

# Scott River Watershed Restoration

## A Fish Tale

*Scott River Watershed Council*

Betsy Stapleton & Erich Yokel

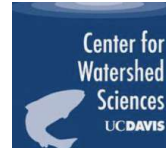
Scott Watershed Informational Forum (SWIF)

February 17, 2022



**SCOTT RIVER**  
WATERSHED COUNCIL

# SRWC gratefully acknowledges our funders and collaborators



*Scott Valley Landowners*

# SRWC has performed stream restoration focused on Coho Salmon and beaver since 2014

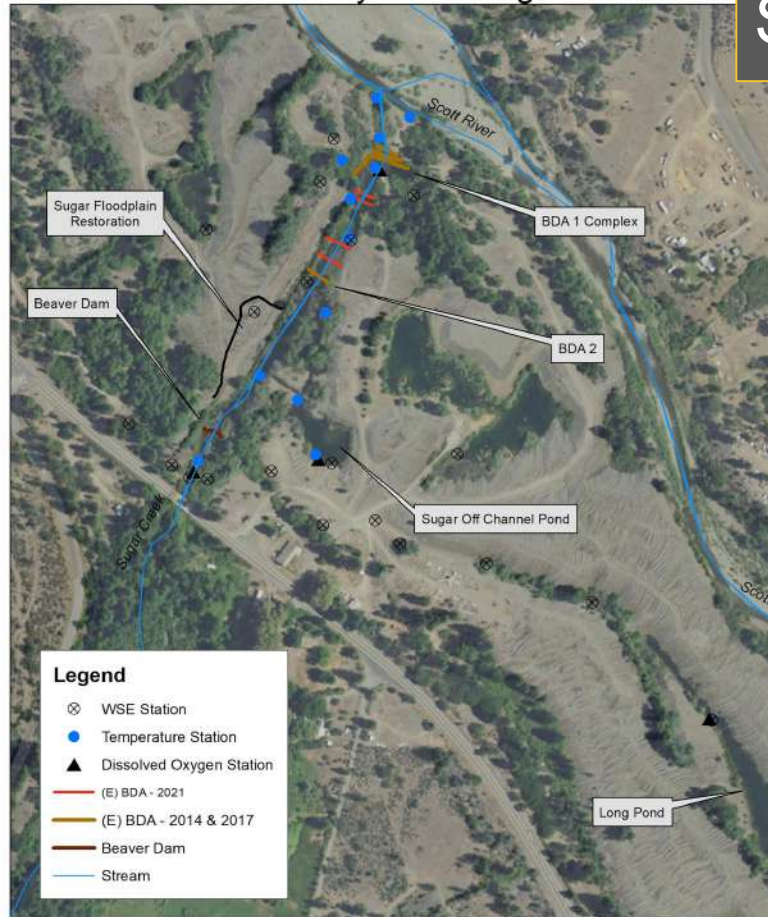
## Objectives:

- Implement ecological restoration projects to address limiting factors of all life stages of Coho Salmon
- Seek solutions that offer multiple ecological services
- Emphasize the role beaver play in stream systems
- Perform physical and biological monitoring to demonstrate effectiveness of restoration, understand environmental condition and gain a better understanding of life strategies of the fishery
- Utilize monitoring to guide adaptive management



# Sugar Creek Restoration Complex

- Sugar Creek BDAs installed in 2014, 2017 and 2021 and maintained all years
- Sugar Creek Off Channel Pond connected in 2015
- Beaver built dam in 2018
- Sugar Creek Floodplain implemented in 2020
- Long Pond Habitat Enhancement Project started 2017- Design completed in 2021





# SRWC PIT Tag Program







BDA during Chris O'Keefe's Fish Passage Experiment (August 19, 2019)



Charnna Gilmore at natural beaver dam in Sugar Creek BDA Treatment Reach (Nov 5, 2019)



## Juvenile Fish Sampling Effort



# Mentors



2014.05.19 1





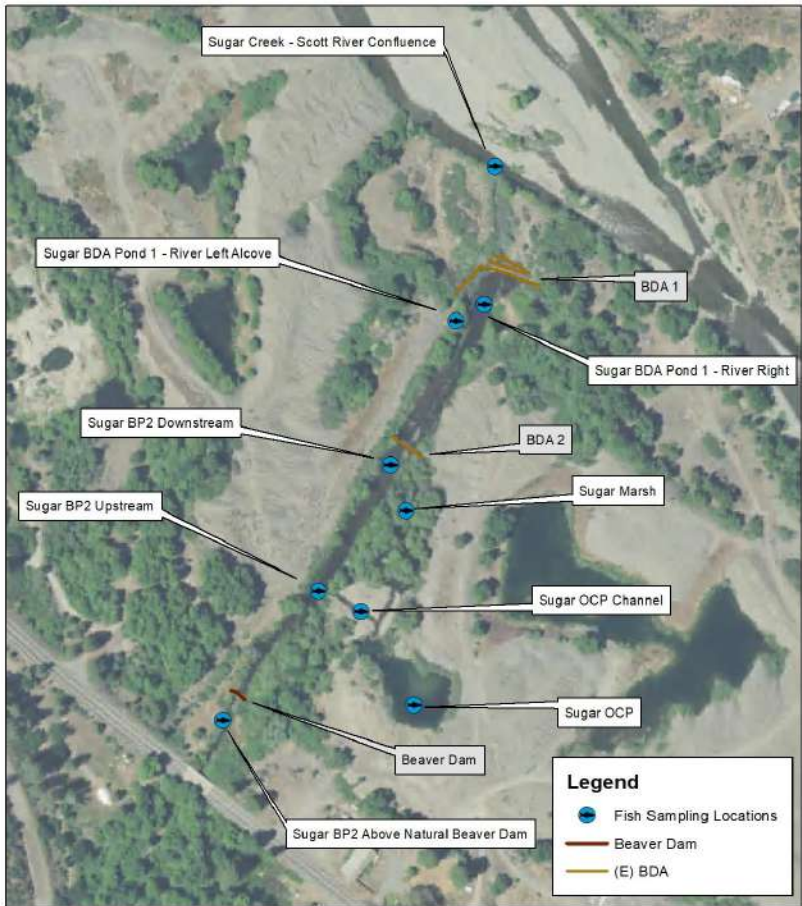
### Total PIT Tags Applied

Brood Year	First Sampling Effort	Final Sampling Effort	Sugar Creek	French Creek	Total
2015	7/19/2016	5/5/2017	734	316	1050
2016	7/24/2017	4/19/2018	1078	418	1496
2017	7/16/2018	4/30/2019	594	800	1394
2018	7/31/2019	4/15/2020	2004	1515	3519
2019	6/17/2020	5/4/2021	338	1984	2322
2020	7/2/2021		319	356	675

07 30 2020



# Sugar Creek - Fish Sampling Locations

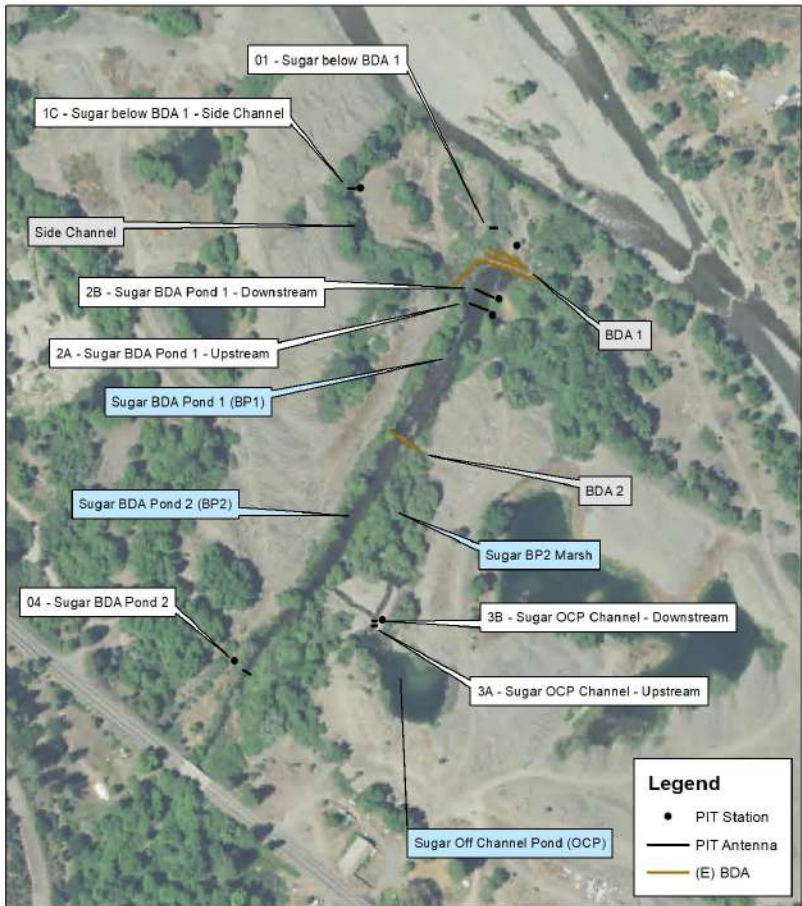


Sample Multiple Habitats in each sample reach:

