ADULT SALMONID MONITORING
IN THE LAGUNITAS CREEK WATERSHED 2023-2024

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In collaboration with the National Park Service, Point Reyes National Seashore and the Salmon Protection and Watershed Network (SPAWN)

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Cover photo: Two female Coho Salmon competing for space (Marin Water)

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EXECUTIVE SUMMARY

Adult salmonid surveys were conducted by staff and volunteers of Marin Water, the Watershed Stewards Program (WSP), National Park Service (NPS), Salmon Protection and Watershed Network (SPAWN), and the California Department of Fish and Wildlife (CDFW). Surveys were conducted on the main stem of Lagunitas Creek and four tributaries: San Geronimo Creek, Devil's Gulch, Cheda Creek, and Olema Creek. These annual surveys are intended to document the spawning run of Coho Salmon (*Oncorhynchus kisutch*), while also collecting data on steelhead (*O. mykiss*), Chinook or "king" Salmon (*O. tshawytscha*), Chum Salmon (*O. keta*), and Pink Salmon (*O. gorbuscha*). The first survey of the season was conducted by Marin Water on November 2, 2023, and surveys ended on March 8, 2024.

This year, 343 Coho Salmon redds and 693 live Coho Salmon were observed in the Lagunitas Creek Watershed. The coho escapement estimate was 686, based on a conservative assumption of two spawners per redd. The redd count was 48% higher than average and nearly doubled from the spawning run three years earlier.

Both the steelhead and Chinook Salmon runs were below average. Surveyors observed 54 steelhead redds and only seven live fish. Based on an assumption of two spawners per redd, the steelhead escapement estimate was 108 adults. There were 11 Chinook Salmon redds and 55 live Chinook observed, with a conservative Chinook Salmon escapement estimate of 22 spawners. Neither Pink Salmon nor Chum Salmon were observed in the watershed.

INTRODUCTION

Salmonids of the Lagunitas Creek Watershed

Two species of salmonids are found in the Lagunitas Creek Watershed year-round: Coho Salmon (*Oncorhynchus kisutch*) and steelhead (*O. mykiss*). Adult Chinook or "king" Salmon (*O. tshawytscha*) are observed in most years, as are a handful of Chum Salmon (*O. keta*). Pink Salmon (*O. gorbuscha*) have been observed occasionally since 2017.

Coho Salmon and steelhead populations in the watershed have fluctuated widely since the first watershed-wide surveys in 1970 and are significantly reduced from historic populations. Human-caused factors for this decline include habitat alterations such as water diversions, road building, timber harvest, urbanization, flood control structures and practices, and climate change (NMFS 2012). This decline resulted in the listing of Coho Salmon in the Central California Coast Evolutionarily Significant Unit (ESU) as endangered under federal and California Endangered Species Acts. Steelhead are listed as federally threatened.

Coho Salmon and steelhead are anadromous fishes, rearing at least partially in freshwater, migrating to the ocean as smolts, spending their adult life in the ocean, and then migrating back

into freshwater streams to spawn. Most Coho Salmon from California streams spend approximately 18 months in freshwater (including incubation) and 18 months in the ocean, returning to spawn in their natal stream in their third year, after which they die (Shapalov and Taft 1954, Moyle 2002). They can be grouped into three-year classes, defined as the current generation of spawners, the parent generation that spawned three years earlier, as well as previous generations. Spawning years with relatively poor reproductive success can result in poor spawning runs three years later. While the majority of coho return as three-year-old fish, some males, called jacks, spend less than a year in the ocean before becoming sexually mature and returning to their natal stream to spawn at two years of age (Sandercock 1991).

Spawning coho begin to arrive near the mouth of Lagunitas Creek in early fall to begin acclimation to freshwater before migrating upstream (Bratovich and Kelley 1988). The spawning period is generally from mid-November to late-January, but adult coho have been observed from late-October to late-February. The life history of steelhead is more flexible than that of Coho Salmon. Steelhead generally spend one to three years in freshwater and one or two years in the ocean before returning to spawn, although the most common life history pattern is to spend two years in fresh water and two years in the ocean (Shapalov and Taft 1954). Unlike coho, steelhead can return to the ocean after spawning and spawn multiple times. This flexibility means that steelhead do not show strong year class patterns in their spawning runs. Steelhead are generally first observed in Lagunitas Creek in late December or early January and continue spawning through April or even into May.

Coho Salmon and steelhead usually spawn at the heads of riffles with gravel substrate (Moyle 2002). Females may excavate small test pits in the gravel substrate before deciding on a site to lay their eggs. Once decided, the female will dig a larger pit (called a “redd”) where she deposits her eggs. Often more than one adult male will fertilize the eggs by releasing milt before the female covers the eggs with additional gravel (Moyle 2002). Following spawning, female coho may guard the redd for up to four weeks before dying, while female steelhead attempt to return to the ocean.

Location and Organizations

Lagunitas Creek originates on the north slope of Mount Tamalpais and flows in a northwesterly direction for 40 km to Tomales Bay (Figure 1). The lower 19 km is accessible to anadromous salmonids. San Geronimo Creek, Devil’s Gulch, Nicasio Creek, and Olema Creek are the major tributaries to Lagunitas Creek. Devil’s Gulch, which flows through National Park and State Park land before entering Lagunitas Creek, is the smallest of these tributaries but provides important spawning and rearing habitat for Coho Salmon and steelhead. Other tributaries to Lagunitas Creek include Cheda Creek, which supports Coho Salmon spawning, and McIsaac Creek, where Coho Salmon have not been seen in many years. The tributaries to San Geronimo Creek that

provide spawning habitat include Arroyo, Evans, Larsen, Montezuma, and Woodacre Creeks. Fifty-two percent of the land within the Lagunitas Creek watershed is publicly owned by Marin Water, the National Park Service, California Department of Parks and Recreation, and Marin County Parks.

