

Mattole River Juvenile Coho Salmon Summer Spatial Structure Monitoring 2017



Coho salmon in Baker Creek, Mattole River watershed, June 2017. Photo by Kris Schultz.

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Abstract

To assess coho salmon (*Onchorynchus kisutch*) population spatial structure in the Mattole River watershed, we used multi-pass snorkel surveys to gather information on the presence of coho and other aquatic vertebrates, and a suite of habitat parameters, during the summer baseflow period in 2017. Possible survey reaches were pre-defined to include all likely coho rearing habitat in the watershed, based on GIS-calculated reach gradient, valley width, and mean annual discharge. We surveyed a total of 53 reaches. In 2017 coho were detected in 7 of 53 reaches. Multi-scale occupancy models were used to calculate the proportion of area occupied (PAO) and the probability of species occurrence at both the reach and sample unit scale. Coho PAO in 2017 was 0.03, considerably less than the PAO from 2013-2016, which ranged from 0.08-0.13. Unit-level occupancy (within occupied reaches) was 0.18, while reach-level occupancy was 0.17. Chinook Salmon PAO was 0.07. Juvenile *O. mykiss* were widely distributed, present in 53 of 53 reaches and nearly every sample unit.

Coho abundance and distribution was markedly reduced in 2017 compared to previous years, with no more than 10 individuals observed in any of the 1,036 pools surveyed. Juvenile distribution suggested that successful spawning in the winter of 2016/17 was limited to a short stretch of the mainstem Mattole River upstream of the town of Whitethorn, and the very low numbers of parr may have been the product of only a single successful redd. The lack of juveniles encountered, despite the most spatially extensive survey effort to date, raises serious concerns about the future persistence of coho salmon in the Mattole River watershed.

Introduction

Spatial structure, along with abundance, diversity, and productivity, is one of the key population characteristics that need to be assessed in order to evaluate trends in salmon population viability (Adams et al. 2011, McElhany et al. 2000). To assess coho salmon (*Oncorhynchus kisutch*) population spatial structure in the Mattole River watershed, we used multi-pass snorkel surveys to gather information on the presence of coho and other aquatic vertebrates, and a suite of habitat parameters, during the summer baseflow period in 2017. Surveys were also conducted annually from 2013 to 2016 using the same protocol.

Study Area

The project took place in the 304 mi² Mattole River watershed, in coastal Humboldt and Mendocino counties.

Objectives

The primary project objective was to complete surveys and data analysis to estimate the occupancy of juvenile coho at both reach and population scales, and determine distribution (spatial structure) of juvenile coho salmon in Mattole River watershed. Additional objectives were to assess trends in coho salmon spatial structure, and provide information for restoration and species management.

Methods

Field methods followed Garwood and Ricker (2016), and those described in detail in that document are reviewed only briefly here. Prior to the survey season, surveyors attended the protocol training conducted by CDFW in early June. Following this training, multiple days of additional training were conducted surveying a reach not among the GRTS-drawn reaches, focused particularly on species identification.

Reach Selection

Survey reaches were all potential coho salmon spawning reaches in the sample frame that was developed for Mattole River adult salmonid spawner surveys by CDFW with input from the MSG (Garwood and Ricker 2008) (Figure 1). Reaches attributed as potential coho habitat in this sample frame have a maximum stream gradient of five percent or less, and a minimum estimated mean annual discharge of greater than 0.05 cubic meters per second. A handful of reaches that fall outside of these parameters were included based on past documentation of coho presence (Garwood and Ricker 2008).

Reaches were surveyed in order from a spatially-balanced random draw made using the generalized random tessellation stratified (GRTS) algorithm. We did not use a rotational visitation scheme with a fixed panel as recommended in the Coastal Monitoring Plan

(Adams et al. 2011), due to the lack of multi-year funding for this survey effort. A fixed panel survey scheme could be instituted at a future time.

Landowners were contacted for access permission by both mail and phone (when phone numbers were obtainable). Any segment of a reach where access permission was obtained was surveyed, unless the segment required additional travel time of greater than one hour to access (was not adjacent to another surveyed reach) and was so short that it may not have contained any qualifying units.

Field work and data handling

Sample pools within a reach were required to meet specific depth, width, area, and temperature criteria, in addition to descriptive morphologic criteria, as described in Garwood and Ricker (2016). Every other qualifying unit was sampled, with divers identifying and tallying all fish species present, as well as other relevant aquatic or amphibious species. In every fourth sampled pool, an independent double-pass was completed to enable the calculation of detection probability.