Sugar Creek BDA Complex  
Sugar Creek Control Reach  
Mid French Creek Habitats  
Lower Miners Creek



## Sugar Creek - PIT Array Network



# Sugar Creek Array Network

Established network of PIT arrays in key habitats in the Sugar Creek Complex to detect movement and survival

Established six antennas in 2016

Added seventh antenna in side channel during smolt outmigration in 2020

Reconfigured arrays in 2021 after construction of additional BDAs



# Scott River Array Network

- SRWC operating three PIT array networks in the Scott Valley – Sugar BDA Complex, Mid French Creek and Scott River Tailings Oasis
- In November 2019 a PIT array was established at the CDFW Counting Weir to detect returning adults



## Scott River PIT Array Stations



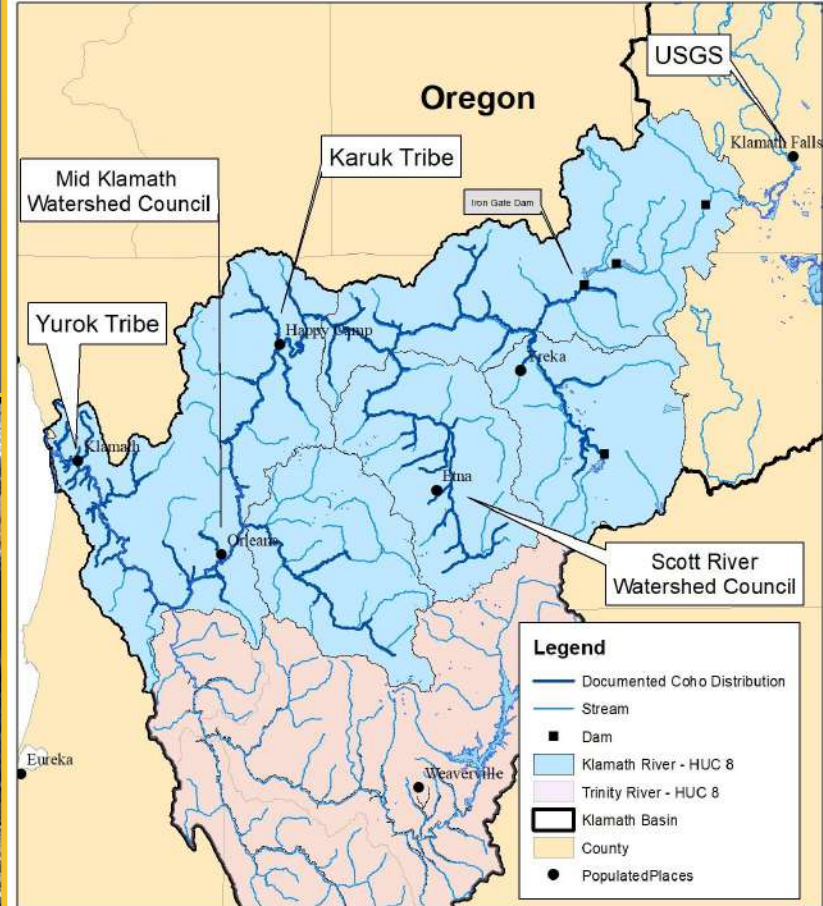
## USGS Database

- Need to coordinate PIT tag efforts in Klamath Basin
- Organize and analyze large amounts of detection data
- Over 30 Collaborating Organizations



Spring Klamath Fisheries Collaborative Meeting  
February 24 – 25, 2022

## Klamath Fisheries PIT Tag Database Project



Coho distribution data from CalFish.org  
Publication date - 6/23/2016

SCOTT RIVER  
Watershed Council  
E. Yokel - 4/13/2020



0 5 10 20 Miles



# Detection of PIT tagged adult returns - Meet 989001032565987 (aka "Freddy Fish")

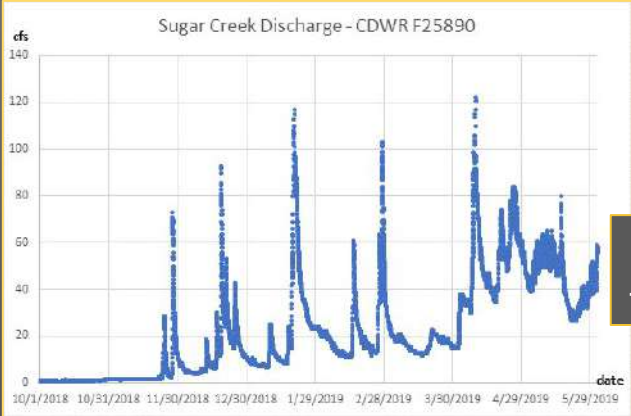


989001032565987	Sugar Creek	Minnow Trap	Sugar Marsh DS	1/8/20				
989001032565987	Sugar Creek	Fyke	Sugar Creek - BP2 US	1/10/20	1/10/20		2 Days (Since last measured)	2
989001032565987	Scott River	93	Scott River RKM 29.0 - CDFW Weir	12/24/2021 19:38:46	12/24/2021 23:48:12	0 Days 4 hrs 9 mins	714 Days 19 hrs 38 mins	714.8185877
989001032565987	Scott River	32	Scott River - Below Alcove Inlet RKM 85.3	12/28/2021 18:49:03	12/28/2021 18:49:03	0 Days 0 hrs 0 mins	3 Days 19 hrs 0 mins	3.792260995
989001032565987	Scott River	32	Scott River - Below Alcove Inlet RKM 85.3	1/5/2022 0:45:07	1/5/2022 20:09:20	0 Days 19 hrs 24 mins	7 Days 5 hrs 56 mins	7.247264931
989001032565987	Sugar Creek	1B	Sugar Below BDA1 RKM 0.05 - DS	1/6/2022 1:05:59	1/6/2022 1:05:59	0 Days 0 hrs 0 mins	0 Days 4 hrs 56 mins	0.205997338
989001032565987	Sugar Creek	1A	Sugar Below BDA1 RKM 0.05 - US	1/6/2022 1:06:00	1/6/2022 1:06:00	0 Days 0 hrs 0 mins	0 Days 0 hrs 0 mins	1.04167E-05
989001032565987	Sugar Creek	2E	Sugar Above BDA1 - BP1	1/6/2022 2:21:49	1/6/2022 2:21:49	0 Days 0 hrs 0 mins	0 Days 1 hrs 15 mins	0.052653588
989001032565987	Sugar Creek	2D	Sugar Below BDA2	1/6/2022 5:33:14	1/6/2022 5:58:50	0 Days 0 hrs 25 mins	0 Days 3 hrs 11 mins	0.132936111
989001032565987	Sugar Creek	2C	Sugar Above BDA2	1/6/2022 6:05:19	1/6/2022 6:05:19	0 Days 0 hrs 0 mins		
989001032565987	Sugar Creek	04	Sugar Above BDA Pond 2 RKM .3	1/6/2022 6:13:27	1/6/2022 6:24:34	0 Days 0 hrs 11 mins		
989001032565987	Sugar Creek	2C	Sugar Above BDA2	1/10/2022 3:22:50	1/10/2022 5:56:31	0 Days 2 hrs 33 mins		
989001032565987	Sugar Creek	04	Sugar Above BDA Pond 2 RKM .3	1/10/2022 6:23:15	1/10/2022 6:43:21	0 Days 0 hrs 20 mins		
989001032565987	Sugar Creek	2C	Sugar Above BDA2	1/10/2022 6:49:24	1/10/2022 6:49:24	0 Days 0 hrs 0 mins		
989001032565987	Sugar Creek	04	Sugar Above BDA Pond 2 RKM .3	1/10/2022 7:00:23	1/10/2022 7:00:23	0 Days 0 hrs 0 mins		
989001032565987	Sugar Creek	2C	Sugar Above BDA2	1/10/2022 7:20:30	1/10/2022 8:54:47	0 Days 1 hrs 34 mins		
989001032565987	Sugar Creek	04	Sugar Above BDA Pond 2 RKM .3	1/10/2022 9:15:43	1/10/2022 9:15:43	0 Days 0 hrs 0 mins		
989001032565987	Sugar Creek	2C	Sugar Above BDA2	1/10/2022 9:45:20	1/10/2022 9:54:57	0 Days 0 hrs 9 mins	0 Days 0 hrs 29 mins	0.020565162
989001032565987	Sugar Creek	04	Sugar Above BDA Pond 2 RKM .3	1/10/2022 10:09:03	1/10/2022 10:09:03	0 Days 0 hrs 0 mins	0 Days 0 hrs 14 mins	0.009790046
989001032565987	Sugar Creek	2C	Sugar Above BDA2	1/10/2022 10:27:20	1/10/2022 10:27:20	0 Days 0 hrs 0 mins	0 Days 0 hrs 18 mins	0.012699884
989001032565987	Sugar Creek	3B	Sugar OCP Channel - DS	1/10/2022 10:36:41	1/10/2022 10:36:41	0 Days 0 hrs 0 mins	0 Days 0 hrs 9 mins	0.006492361
989001032565987	Sugar Creek	3A	Sugar OCP Channel - US	1/10/2022 10:36:50	1/10/2022 10:36:50	0 Days 0 hrs 0 mins	0 Days 0 hrs 0 mins	0.000109375
989001032565987	Sugar Creek	04	Sugar Above BDA Pond 2 RKM .3	1/10/2022 14:08:07	1/10/2022 14:08:07	0 Days 0 hrs 0 mins	0 Days 3 hrs 31 mins	0.146723495