Marin Water is a public agency that withdraws water from the Lagunitas Creek basin in order to provide water to residents of central and southern Marin County. Marin Water operates four reservoirs on the mainstem of Lagunitas Creek and a fifth reservoir on Nicasio Creek. Water is released from Kent Lake to ensure year-round minimum stream flows in Lagunitas Creek (Table 1). In addition, Marin Water releases periodic "upstream migration flows," which are intended to facilitate passage of anadromous fish through shallow areas in the creek, and are required on November 15, December 1, January 1, and February 1 in the absence of a natural storm event preceding those dates.

Table 1. Flow requirements on Lagunitas Creek at S.P. Taylor State Park.

Time Period	Normal Year Flow (cfs)	Dry Year Flow (cfs)
November 1/15* - December 31	20	20
January 1 - March 15	25	20
March 16 - March 31	20	20
April 1 - April 30	16	14
May 1 - June 15	12	10
June 16 - November 1/15*	8	6

* The minimum flow of 20 cubic feet per second (cfs) in November is to begin following the first storm that produces a "trigger" flow of 25 cfs at the USGS gage at S.P. Taylor State Park. In the absence of a storm causing a "trigger" flow, the 20-cfs requirement becomes effective on November 15 of each year.

METHODS

Marin Water fisheries staff conduct surveys on Lagunitas Creek, San Geronimo Creek, and Devil's Gulch. Surveys on Olema Creek and Cheda Creek are conducted by NPS. AmeriCorps members serving with The Watershed Stewards Program (WSP) assist NPS and Marin Water staff with their survey work. SPAWN staff and volunteers conduct spawner surveys in five tributaries to San Geronimo Creek, as well as the headwater section of San Geronimo Creek upstream of Woodacre Creek.

Marin Water fisheries staff and WSP members walked sections of creek once per week, streamflow and weather permitting, between November 2, 2023 and March 8, 2024. Lagunitas Creek was divided into three sections for weekly surveys (Figure 1): Tocaloma Bridge to Devil's

Gulch (4.0 km), Devil's Gulch to Shafter Bridge (4.8 km), and Shafter Bridge to Peters Dam (0.8 km). The section of Lagunitas Creek from Tocaloma Bridge downstream to the confluence of Nicasio Creek was surveyed twice. In Devil's Gulch, Marin Water biologists surveyed from the mouth to a bedrock cascade approximately three km upstream, which is impassable to coho. We also surveyed a 400 m fork of Devil's Gulch near the upstream end of our survey reach. San Geronimo Creek was walked in two sections: from its confluence with Lagunitas Creek to Meadow Way Bridge (3.8 km) and from Meadow Way Bridge to the confluence of Woodacre Creek (3.4 km). Each stream section was surveyed from the downstream end to the upstream end, apart from the section of Lagunitas Creek downstream of Tocaloma, which was surveyed in a downstream direction.

Surveyors recorded observations of redds, live adult salmonids, salmonid carcasses, and test (i.e., incomplete) redds. Live fish were recorded as male, female, jack, or unknown. Their behavior, condition (color, wear marks, pronounced kype, etc.), and their location in relation to landmarks such as tributaries or bridges were noted. All observed spawning activity was also recorded. Marin Water surveyors collected otoliths from carcasses for subsequent life history analyses and tissue samples for genetic analyses by UC Berkeley and the National Marine Fisheries Service (NMFS), respectively. We attempted to determine if female salmonids had spawned by inspecting for caudal fin wear. Other information recorded during each survey included survey start and stop times, weather conditions, stream flow, and qualitative observations of water clarity. We intended to collect heads from hatchery origin Chinook salmon, in order to retrieve coded-wire tags, although no carcasses with clipped adipose fins were found.

Redds were classified as having been constructed by one of the salmonid species or recorded as "unknown." Redds were considered to have been conclusively built by one of these species when an identified fish was observed on the redd, or when only one species was present in the creek (e.g., steelhead after January). When fish were not present, redds were classified based on their dimensions, shape, depth, substrate, location, and relative abundance of salmonid species at the time of the survey. When coho were present in the creek, large redds with wide and shallow pits were classified as coho redds. Smaller redds with deep pits and sharp margins were generally classified as steelhead redds after the first live steelhead were observed. Unoccupied redds observed at a time when multiple salmonid species were in the creek and not displaying clearly diagnostic characteristics were classified as "unknown." Redd classification was evaluated at the end of the season by reviewing field notes for unoccupied redds and by comparing redd dimensions of occupied and unoccupied redds.

Marin Water surveyors assigned a unique number to each redd and marked its location in the field by hanging colored tape (pink this year) on adjacent vegetation. Redds were marked this

way so no redd would be double counted during subsequent surveys and so any additional redds near that site could be distinguished. Flagging was labeled with the date, the redd number, redd dimensions, and the position of the redd with respect to the channel (i.e. mid-channel, whole channel, left- or right-bank, etc.). The flag was hung in line with the upstream end of the redd pit, so further enlargement of the redd would be conspicuous during subsequent surveys. If it was determined that a female made a small "test" pit and not a redd, the site was recorded as a "test redd" and flagged with white flagging. We also mapped GPS points for each redd using ArcGIS Field Maps software with a hand held device. We measured the maximum length and width of all redds unless fish were actively constructing the redd or displaying spawning behavior. To avoid disturbing fish we hung white flagging, in addition to the colored flagging, next to occupied redds as a reminder to measure the redd later when no fish were present. We attempted to identify when redds appeared to have been built on or overlapping older redds.

We identified fish that were likely counted multiple times over subsequent surveys, including multiple observations of schools of fish in pools and females holding on redds. At the end of the survey season these subsequent observations were subtracted from the fish totals. To avoid overestimating adult abundance we conservatively estimated escapement by assuming that each redd represented two spawning adults. The marine survival rate for Coho Salmon was calculated as the escapement estimate divided by the previous year's coho smolt emigration estimate (e.g., 2023-24 escapement / 2022 smolt emigration).