In “large river” reaches, defined as mean annual discharge of $>10 \text{ m}^3 \text{ s}^{-1}$ (which in the Mattole sample frame is mainstem river reaches with reach ID #'s 273-299), qualifying units were defined by the presence of cover in addition to the above criteria, and every pool meeting the criteria was sampled, due to the infrequent occurrence of qualifying units.

The following physical parameters were recorded for each sampled unit: pool type, length, average width, maximum depth, cover rating, instream shelter, and woody debris. In reaches where coho were observed, surveyors were instructed to obtain photographic documentation of coho presence.

Data from paper field data sheets was entered into the *Microsoft Access* database provided by CDFW. QA/QC checks were completed based on procedures provided by CDFW staff.

Data analysis – occupancy and spatial structure

Population spatial structure was assessed by using detection probabilities from the independent double-pass dives to calculate the probability of species occupancy at the sample unit and sample reach scale. The single-season multi-method approach in program PRESENCE (USGS 2017) was used to calculate estimates of occupancy (ψ), estimates of conditional occupancy (θ), and detection probability (p) for each species and age class category. P was assumed to remain constant in pools between the two snorkel passes. The proportion of area occupied (PAO) was calculated by multiplying the estimate of occupancy (ψ) and the estimates of conditional occupancy (θ) (Garwood and Larson 2014).