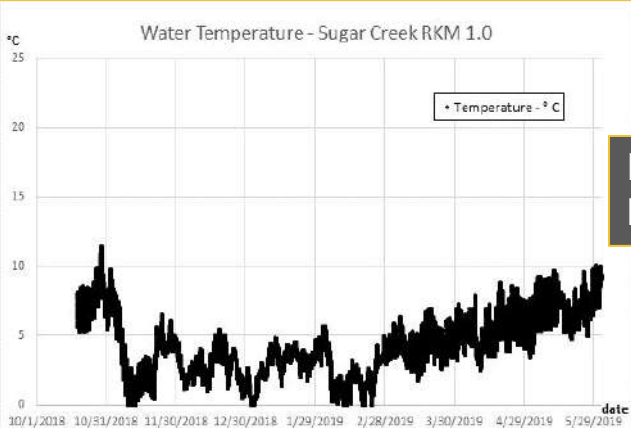
Freddy was detected on multiple arrays from the Scott River CDFW Weir to the Scott River Tailings and ultimately on multiple arrays within the Sugar Creek BDA Network

# Welcome to the World Freddy, Good Luck Buddy!

Inception of 2021 adult returns - Spawned 12/15/2018 Brood Year 2018



High flows during incubation - potential redd scour



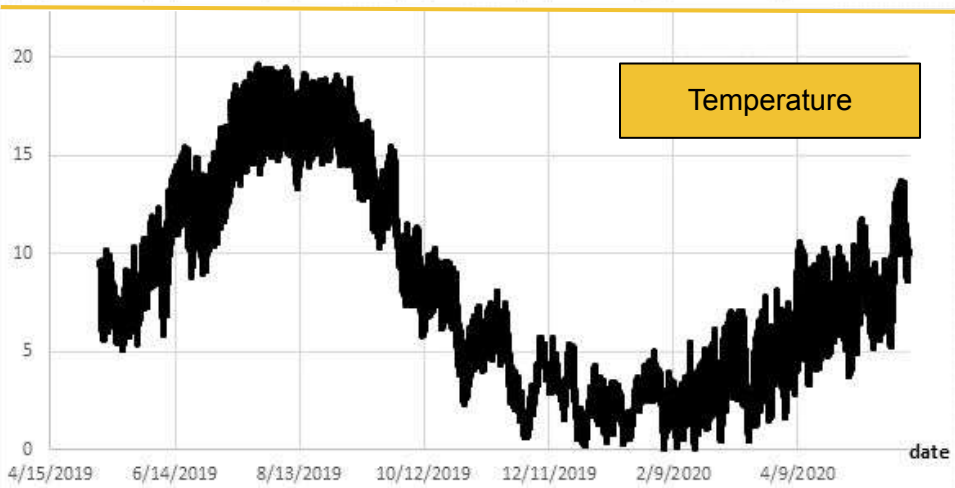
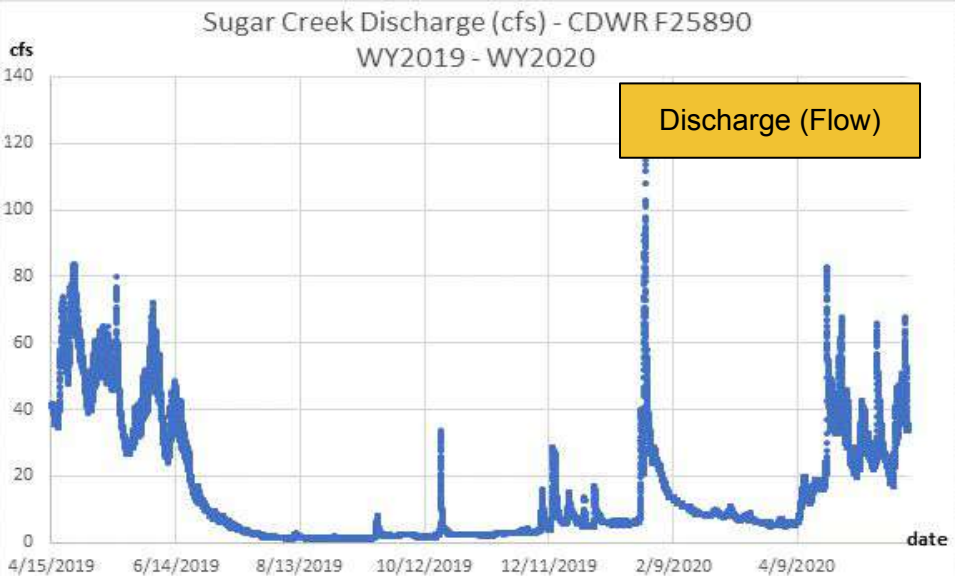
Low Water Temperatures during incubation – late emergence

## Lower Sugar Creek Coho Spawning Ground Survey - 1/3/2019





Juvenile rearing during summer base flow and winter runoff period



*Freddy* visited us on January 8, 2020. Forklength = 90 mm and Weight = 7.0 g

Had spent approximately eight months of freshwater rearing  
Captured significant number of this cohort previously (July to Dec)  
Still 4 – 5 months until outmigration as smolt upon capture

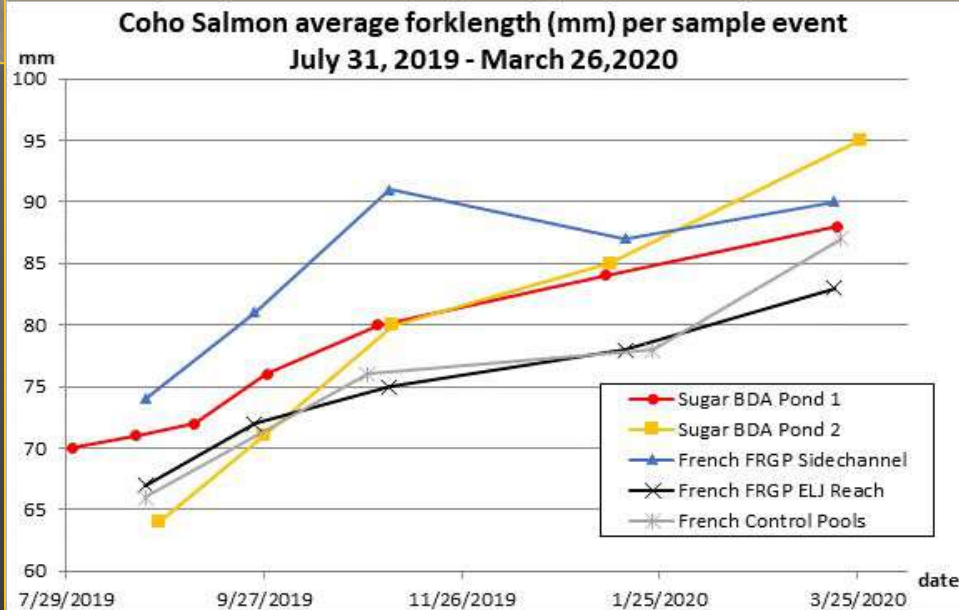


Figure 1 – Average forklength (mm) of Coho Salmon per sample event at sample site