RESULTS

A total of 343 Coho Salmon redds and 693 live Coho Salmon were observed during spawner surveys in the Lagunitas Creek Watershed (Table 2). The redd count was 48% higher than the 20-year average and 98% higher than the count three years ago (Figure 2). The estimated minimum escapement was 686, based on the assumption of two spawners per redd. A record 25% of spawning occurred in Olema Creek. The remaining spawning included 35% in mainstem Lagunitas Creek, 33% in the San Geronimo Creek watershed, 6% in Devil's Gulch, and 1% in Cheda Creek.

A total of 54 steelhead redds were observed (Figure 3), corresponding to a minimum escapement estimate of 108 steelhead. Only seven adult steelhead were observed in the watershed (Table 3). Of the steelhead redds observed, 55% were in the San Geronimo Creek watershed, 30% in Devil's Gulch, 11% in Lagunitas Creek, and 4% in Olema Creek.

Surveyors documented 11 Chinook Salmon redds and 55 live Chinook Salmon this season (Table 4). There was no evidence of Pink nor Chum Salmon in the watershed. Marin Water surveyors could not determine the origin of 23 redds (8% of Marin Water redds).

DISCUSSION

The 2023-24 Coho Salmon spawning run was the largest for its year class, twice the size of the run three years earlier, and ranked as the sixth-largest run observed since 1997. While these fish experienced slightly below-average marine survival (3.2% compared with 3.7% since 2007), early life stage survival was average to above average. Egg-to-juvenile survival was estimated at 10% (average is 6%), while juvenile-to-smolt survival was 53% (average is 52%). Egg abundance was estimated using an average of 3,200 eggs per redd (Sandercock 1991). Juvenile abundance was extrapolated from fish densities at index reaches, and smolt abundance was estimated from downstream migrant trapping (Ettlinger et al. 2023).

The Chinook salmon run appeared to be small, with a minimum escapement estimate of 22 Chinook, assuming two spawning adults per redd. We consider the 55 live Chinook observed to be an upper escapement estimate, as some fish were likely counted multiple times.

Survey conditions were favorable for most of the spawning season, with surveys squeezed in between frequent rain events (Figure 4). High stream flows prevented surveys during the third week of December, but redds were still clearly visible once flows receded (Figure 5). Beginning in mid-January, frequent rain and high stream flows halted surveys in Lagunitas Creek and severely limited surveys in tributary streams. Observations of live Coho Salmon and redds were already declining sharply by that point, but late-season Coho Salmon spawning was likely missed in Lagunitas Creek (Figure 6).

Wet weather had a much greater impact on steelhead observations. No live steelhead and only six steelhead redds were observed in Lagunitas Creek before surveys ended in mid-January. Surveys continued in tributary streams, however, where very few live steelhead or redds were observed. The steelhead run appeared to be among the very smallest on record, but not for lack of survey effort.

Redd superimposition can indicate a shortage of adequate spawning habitat. Superimposition can kill eggs deposited in the first redd through physical shock, exposure, displacement into less favorable incubation conditions, or predation (Burgner 1991). We observed 23 Coho Salmon redds that were superimposed by later redds (11% of redds observed by Marin Water surveyors). Steelhead superimposed ten coho redds, while ten redds were superimposed by later coho. Three superimposing redds couldn't be classified. High stream flows likely had a greater impact on incubating salmon eggs. Lagunitas Creek flows peaked at 3,160 cubic feet per second on January 25th, which is high enough to mobilize the streambed and potentially dislodge eggs.

Of the 294 redds observed during Marin Water surveys, 156 (53%) were never associated with a live fish. Of these, 12 were observed when steelhead were the only salmonid still spawning,

so were classified as steelhead. All other unoccupied redds were classified by their dimensions, appearance, and the proportions of salmonid species seen that week. Most redds were classified as Coho Salmon based on the abundance of coho that week and their sprawling, sandy pits. Steelhead redds tend to be smaller and/or narrower than the redds of other species, and 36 redds were classified as being built by steelhead based on their size. Evidence was mixed for the remaining 23 unoccupied redds and these remained unclassified.

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Table 2. Observations of Coho Salmon in the Lagunitas Creek Watershed, Spawning Season 2023-24

SURVEY DATE	COHO SALMON IN LAGUNITAS CREEK															TOTAL		
	Pt. Reyes-Nicasio			Nicasio-Tocaloma			Tocaloma-Devil's Gulch			Devil's Gulch-Shafter Bridge			Shafter Bridge-Peters Dam					
	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds
2-Nov-23	-	-	-	-	-	-	0	0	0	-	-	-	-	-	-	0	0	0
15-Nov-23	-	-	-	-	-	-	0	0	0	-	-	-	-	-	-	0	0	0
21-Nov-23	-	-	-	-	-	-	22	0	2	-	-	-	-	-	-	22	0	2
22-Nov-23	-	-	-	-	-	-	-	-	-	7	0	5	-	-	-	7	0	5
28-Nov-23	-	-	-	-	-	-	-	-	-	2	0	4	-	-	-	2	0	4
30-Nov-23	-	-	-	-	-	-	19	0	5	-	-	-	-	-	-	19	0	5
5-Dec-23	-	-	-	-	-	-	-	-	-	22	0	8	0	0	0	22	0	8
6-Dec-23	-	-	-	-	-	-	25	0	3	-	-	-	-	-	-	25	0	3
13-Dec-23	-	-	-	-	-	-	-	-	-	46	1	28	-	-	-	46	1	28
14-Dec-23	-	-	-	1	1	7	16	0	11	-	-	-	6	0	7	23	1	25
26-Dec-23	-	-	-	-	-	-	-	-	-	18	4	4	-	-	-	18	4	4
5-Jan-24	-	-	-	-	-	-	12	0	6	24	8	19	-	-	-	36	8	25
9-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	1	0	7	1	0	7
10-Jan-24	-	-	-	2	0	3	-	-	-	-	-	-	-	-	-	2	0	3
11-Jan-24	-	-	-	-	-	-	8	1	1	-	-	-	-	-	-	8	1	1
Subtotal	**0**	**0**	**0**	**3**	**1**	**10**	**102**	**1**	**28**	**119**	**13**	**68**	**7**	**0**	**14**	**231**	**15**	**120**
Corrected*	**0**			**3**			**97**			**112**			**7**			**219**		