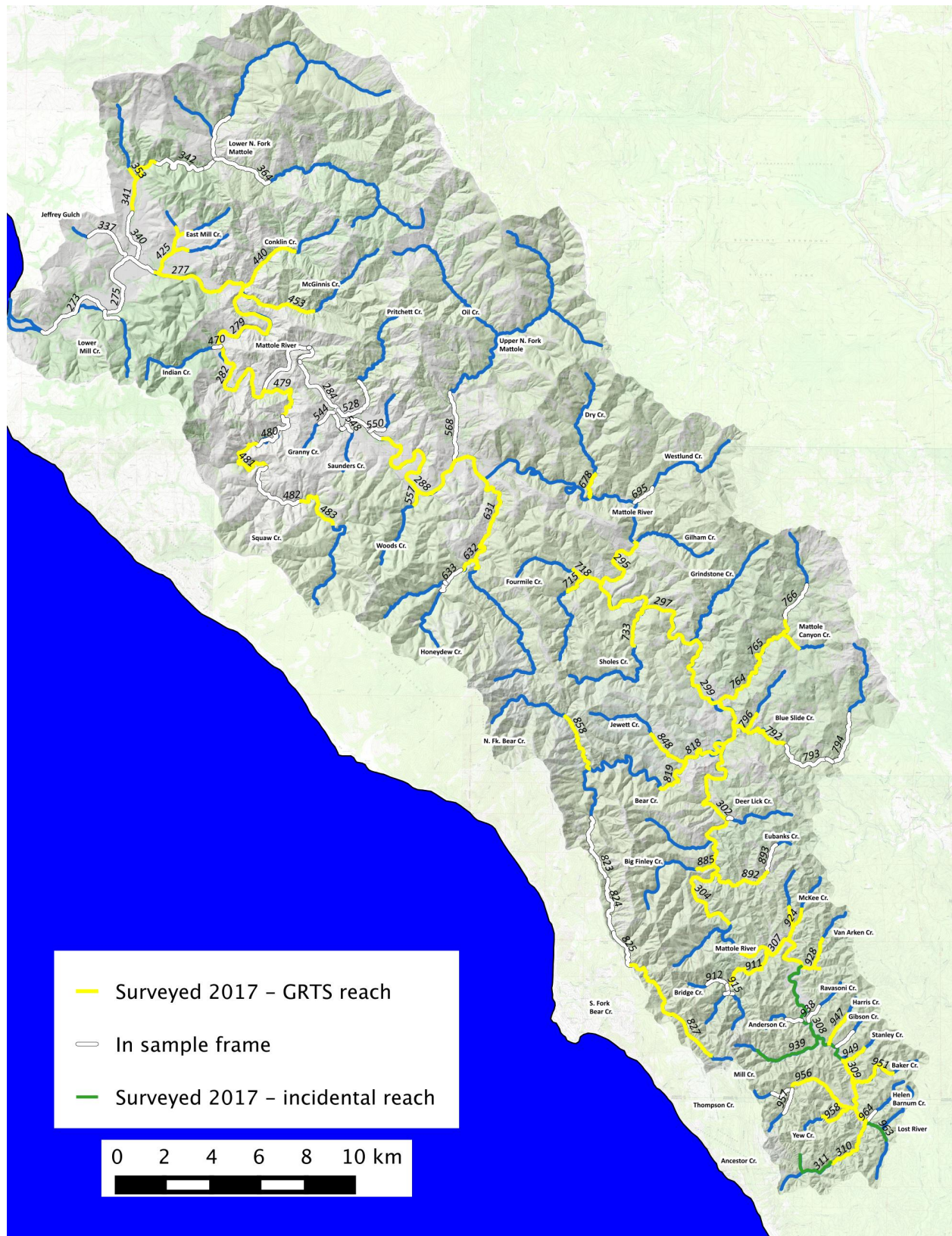


Figure 1. 2017 Mattole Coho summer spatial structure sample frame with reach ID #'s.

Estimate of coho abundance

The use of data collected under this protocol to make watershed-level juvenile coho abundance estimates incorporating detection probabilities and within- and between-reach variance has not yet been completed, but is under development (J. Garwood, pers com. January 2017).

With the highly skewed dataset and a majority of reaches with no coho presence, accounting for between-reach variance and developing a confidence interval would require the use of a bootstrapping technique, which is beyond the scope of this report. To develop an idea of how many juvenile coho were in the watershed in 2017, we calculated a simple watershed-wide “abundance” estimate that does not incorporate detection probability nor provide a confidence interval.

$$\text{Estimated abundance} = \frac{\text{Sum of coho observed (single dive pass)}}{\text{Percentage of total frame length surveyed}} * 2 * \frac{100}{100}$$

The total number of coho observed was multiplied by two since only every other qualifying unit was sampled.

This number should not be construed as a population estimate, but does allow for a relative comparison of year-to-year abundance, and provides context for interpreting spatial structure and distribution results.

Results

Reaches surveyed

One-hundred-one landowners were contacted for stream access permission. Sixty gave permission, while 39 did not respond, or we were unable to find a valid address or phone number to reach them. Two landowners replied and denied access permission.

Out of a total of 97 reaches in the Mattole coho summer spatial structure sample frame, 53 reaches were surveyed in GRTS draw order, 55% of all possible reaches (Table 1). An additional five reaches were surveyed incidentally as training reaches, and with additional funding. Of these 53 reaches, 42 were main reaches and 11 sub-reaches (surveyed by implication with the main reach).

Table 1. Summary of number of GRTS-draw selected reaches and units surveyed by year 2013 -2017.

Year	# of reaches surveyed	Length surveyed (km)	# of units surveyed	% of reaches in frame surveyed	% of frame surveyed by length
2013	27	83.8	588	29%	33%
2014	37	98.7	716	39%	39%
2015	52	141.2	915	51%	51%
2016	47	109.7	868	47%	43%
2017	53	154.8	894	55%	60%

Coho salmon occupancy

In 2017, coho were present in a lower proportion of reaches surveyed, and in fewer pools within those reaches than in the previous four years. Coho were observed in 7 of 53, or 13%, of the GRTS reaches surveyed. The calculated percent area occupied (PAO), the product of reach and pool-level occupancy probabilities, was 0.03, considerably lower than in the previous four years (Table 2). The probability of reach-level occupancy, Ψ (psi), was 0.17. The probability of coho detection in a given pool in a reach where coho were present, Θ (theta), was 0.18, also lower than the previous four years as well (Table 2). Detection probability, p , was 0.89 in 2017, comparable with other years..

Chinook occupancy

Young-of-the-year Chinook were detected in ten stream reaches in 2016, with a PAO of 0.07 (Table 2). Most detections were of a single fish in a pool, with a median count of one. Chinook observations were of two types. Chinook were observed in reaches surveyed in June (early in the survey season) in McGinnis Creek, the Lower North Fork of the Mattole River, and Mattole River 309 upstream of Whitethorn. (Figure 3). These were likely primarily fish that were preparing to migrate downstream, and would not have been present in those reaches if they had been surveyed later in the summer. The remaining seven reaches where Chinook were seen were larger river reaches (reach #'s 277, 282, 288, 287, 299, 302, and 304), where Chinook were observed in isolated pools off the main channel. In many cases these units had apparently been disconnected from the main channel for months. These fish likely sought out these areas at the channel margins in spring high flows in March-May.