Sugar BDA Pond 2 Marsh – Looking upstream - West



# The Tale of Two Fish

Document growth of the population

Observed different rates of growth in different habitats

Coho Salmon - Average Forklength (mm)

Sample Site	Date	Ave FL (mm)	Elapsed Days	mm growth/day
Sugar BP1	7/31/2019	70		
Sugar BP1	8/19/2019	71	19	0.05
Sugar BP1	9/6/2019	72	18	0.06
Sugar BP1	9/28/2019	76	22	0.18
Sugar BP1	10/31 - 11/1/2019	80	34	0.12
Sugar BP1	1/8 - 1/9/2020	84	69	0.06
Sugar BP1	3/19/2020	88	71	0.06

Sample Site	Date	Ave FL (mm)	Elapsed Days	mm growth/day
Sugar BP2	8/26/2019	64		
Sugar BP2	9/27/2019	71	32	0.22
Sugar BP2	11/5/2019	80	39	0.23
Sugar BP2	1/10/2020	85	66	0.08
Sugar BP2	3/26/2020	95	76	0.13



Detected fish on four antennas in Sugar Creek PIT array network

Detected fish on arrays at Sugar OCP Outlet.

Have documented daily movement of fish between OCP and BDA Ponds in past.



Begin Date	End Date	Movement	Days
1/10/2020 12:00	1/13/2020 17:57	BDA Pond 2 to Downstream Beaver Dam	3
1/13/2020 17:57	1/14/2020 18:29	DS Beaver Dam to Sugar OCP Outlet	1
1/14/2020 18:29	3/14/2020 1:00	Between Sugar OCP and BDA Pond 2	59
3/14/2020 1:00	4/15/2020 19:43	BDA Pond 2	33
4/15/2020 19:43	4/20/2020 19:34	Sugar OCP Outlet to DS Beaver Dam	5
4/21/2020 19:58	4/22/2020 20:16	DS Beaver Dam to Downstream BDA 1	1

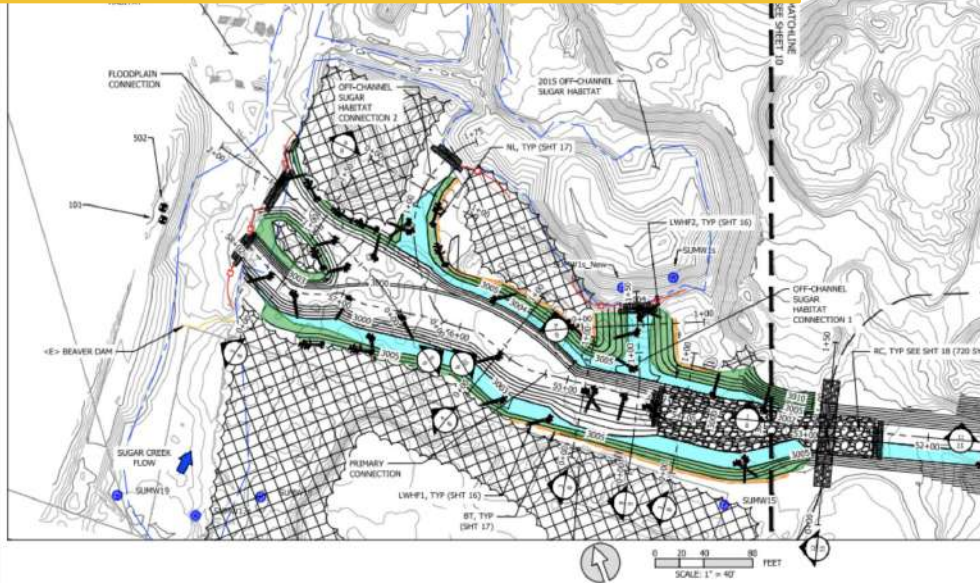
PIT Tagged Coho Salmon - 989001032565987  
Utilization of Sugar Off Channel Pond

Date Enter OCP	Date Exit OCP	Duration in OCP	
		Days	Hours
1/14/2020 22:14	1/15/2020 18:20	0.8	20
1/16/2020 3:00	1/16/2020 17:59	0.6	15
1/17/2020 2:16	1/17/2020 17:30	0.6	15
1/18/2020 2:30	1/18/2020 17:35	0.6	15
1/19/2020 2:50	1/19/2020 17:39	0.6	15
1/23/2020 6:36	1/23/2020 18:35	0.5	12
1/25/2020 4:22	1/25/2020 16:44	0.5	12
1/28/2020 7:08	1/28/2020 17:38	0.4	10
2/6/2020 6:35	2/11/2020 18:14	5.5	132
2/12/2020 18:31	2/13/2020 17:59	1.0	23
3/5/2020 4:13	3/5/2020 18:16	0.6	14
3/5/2020 18:45	3/6/2020 18:36	1.0	24
3/10/2020 3:13	3/10/2020 18:56	0.7	16
3/10/2020 21:20	3/11/2020 5:47	0.4	8
3/11/2020 19:22	3/12/2020 3:56	0.4	9
3/12/2020 4:21	3/12/2020 18:55	0.6	15
3/12/2020 19:22	3/14/2020 0:59	1.2	30



# Long Pond Design

Enhance complex low velocity  
Rearing habitats and connect existing cold surface water



CUT AND FILL SUMMARY			
SITE	CUT (CU YD)	FILL (CU YD)	BALANCE (CU YD)
LONG POND PRIMARY CONNECTION WITH OFF-CHANNEL SUGAR HABITAT CONNECTIONS 1 & 2, AND FLOODPLAIN CONNECTION	7,950	50	7,900
FILL AREA 1*	0	39,500	-39,500
TOTAL	7,950	39,450	-31,500

\* SITE LOCATED ON SHEET 12, INCLUDES APPROXIMATELY 2,150 CU YD FILL FROM HABITAT FEATURE AND PLANTING ZONE SOIL AMENDMENT OVER EXCAVATION.

### GENERAL NOTES

- CONTRACTOR SHALL LIMIT EARTHWORK TO PERMANENT AND TEMPORARY FEATURES SHOWN ON THE PLANS AND PER DIRECTION OF CAR.
- DISTURBANCE OUTSIDE THE WORK SHOWN SHALL BE MINIMIZED.
- THE FILL AREA SHALL BE STABILIZED, WITH A MINIMIZED FOOTPRINT AND MATCHED EXISTING GRADES, TOP ELEVATION OF FILL AREA NOT TO EXCEED HIGHEST EXISTING GRADE TIE-IN PER DIRECTION OF CAR.
- NEGATIVE VALUES SHOWN IN CUT AND FILL SUMMARY TABLE DENOTE SITE FILL VOLUME DEFICIT. NEGATIVE BALANCE VOLUMES INDICATE SITES REQUIRING MORE FILL VOLUME THAN CUT VOLUME PER PLAN VIEW SHOWN ON SHEET.
- IF BEDROCK IS ENCOUNTERED ABOVE PROPOSED GRADE SHOWN, CONTRACT TO MATCH EXISTING BEDROCK ELEVATION AND PER DIRECTION OF CAR.
- ESTABLISH PLANTING ZONES FOLLOWING APPROVAL BY CAR AND ENGINEER OF PROPOSED GRADE, SEE SHEETS 19 AND 20, AND SPECIAL PROVISIONS FOR PLANTING ZONE LAYOUT AND DETAILS.