SURVEY DATE	COHO SALMON IN SAN GERONIMO CREEK									COHO SALMON IN DEVIL'S GULCH			COHO SALMON IN OLEMA CREEK[2]			TOTAL		
	Mouth-Meadow Way			Meadow Way-Woodacre Cr.			Tributaries[1]											
	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds	Live Coho	Carcasses	Redds
28-Nov-23	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
3-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	1	0	0	1	0	0
10-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
13-Dec-23	3	0	1	-	-	-	-	-	-	-	-	-	-	-	-	3	0	1
17-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	151	0	36	151	0	36
19-Dec-23	-	-	-	-	-	-	-	-	-	16	0	0	-	-	-	16	0	0
26-Dec-23	96	2	33	-	-	-	-	-	-	-	-	-	-	-	-	96	2	33
27-Dec-23	-	-	-	3	3	1	-	-	-	-	-	-	-	-	-	3	3	1
28-Dec-23	-	-	-	-	-	-	25	0	10	4	5	4	-	-	-	29	5	14
30-Dec-23	-	-	-	-	-	-	2	0	1	-	-	-	-	-	-	2	0	1
31-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	17	0	5	17	0	5
2-Jan-24	-	-	-	40	8	23	-	-	-	-	-	-	-	-	-	40	8	23
4-Jan-24	-	-	-	-	-	-	-	-	-	3	0	13	-	-	-	3	0	13
7-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	43	20	43	43	20	43
8-Jan-24	-	-	-	21	10	7	-	-	-	-	-	-	-	-	-	21	10	7
9-Jan-24	-	-	-	-	-	-	16	0	19	-	-	-	-	-	-	16	0	19
12-Jan-24	19	19	4	-	-	-	0	0	10	-	-	-	-	-	-	19	19	14
14-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	4	0	2	4	0	2
18-Jan-24	-	-	-	7	5	1	-	-	-	0	0	1	-	-	-	7	5	2
28-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	1	3	1	1	3	1
29-Jan-24	-	-	-	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
30-Jan-24	2	1	1	-	-	-	-	-	-	0	0	1	-	-	-	2	1	2
12-Feb-24	-	-	-	-	-	-	-	-	-	0	0	0	-	-	-	0	0	0
13-Feb-24	0	0	1	0	0	0	-	-	-	-	-	-	-	-	-	0	0	1
25-Feb-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
26-Feb-24	-	-	-	-	-	-	-	-	-	0	0	0	-	-	-	0	0	0
27-Feb-24	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
28-Feb-24	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	0	0	0
7-Mar-24	0	0	0	-	-	-	-	-	-	0	0	0	-	-	-	0	0	0
8-Mar-24	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	0	0	0
17-Mar-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
Subtotal	**120**	**22**	**40**	**73**	**27**	**33**	**43**	**0**	**40**	**23**	**5**	**19**	**217**	**23**	**87**	**476**	**77**	**219**
Corrected*	**120**			**68**			**43**			**23**			**217**			**471**		

Notes:

(-) Indicates that the spawner survey did not cover the area on that date.

* Corrected coho observations compensate for coho that were presumably double counted.

[1] Data provided by the Salmon Protection and Watershed Network (SPAWN).

[2] Data provided by the National Park Service.

COHO SALMON IN OTHER TRIBUTARIES			
CHEDA CREEK[2]	3	0	4
COHO TOTAL	**693**	**92**	**343**

Table 3. Observations of Steelhead in the Lagunitas Creek Watershed, Spawning Season 2023-24

SURVEY DATE	STEELHEAD IN LAGUNITAS CREEK															TOTAL		
	Pt.Reyes-Nicasio			Nicasio-Tocaloma			Tocaloma-Devil's Gulch			Devil's Gulch-Shafter Bridge			Shafter Bridge-Peters Dam					
	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds
5-Jan-24	-	-	-	-	-	-	0	0	2	0	0	1	-	-	-	0	0	3
9-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	2	0	0	2
11-Jan-24	-	-	-	-	-	-	0	0	1	-	-	-	-	-	-	0	0	1
SUBTOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**6**
Corrected*	**0**			**0**			**0**			**0**			**0**			**0**		

SURVEY DATE	STEELHEAD IN SAN GERONIMO CREEK									STEELHEAD IN DEVIL'S GULCH			STEELHEAD IN OLEMA CREEK[2]			TOTAL		
	Mouth-Meadow Way			Meadow Way-Woodacre Cr.			Tributaries[1]											
	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds	Steelhead	Carcasses	Redds
3-Dec-23	-	-	-	-	-	-	-	-	-	0	0	1	0	0	0	0	0	1
10-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
17-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
24-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
28-Dec-23	-	-	-	-	-	-	-	-	-	0	0	1	-	-	-	0	0	1
31-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
2-Jan-24	-	-	-	0	0	2	-	-	-	-	-	-	-	-	-	0	0	2
4-Jan-24	-	-	-	-	-	-	-	-	-	0	0	3	-	-	-	0	0	3
7-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
8-Jan-24	-	-	-	1	0	1	-	-	-	-	-	-	-	-	-	1	0	1
12-Jan-24	0	0	6	-	-	-	0	0	2	-	-	-	-	-	-	0	0	8
14-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	1	0	0	1
18-Jan-24	-	-	-	0	0	4	-	-	-	0	0	5	-	-	-	0	0	9
28-Jan-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	1	0	0	1
29-Jan-24	-	-	-	0	0	4	-	-	-	-	-	-	-	-	-	0	0	4
30-Jan-24	1	0	4	-	-	-	-	-	-	3	0	2	-	-	-	4	0	6
12-Feb-24	-	-	-	-	-	-	-	-	-	0	0	0	-	-	-	0	0	0
13-Feb-24	0	0	1	0	0	3	0	0	1	-	-	-	-	-	-	0	0	5
25-Feb-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
26-Feb-24	-	-	-	-	-	-	-	-	-	0	0	4	-	-	-	0	0	4
27-Feb-24	2	0	1	-	-	-	-	-	-	-	-	-	-	-	-	2	0	1
28-Feb-24	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	0	0	0
7-Mar-24	-	-	-	-	-	-	-	-	-	0	0	0	-	-	-	0	0	0
8-Mar-24	-	-	-	0	0	1	-	-	-	-	-	-	-	-	-	0	0	1
17-Mar-24	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
SUBTOTAL	**3**	**0**	**12**	**1**	**0**	**15**	**0**	**0**	**3**	**3**	**0**	**16**	**0**	**0**	**2**	**7**	**0**	**48**
Corrected*	**3**			**1**			**0**			**3**			**0**			**7**		