Steelhead occupancy

Young-of-the-year (YOY) *O. mykiss* (either rainbow trout or steelhead) were widespread throughout the sample frame, present in 53 out of 53 reaches surveyed (Table 2, Figure 4), with a PAO of 0.95. Mean and median counts per pool were 21.3 and 13, respectively. *O.*

mykiss judged to be from older age classes, lumped together as 1+ fish, were slightly less widespread and abundant, but still present in 47 out of 53 reaches, with a PAO of 0.71. These results are similar to the last four years, with juvenile steelhead present in nearly every Mattole stream reach that spawning adults can access, and that contains at least some water throughout the summer.

Table 2. Summer juvenile occupancy estimates by salmonid species, Mattole River basin, 2013-2017.

Species and Year	Psi	SE	95% CI	Theta	SE	95% CI	<i>p</i>	SE	95% CI	PAO	# of Reaches present	Mean pool count	Median pool count
Coho salmon 2013	0.31	0.10	0.15 - 0.52	0.43	0.03	0.36 - 0.50	0.86	0.03	0.80 - 0.91	0.13	7 of 24	5.7	4
Coho salmon 2014	0.35	0.08	0.21 - 0.53	0.37	0.05	0.28 - 0.46	0.68	0.07	0.53 - 0.80	0.13	12 of 37	10.3	4
Coho salmon 2015	0.14	0.05	0.07 - 0.27	0.57	0.04	0.50 - 0.60	0.98	0.02	0.90 - 1.00	0.08	7 of 51	13.3	6
Coho salmon 2016	0.25	0.06	0.14 - 0.39	0.45	0.03	0.39 - 0.52	0.83	0.04	0.73 - 0.90	0.11	11 of 46	5.8	3
Coho salmon 2017	0.17	0.06	0.08 - 0.32	0.18	0.03	0.13 - 0.24	0.89	0.06	0.70 - 0.97	0.03	7 of 53	2.1	1
Chinook Salmon 2013	0.47	0.11	0.27 - 0.68	0.22	0.03	0.17 - 0.28	0.71	0.06	0.58 - 0.81	0.10	10 of 25	3.4	1
Chinook Salmon 2014	0.15	0.06	0.06 - 0.30	0.29	0.08	0.15 - 0.47	0.79	0.11	0.50 - 0.94	0.04	5 of 37	2.1	2
Chinook Salmon 2015	0.39	0.08	0.25 - 0.55	0.22	0.03	0.16 - 0.29	0.69	0.08	0.52 - 0.81	0.09	16 of 51	4.8	1
Chinook Salmon 2016	0.22	0.07	0.11 - 0.38	0.19	0.05	0.11 - 0.32	0.60	0.13	0.34 - 0.82	0.04	8 of 46	3.0	1
Chinook Salmon 2017	0.24	0.07	0.13 - 0.39	0.27	0.07	0.15 - 0.43	0.52	0.12	0.30 - 0.73	0.07	10 of 53	2.6	1

Species and Year	Psi	SE	95% CI	Theta	SE	95% CI	p	SE	95% CI	PAO	# of Reaches present	Mean pool count	Median pool count
YOY <i>O. mykiss</i> 2013	1.00	-	-	0.95	0.01	0.93 - 0.97	0.98	<0.01	0.97 - 0.99	0.95	25 of 25	27.2	15
YOY <i>O. mykiss</i> 2014	1.00	-	-	0.82	0.02	0.78 - 0.85	0.97	<0.01	0.95 - 0.98	0.82	37 of 37	44.8	23
YOY <i>O. mykiss</i> 2015	1.00	-	-	0.89	0.01	0.87 - 0.91	0.96	<0.01	0.94 - 0.97	0.89	50 of 51	34.6	12
YOY <i>O. mykiss</i> 2016	0.98	0.02	0.86 - 1.00	0.96	<0.01	0.94 - 0.97	0.97	<0.01	0.96 - 0.98	0.94	45 of 46	22.5	13
YOY <i>O. mykiss</i> 2017	1.00	-	-	0.95	<0.01	0.93 - 0.96	1.00	-	-	0.95	53 of 53	21.3	13
1+ <i>O. mykiss</i> 2013	1.00	-	-	0.94	0.01	0.91-0.95	0.93	0.01	0.91 - 0.95	0.93	25 of 25	10.7	6
1+ <i>O. mykiss</i> 2014	0.92	0.04	0.78 - 0.98	0.76	0.03	0.70 - 0.81	0.79	0.03	0.73 - 0.84	0.73	34 of 37	4.8	3
1+ <i>O. mykiss</i> 2015	0.95	0.03	0.83 - 0.98	0.75	0.02	0.66 - 0.75	0.82	0.02	0.77 - 0.86	0.67	47 of 51	5.4	3
1+ <i>O. mykiss</i> 2016	0.96	0.03	0.84 - 0.99	0.72	0.03	0.66 - 0.76	0.78	0.03	0.73 - 0.82	0.68	45 of 46	3.2	2
1+ <i>O. mykiss</i> 2017	0.93	0.04	0.79 - 0.98	0.76	0.02	0.71 - 0.81	0.78	0.02	0.74 - 0.83	0.71	47 of 53	4.8	3