HABITAT FEATURE SCHEDULE			
TYPE	NORTHING	EASTING	KEY ELEVATION
LWPF1	237221.53	6333308.66	3005.00
LWPF1	2372247.64	6335274.49	3005.00
LWPF1	2372313.33	6339222.80	3004.00
LWPF1	2372291.46	6335212.55	3004.00
LWPF1	2372260.59	6335196.90	2996.00
LWPF1	2372273.49	6335130.36	3005.00
LWPF1	2372302.29	6335101.07	3004.00
LWPF1	2372336.26	6335110.66	2999.00
LWPF1	2372379.05	6335138.53	3004.00
LWPF1	2372380.64	6335024.42	3004.00
LWPF1	2372418.91	6335014.21	2999.00
LWPF1	2372448.53	6335021.11	3000.00
LWPF1	2372473.50	6335019.85	3000.00
LWPF1	2372533.06	6335014.03	3000.00
LWPF1	2372386.46	6335056.15	2995.00
LWPF1	2372436.27	6334978.43	2999.00
LWPF1	2372454.25	6335066.97	3000.00
LWPF1	2372465.68	6334960.34	2994.00
LWPF2	2372176.41	6335272.22	3005.00
LWPF2	2372246.37	6335219.87	2999.00
LWPF2	2372324.55	6335244.69	3004.00
LWPF2	2372275.27	6335175.65	2996.00
LWPF2	2372462.19	6335082.02	3004.00
NL	2372332.09	6335185.66	3006.00
NL	2372380.82	6335014.80	3005.75
NL	2372429.67	6335164.09	3005.75
NL	2372462.74	6335112.38	3005.00
NL	2372399.78	6334976.26	3007.00
NL	2372473.09	6335056.67	3004.00
NL	2372488.91	6335041.24	3004.00
NL	2372462.56	6335009.29	3004.00
NL	2372516.70	6335026.33	3003.00

LONG POND HABITAT  
ENHANCEMENT PROJECT -  
100% DESIGN

SISKIYOU COUNTY, CA

Stillwater Sciences

1000 G STREET WATER  
MENDOTA, CA 95021

© 2019 Stillwater



SCOTT RIVER

WATERSHED COUNCIL

SCOTT RIVER WATERSHED COUNCIL

514 N STATE HIGHWAY 3

P.O. BOX 355

ETNA, CA 96027

530-598-2733



PROJECT NUMBER: 904.00

DATE: AS NOTED

SCALE: 12/3/21

DESIGN: JS/RWK

DRAWN: HLG/RWK

CHECKED: JS/JM

APPROVED: JS/JM



LONG POND REST. STA

51+00 TO 58+00 PLAN

SHEET 7 OF 20





Why do juveniles  
in Sugar Creek  
BDA habitats  
grow so big?







# From Food Web to *Freddy's* Food

Bella Vista  
FOUNDATION

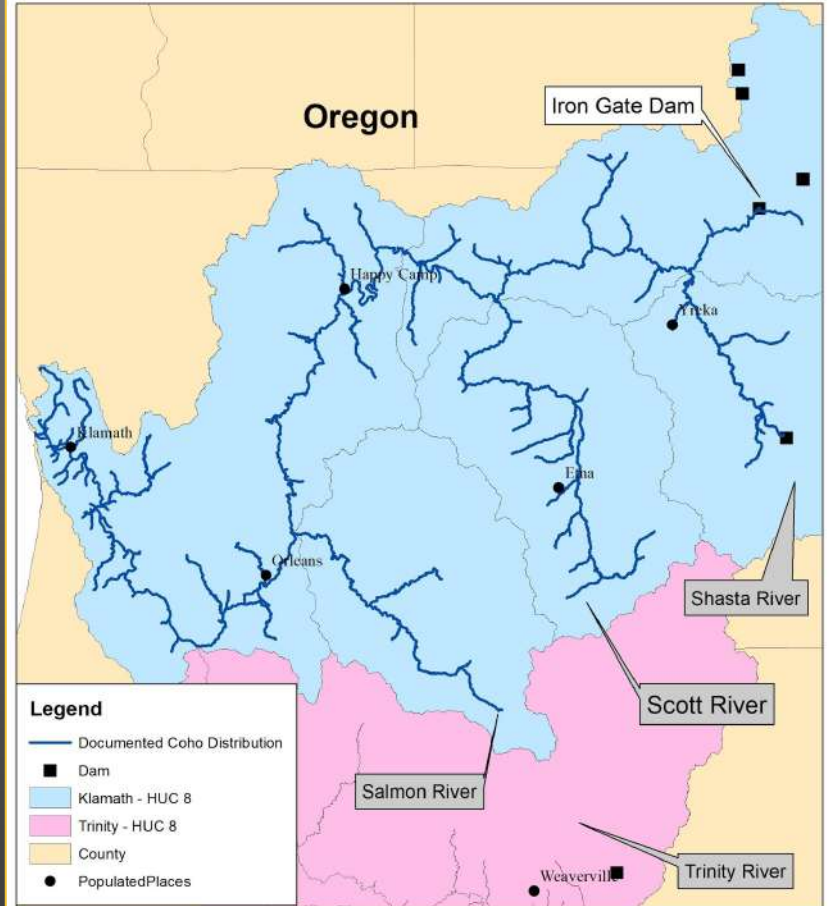


*Bye Freddy, Safe Travels!*

## Smolt Migration Down the Klamath: Spring 2020

- Challenging conditions during smolt outmigration: poor water quality & high incidence of disease
- Value of Mid-Klamath refugia: non-natal juvenile rearing

## Documented Coho Salmon Distribution - Klamath Basin



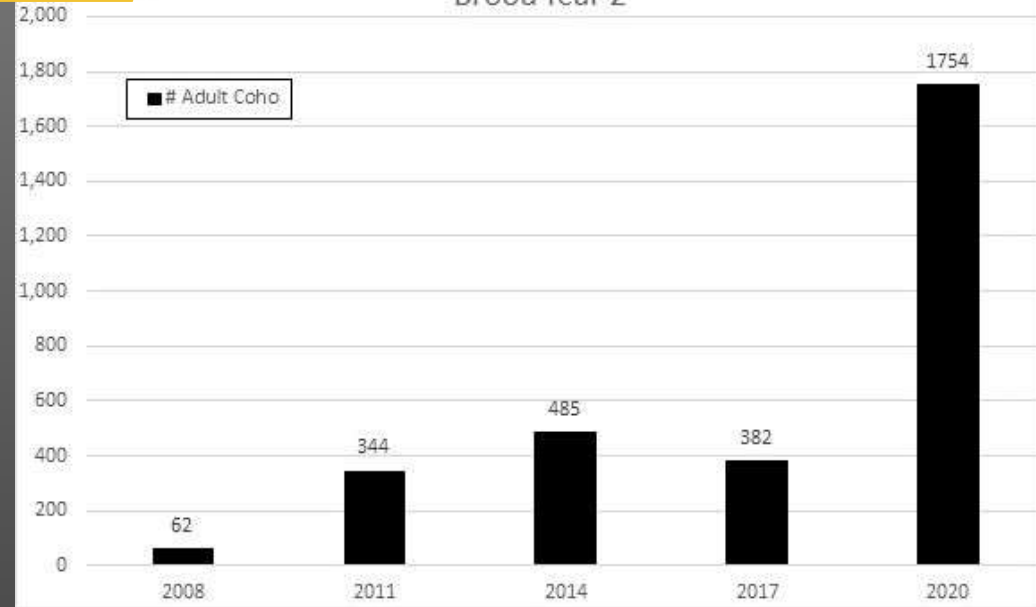
Coho distribution data from CalFish.org  
Publication date - 6/23/2016



# Freddy & the Pacific Ocean



Scott River Annual Adult Coho Salmon Escapement - CDFW  
Brood Year 2



Coho Salmon spend approximately one and a half years in the Ocean

Black box- how much do ocean conditions affect return- stay tuned

*Welcome Home Freddy!*



Detected CDFW Weir - Scott River RKM 29.0  
611 Days – From detection leaving Sugar Creek to return