Notes:

(-) Indicates that the spawning survey did not cover the area on that date.

* Corrected observations compensate for fish that were presumably double counted.

[1] Data provided by the Salmon Protection and Watershed Network (SPAWN).

[2] Data provided by the National Park Service.

STEELHEAD IN OTHER TRIBUTARIES			
CHEDA CREEK	0	0	0
STEELHEAD TOTAL	**7**	**0**	**54**

Table 4. Observations of Chinook Salmon in the Lagunitas Creek Watershed, Spawning Season 2023-24

SURVEY DATE	CHINOOK IN LAGUNITAS CREEK															TOTAL		
	Pt Reyes - Nicasio			Nicasio-Tocaloma			Tocaloma-Devil's Gulch			Devil's Gulch-Shafter Bridge			Shafter Bridge-Peters Dam					
	Chinook	Carcasses	Redds	Chinook	Carcasses	Redds	Chinook	Carcasses	Redds	Chinook	Carcasses	Redds	Chinook	Carcasses	Redds	Chinook	Carcasses	Redds
21-Nov-23	-	-	-	-	-	-	2	0	0	-	-	-	-	-	-	2	0	0
22-Nov-23	-	-	-	-	-	-	-	-	-	4	1	3	4	0	1	8	1	4
28-Nov-23	-	-	-	-	-	-	-	-	-	4	0	2	4	0	0	8	0	2
30-Nov-23	-	-	-	-	-	-	1	0	2	-	-	-	-	-	-	1	0	2
5-Dec-23	-	-	-	-	-	-	-	-	-	17	1	2	0	0	0	17	1	2
6-Dec-23	-	-	-	-	-	-	1	1	0	-	-	-	-	-	-	1	1	0
13-Dec-23	-	-	-	-	-	-	-	-	-	14	1	0	-	-	-	14	1	0
14-Dec-23	-	-	-	-	-	-	-	-	-	-	-	-	3	0	1	3	0	1
26-Dec-23	-	-	-	-	-	-	-	-	-	0	1	0	0	0	0	0	1	0
5-Jan-24	-	-	-	-	-	-	-	-	-	1	1	0	-	-	-	1	1	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**1**	**2**	**40**	**5**	**7**	**11**	**0**	**2**	**55**	**6**	**11**
Corrected*	**0**			**0**			**4**			**40**			**11**			**55**		

