of monitoring sites, a public platform for sharing data, and a comprehensive science framework to follow when tackling future wetland restoration projects in the estuary. A program of this magnitude takes several years to develop and be implemented, and they are 2-3 years into the process.

A full WRMP plan has been made and is available on the website, https://www.sfestuary.org/wrmp/.

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## SUPERIMPOSITIONS, SPAWNING AND SALMONIDS, CONTINUED FROM PG.7

At the start of the spawner season in November, Chinook Salmon (Oncorhynchus tshawytscha) are typically the first species of salmonids to dig their redds in the bed of Lagunitas Creek. Coho Salmon (Oncorhynchus kisutch) leave the ocean and migrate upstream shortly after, followed by a Steelhead Trout (Oncorhynchus mykiss) run beginning in late January and early February. The order of these runs is notable, as chinook hold first priority in selecting suitable spawning habitat, while steelhead often reach Lagunitas Creek in a state inundated by hundreds of former redds. Queue the superimpositions.

In fisheries vernacular, superimpositions allude to a new redd built on top of an existing redd. A redd can be classified as "partially superimposed" or "completely superimposed", the latter almost always being fatal. A superimposing redd can kill the eggs of the original redd by physical shock, displacement, exposure, and predation [1]. To experts, a high number of "complete superimpositions" generally forecast a small juvenile population for the subsequent year.

> **"SUPERIMPOSITIONS ALMOST ALWAYS INDICATE A SHORTAGE OF SPAWNING HABITAT"**

Spawning success largely depends on a fish's ability to find the most optimal spawning conditions, and superimpositions almost always indicate a shortage of spawning habitat. During the 2020-21 spawner season in Lagunitas Creek, survey data showed an unusually high incidence of superimpositions. Of the 253 recorded redds, 72 or 28.5% showed some level of superimposition, compared with last year's 21.2%. This conspicuous lack of spawning habitat can be attributed to several factors including low flows, inadequate rainfall, and inaccessibility to other tributaries, causing more fish to spawn on the same section of creek. Although superimpositions are not uncommon in Lagunitas Creek, this year's inflated numbers are indicative of a changing climate and surely the antecedent of ongoing drought conditions.


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Lindsay holding a steelhead while at the weir when serving with NOAA SWFSC. Photo Credit: Karlee Liddy

# ALUMNI SPOTLIGHT: LINDSAY HANDSON

NOAA SOUTHWEST FISHERIES CENTER IN SANTA CRUZ- YEAR 25

**INTERVIEWED BY:SOPHIA TROEH, SERVING AT WSP SAN LUIS OBISPO**

***What was your WSP experience like?***

I had a blast serving with my team at NOAA! I love fish and science, and working with the people at NOAA allowed me to get a foot in the door with not just field research, but the behind-the-scenes aspect of being a fisheries scientist. I was incorporated into their team and in all aspects of the science, which was exciting for me. How could you beat seeing fish spawn in the creek and being in the field every day?

***What experience was especially memorable for you?***

Two or three times a week, we would do spawner surveys. Santa Cruz is the furthest southern extent of Coho Salmon. It was so exciting to walk through the redwood forest, come around a bend and see fish spawning. You never knew what to expect in a day getting out in the field, and I got to learn what the local ecosystem was like and observed how it changed every time I returned. Doing field work at the same river reaches created a sense of place and understanding that I wouldn't have gotten another way.

***What have you been doing since WSP? What are your current responsibilities and positions?***

I am currently working on my master's degree at Northern Arizona University Flagstaff. I am monitoring a population of native fish in the Grand Canyon. It's very hard to access, so fieldwork is conducted a month at a time. I'm also doing statistics and modeling. After graduating, I hope to continue researching fish in the Grand Canyon. I eventually want to get a Ph.D. as a research ecologist.

**CONTINUED ON PG. 11**

***What is your favorite part of what you do now?***
I have always loved fieldwork, and for ours, we float downstream for 250 miles in the Grand Canyon. I get to raft down the river and see all these different rock layers and what's underwater in such a turbid river.

***What advice would you give current WSP Corpsmembers?***
My favorite part of service was the ability to be creative. Being in WSP was a great way for me to have my creative endeavors be used for something good. I got to make t-shirts and outreach materials with my art skills. My advice is to find ways to use any skill you have in the program. If you see something you are interested in or there is something you want to explore, now is the time to do it. People get excited to see you excited.

Lindsay with a flannelmouth sucker, the focus species of her master's research in the Grand Canyon. Photo Credit: Mike Yard

***What role did WSP play in your career path?***
Before WSP, I wasn't sure what subfield I wanted to be in in the sciences. Doing WSP made me realize my interest is fish. Fish have always been a part of my life, but I never realized how diverse, resilient and cool they are. It's fascinating! My WSP experience allowed me to succeed in this faster-paced program for my master's degree.

**Check out Lindsay's art website and Instagram!**
**Lindsay E Hansen (@lindsayehansenart)**
**https://www.lindsayehansen.com/**

"*Veins of the Forest*". Painting by Lindsay Hansen

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ccc.ca.gov/watershed-stewards-program/

# Our Mission

The Watershed Stewards Program (WSP) is dedicated to improving watershed health by actively engaging in restoration science, civic service, and community education while empowering the next generation of environmental stewards.

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