Detection Date	PIT No	Date Marked	Species	Location	PIT No	FL (mm)	Wt (g)
11/26/2019 0:53	9891006781562	8/14/2017	Coho Salmon	Mid French - Pool 3	989001006781562	76	4.5
12/4/2019 3:54	9891006884664	9/28/2017	Coho Salmon	Sugar BDA Pond 2	989001006884664	90	7.4
12/9/2019 3:53	9891006884377	9/28/2017	Coho Salmon	Sugar BDA Pond 1	989001006884377	79	5.4
12/9/2019 8:40	9891006085552	7/25/2017	Coho Salmon	Sugar BDA Pond 1	989001006085552	68	3.5
12/10/2019 0:38	9891006086272	7/25/2017	Coho Salmon	Sugar BDA Pond 1	989001006086272	73	5
12/10/2019 11:52	9891006826512	8/16/2017	Coho Salmon	Sugar BDA Pond 1	989001006826512	72	3.8

In November and December 2019, six adult PIT tagged Coho Salmon were detected at CDFW Weir  
4 were detected at the Sugar Creek Array Network

Antenna	Detection Date	PIT No	Mark Location	Antenna	Detection Date	PIT No	Migration Time (days)
CDFW Weir	12/4/2019 3:54	9891006884664	Sugar BDA Pond 2	Sugar Creek - 01	12/7/2019 20:20	989001006884664	3.7
CDFW Weir	12/9/2019 3:53	9891006884377	Sugar BDA Pond 1	Sugar Creek - 01	12/12/2019 20:58	989001006884377	3.7
CDFW Weir	12/9/2019 8:40	9891006085552	Sugar BDA Pond 1	Sugar Creek - 01	12/12/2019 2:48	989001006085552	2.8
CDFW Weir	12/10/2019 0:38	9891006086272	Sugar BDA Pond 1	Sugar Creek - 01	12/13/2019 3:50	989001006086272	3.1

During the adult escapement in 2021-2022, 24 PIT tagged Coho Salmon  
were detected in the Scott River

21 of the adults (88%) were tagged by the SRWC in the Scott River  
3 were tagged by the Karuk Tribe in Mid Klamath restoration projects

3 days and 19 hours – traveled from CDFW Weir to Tailings Project – 35 miles  
Detected again 7 days later at Tailings array



Scott River Tailings Oasis  
Restoration Project

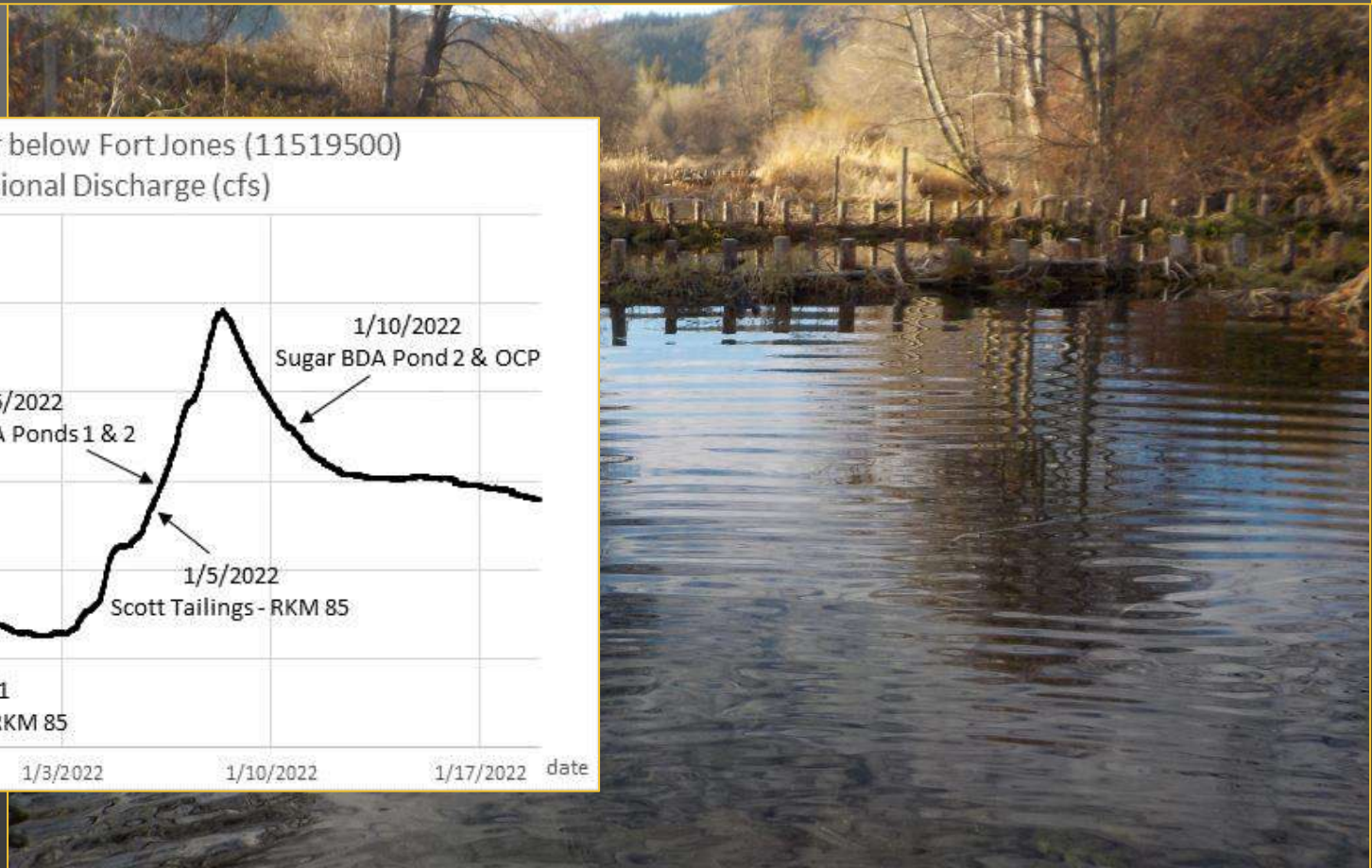
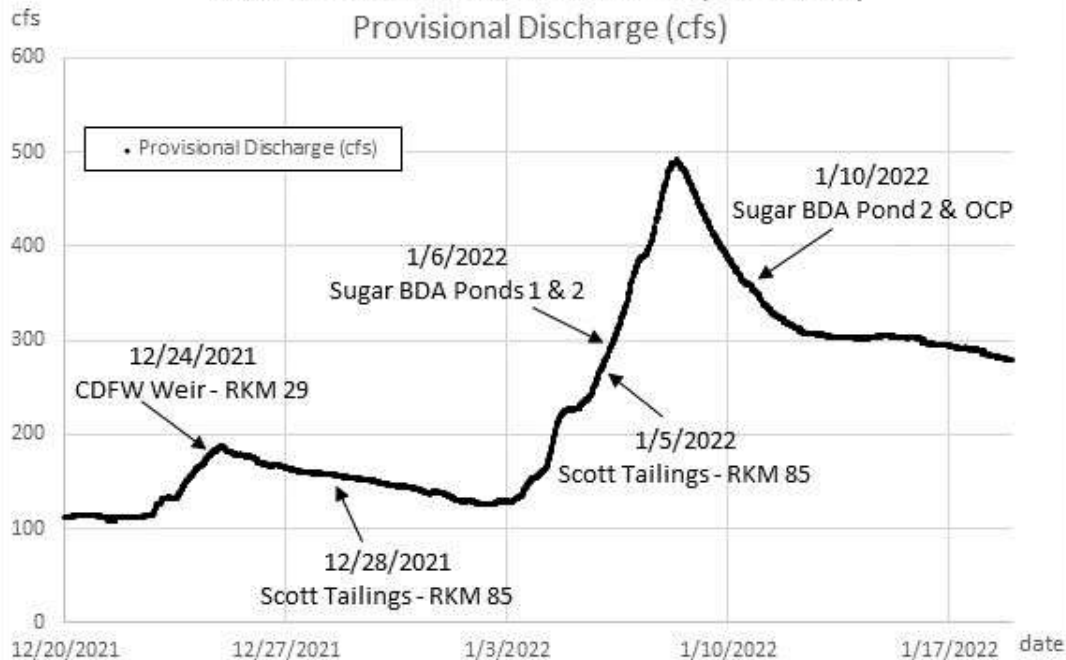