CHINOOK TOTAL			
	55	**6**	**11**

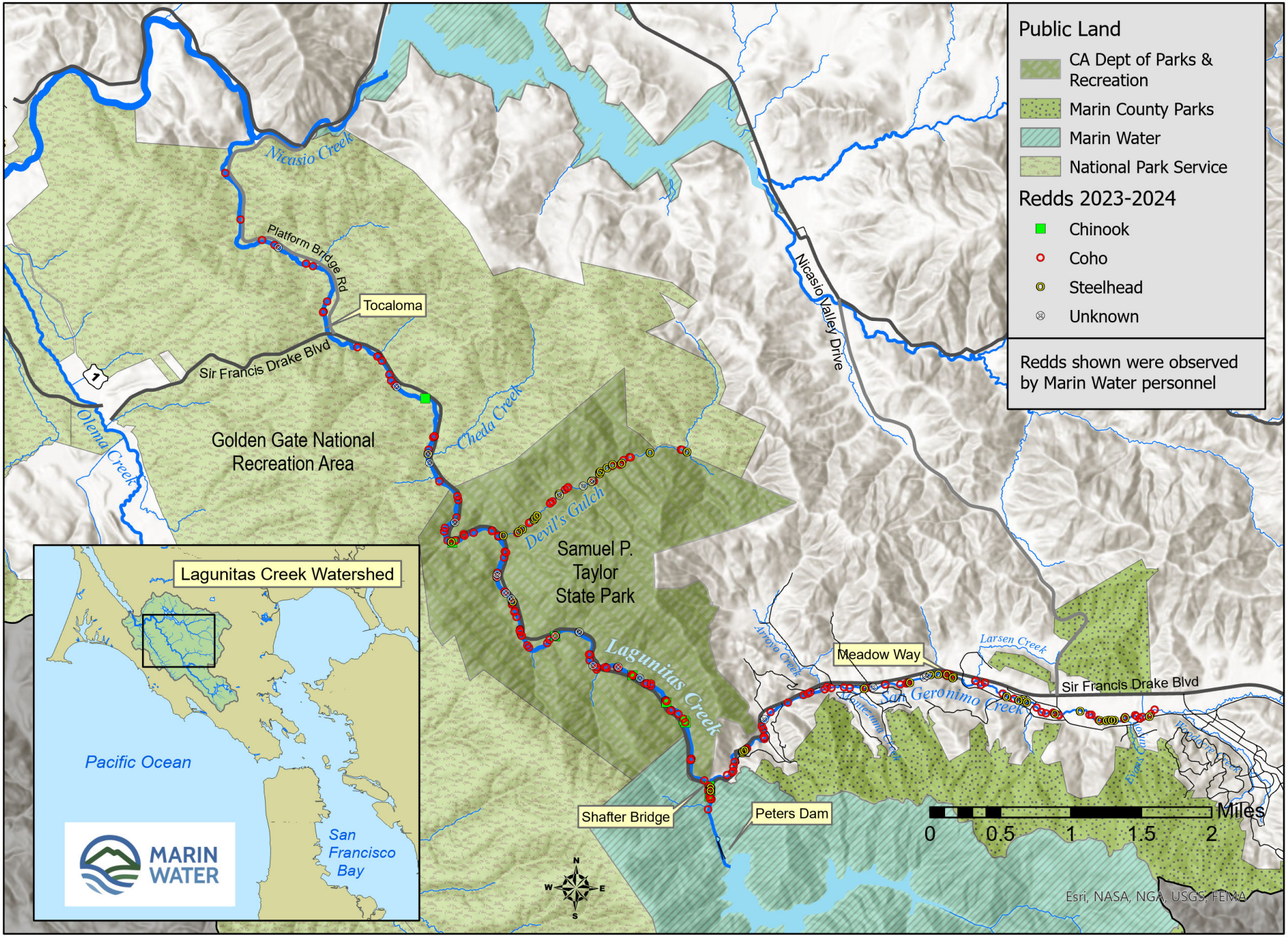
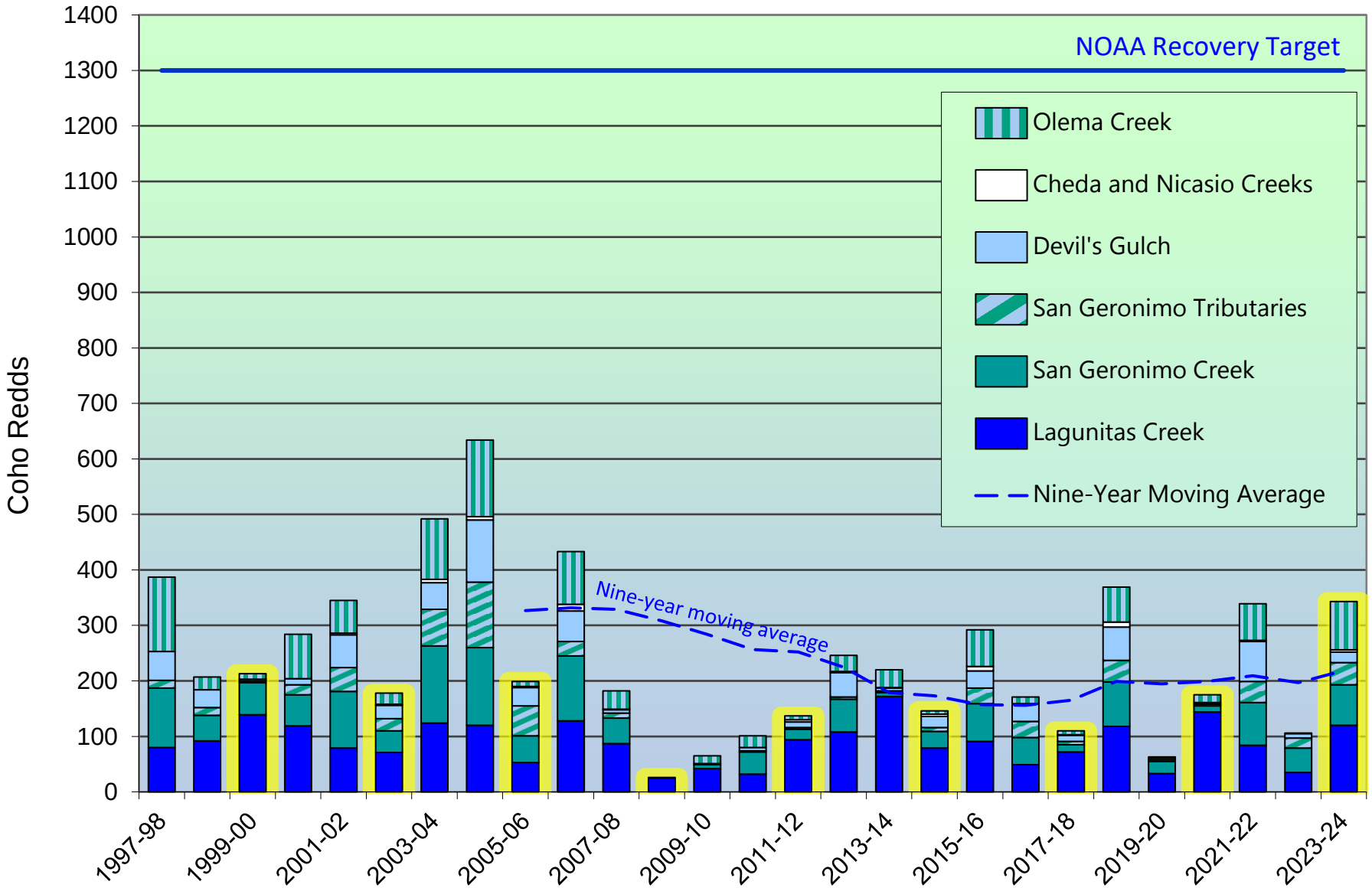


Figure 1. Salmonid redds in the Lagunitas Creek Watershed, 2023-24



Note: The NOAA recovery target is 2,600 adults or 1,300 redds assuming two fish per redd.

Figure 2. Coho Salmon Redds in the Lagunitas Creek Watershed (the current year class is highlighted).

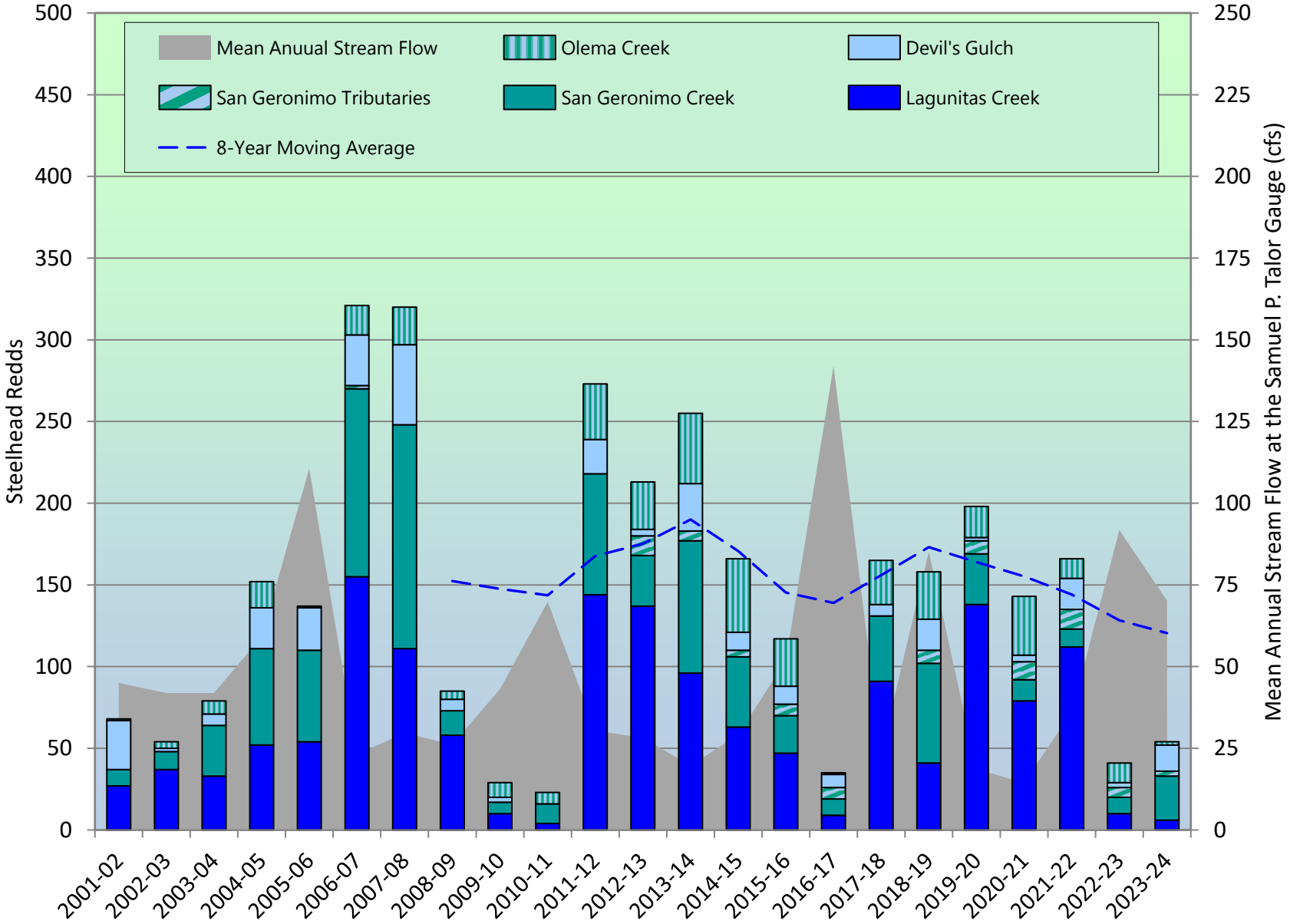


Figure 3. Steelhead Redds in the Lagunitas Creek Watershed.

Note: Wet years typically result in fewer surveys.