Traveled from Tailings array to  
array downstream Sugar BDA1 Complex – 5 hours



# 1 hr 15 min from array below BDA 1 Complex to array in BDA 1 Pond

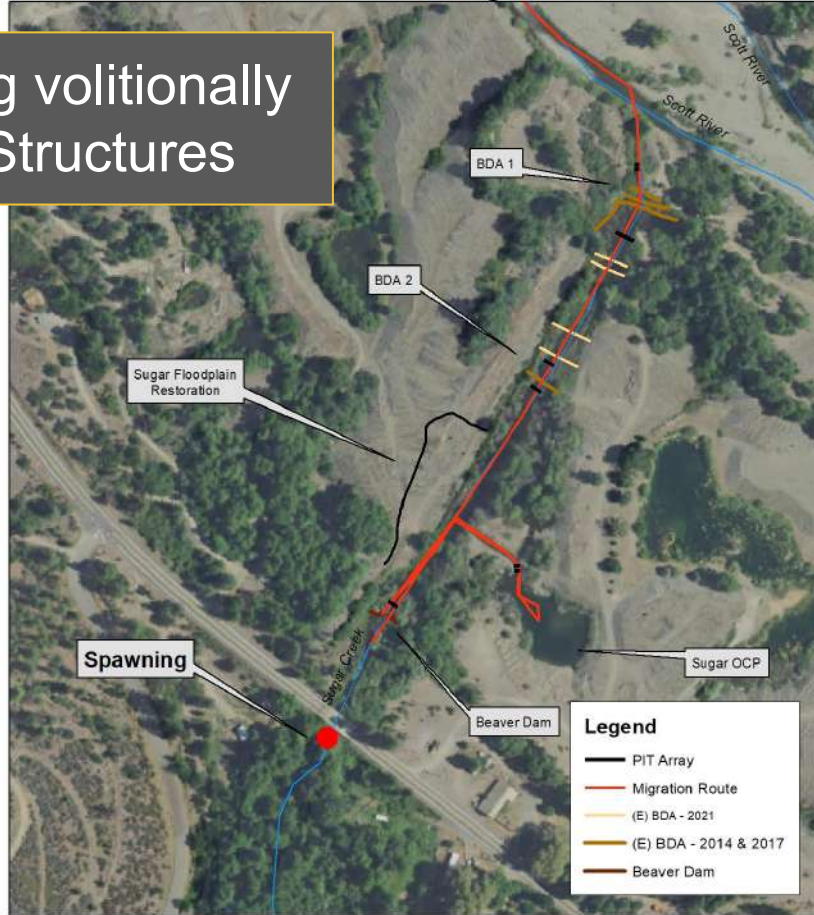
USGS Scott River below Fort Jones (11519500)  
Provisional Discharge (cfs)





# Sugar Creek BDA Complex Detected Adult Fish Migration Route

This guy is moving volitionally through the BDA Structures



*Go Freddy Go!*




Detected on upstream array below beaver dam







What was  
he doing  
up there?