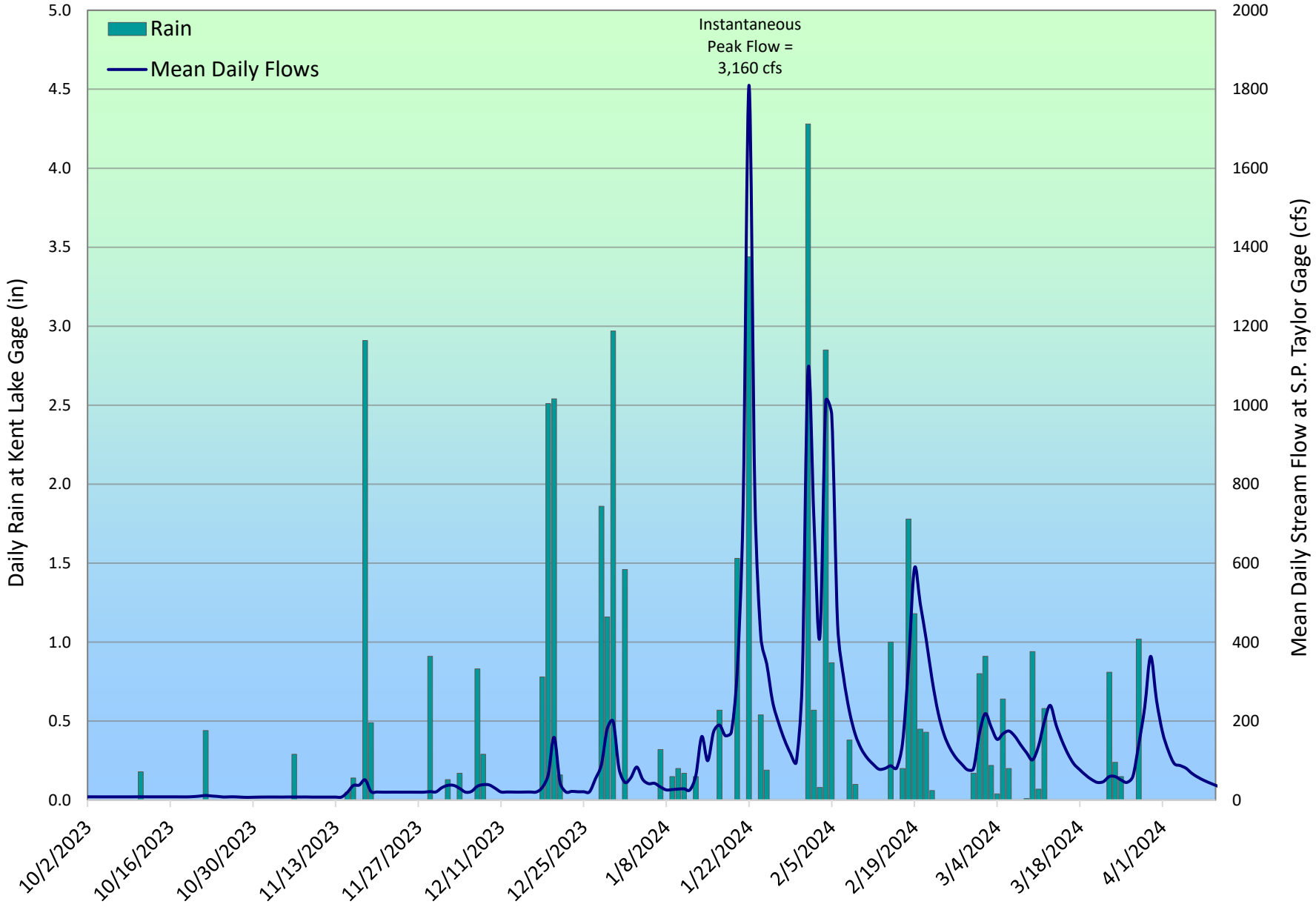


Figure 4. Rain and Lagunitas Creek Stream Flow 2023-24

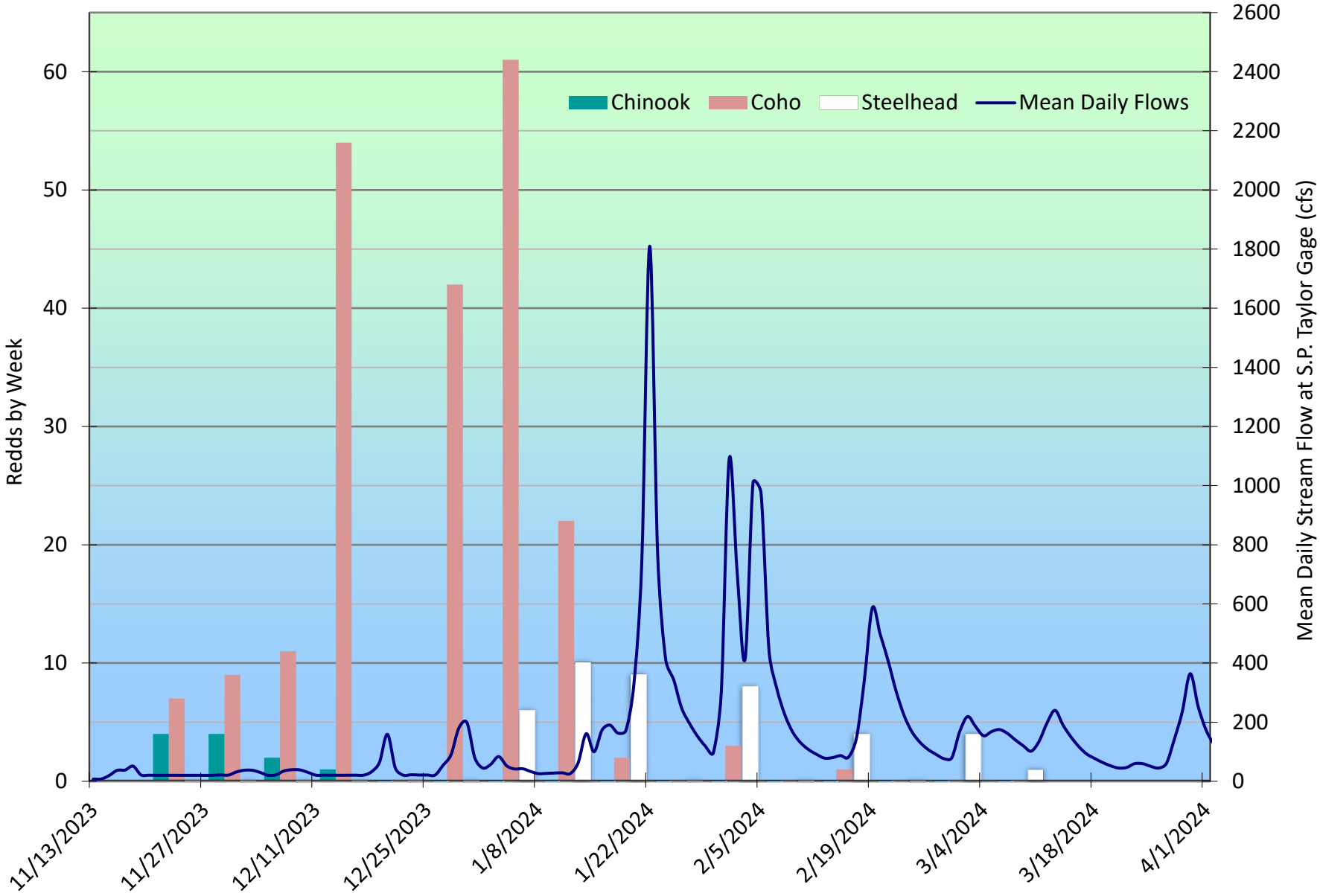


Figure 5. Salmonid Redds and Lagunitas Creek Stream Flows 2023-24