Multiple Adults  
spawning at  
Highway 3 Bridge

Juveniles will emerge  
into beaver pond

*Nice Work, Freddy!*

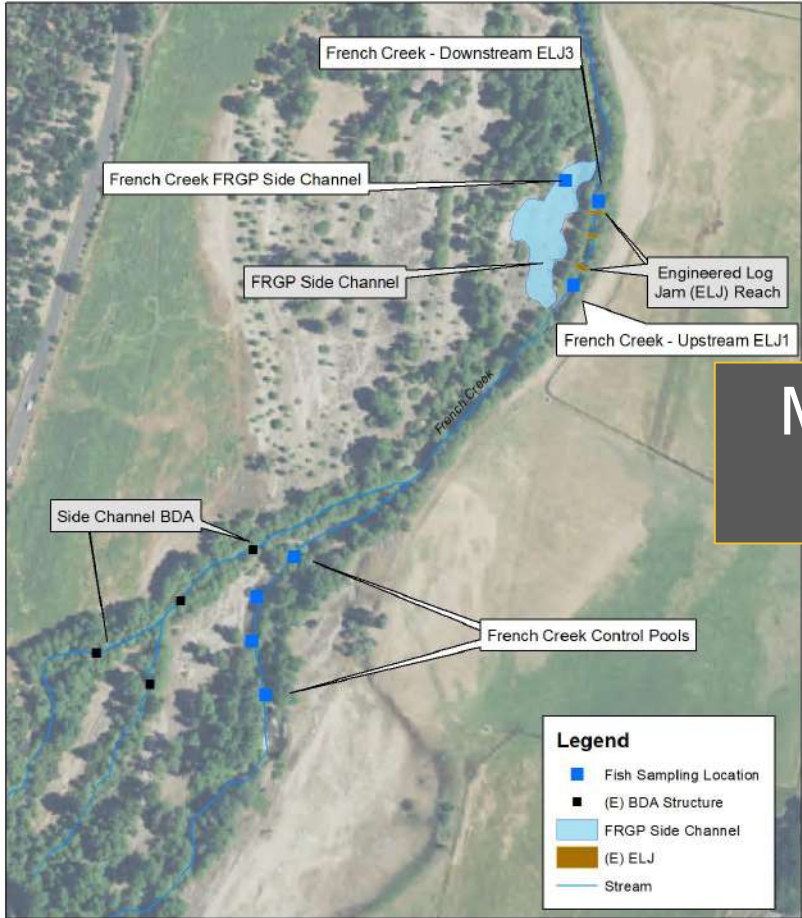




*RIP Freddy!*

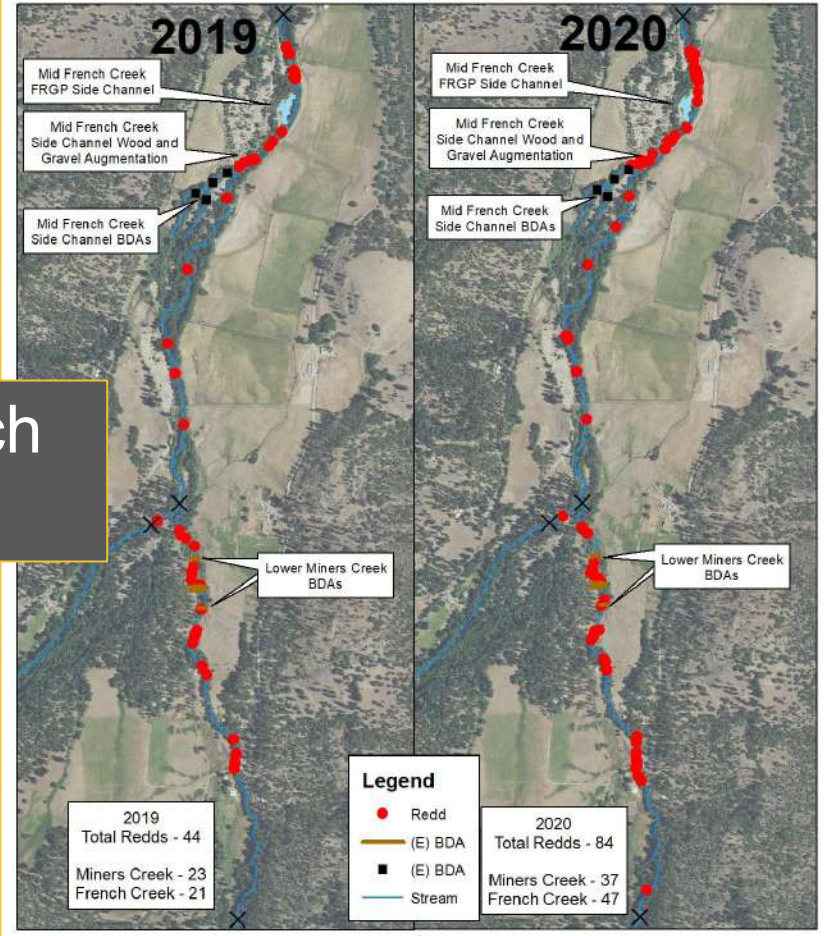


# Mid French Creek - Fish Sampling Locations - 2019



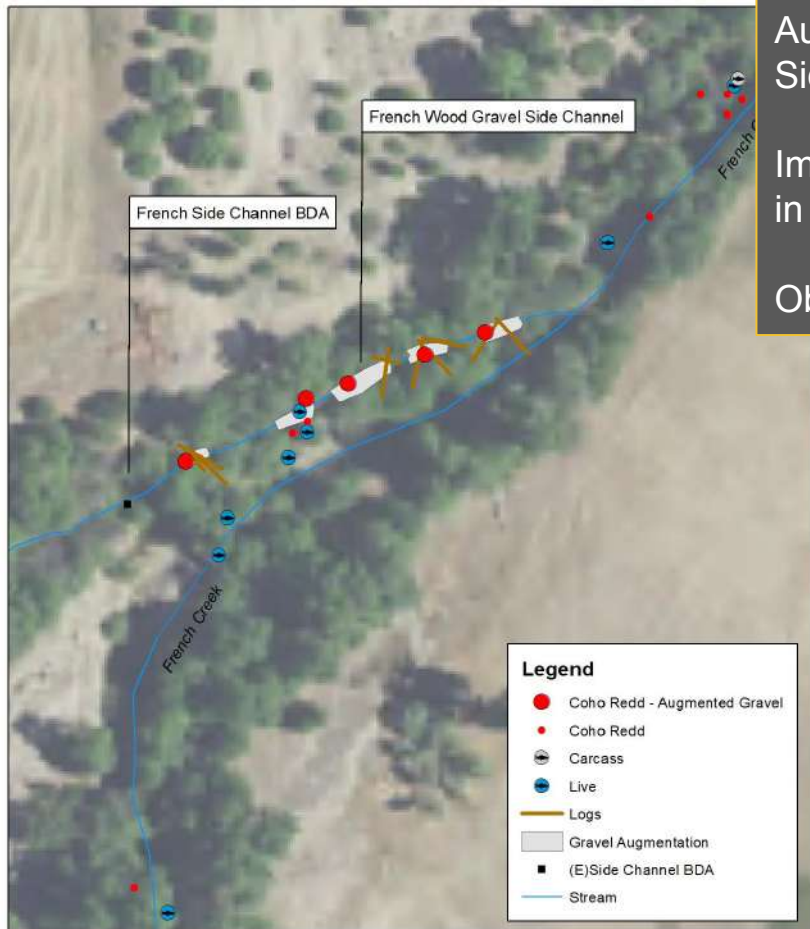
# Mid French Creek

# Lower Miners Creek & Mid French Creek - Coho Spawning Ground Survey Redds - 2019 and 2020





Mid French Creek Wood Gravel Side Channel  
Coho Salmon Redds - December 2020 - January 2021



Augmented spawning gravel in the main stem in 2018 – FRGP Side Channel

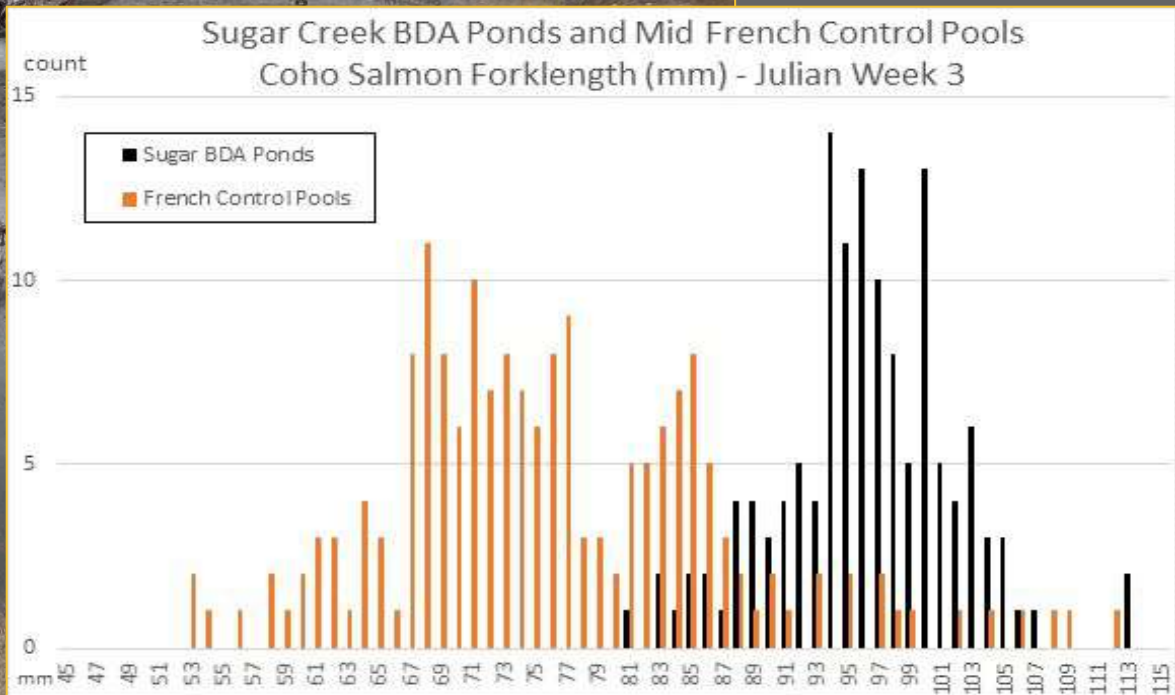
Implemented the Wood and Gravel Augmentation Side Channel in 2019

Observed immediate utilization of introduced gravels



# FRGP Side Channel

Documented significant differences in condition between French and Sugar Fish in 2021 and 2022

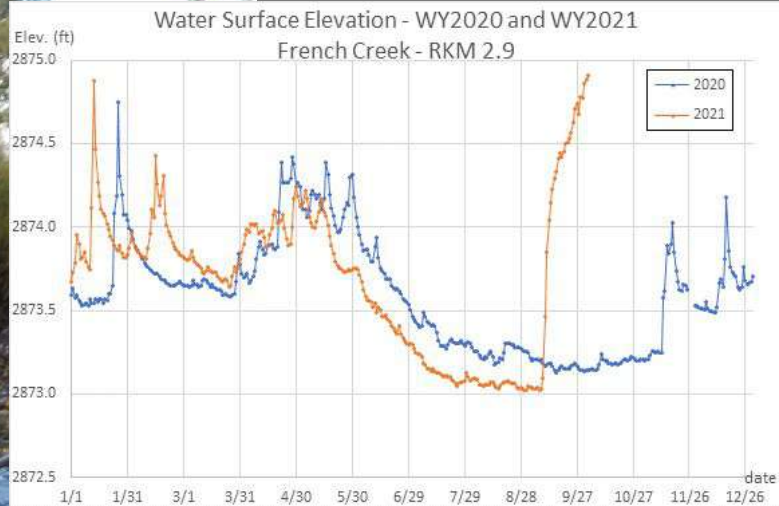




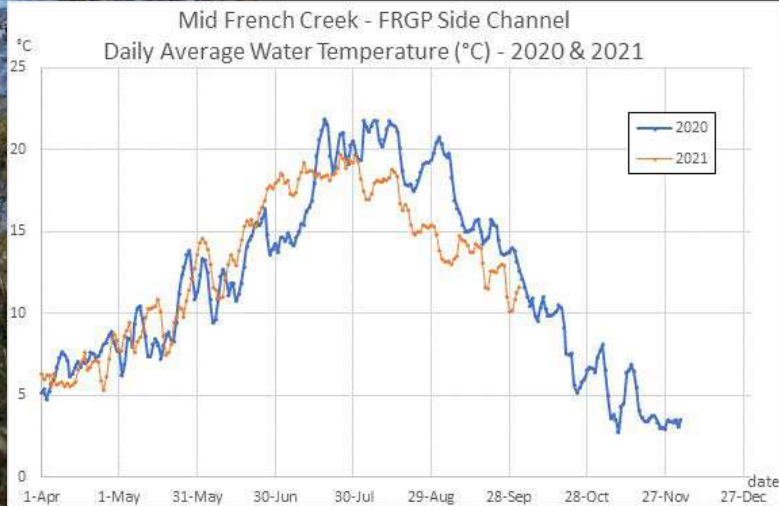
# Meet Frenchie!

Natural Beaver Dam in French

Beaver Dam construction significantly increases Water Surface Elevation



And decreases temperatures in FRGP Side Channel



# Beaver and Coho Salmon Evolved Together







*Questions?*

*Thank you!*

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