Psi Ψ - The probability a species is detected in a given reach for the survey year.

Theta Θ Conditional occupancy - the probability a species is detected in a given sample pool conditional to the species being present in the reach for the survey year.

p-Individual species detection probability if present in a given sample pool.

PAO-Proportion of area occupied. (PSI * Theta) Overall occupancy value; incorporates reach-level- and pool-level occupancy for the entire sample frame in a given year

Coho salmon distribution

Coho observations in 2017 as in past years were concentrated in the southern portion of the watershed although both abundance and distribution appeared to be notably reduced (Table 3, Figure 2). Among the seven GRTS drawn reaches where coho were detected, over 80% of the fish observed were in Mattole River reach 310. Reach 311 immediately upstream, surveyed as an incidental reach, contained similar numbers of coho. These were also the only reaches where coho parr were sufficiently abundant to imply that spawning had occurred in that reach. In all other reaches no more than eleven coho were observed. The highest number of coho observed in a single pool was only ten fish, in reach 311. Only three individual coho were observed in the entirety of the watershed downstream of Mill Creek, which enters the mainstem just downstream of Whitethorn (Figure 2).

Table 3. Number of units surveyed, and coho occupancy and Chinook presence by reach, 2017

Reach ID	Stream Name	# of units in reach	# of units occupied by coho	Total # coho observed	Mean coho count per pool	Suspected coho rearing type	Total # Chinook observed
277	Mattole River	4	0				8
279	Mattole River	3	0				0
282	Mattole River	5	0				11
288	Mattole River	10	0				12
295	Mattole River	3	0				0
297	Mattole River	2	0				1
299	Mattole River	3	0				4
302	Mattole River	16	1	1	1.0	non-natal	1
304	Mattole River	32	0				2
307	Mattole River	16	0				0
309	Mattole River	30	8	9	1.1	non-natal	12
310	Mattole River	48	29	88	3.0	natal	0
341	Lower N. Fork Mattole	6	0				12
353	Grizzly Creek	4	0				0
425	East Mill Creek	10	0				0
428	East Mill Creek	10	0				0
430	East Mill Creek	9	0				0
432	East Mill Creek	4	0				0
440	Conklin Creek	6	0				0
453	McGinnis Creek	27	1	1	1.0	non-natal	4
479	Squaw Creek	4	0				0
481	Squaw Creek	14	0				0
483	Squaw Creek	12	0				0
557	Woods Creek	2	0				0
631	Honeydew Creek	6	0				0
632	Honeydew Creek	9	0				0
641	Honeydew Creek, Lower E. Fork	1	0				0
678	Dry Creek	11	0				0

Technical Report - Mattole River Juvenile Coho Salmon Distribution Monitoring 2017

Reach ID	Stream Name	# of units in reach	# of units occupied by coho	Total # coho observed	Mean coho count per pool	Suspected coho rearing type	Total # Chinook observed
715	Fourmile Creek	27	0				0
718	Fourmile Creek, N. Fork	8	0				0
733	Sholes Creek	21	0				0
764	Mattole Canyon Creek	13					0
765	Mattole Canyon Creek	17	0				0
770	Panther Creek	11	0				0
792	Blue Slide Creek	16	0				0
818	Bear Creek	14	0				0
819	Bear Creek	10	1	1	1	non-natal	0
826	Bear Creek, S. Fork	35	0				0
827	Bear Creek, S. Fork	72	0				0
848	Jewett Creek	35	0				0
858	N. Fork Bear Creek	27	0				0
885	Big Finley Creek	6	0				0
892	Eubanks Creek	14	0				0
911	Bridge Creek	22	0				0
924	McKee Creek	26	0				0
926	Painter Creek	2	0				0
928	Van Arken Creek	20	0				0
930	Van Arken Creek, South Fork	2	0				0
947	Harris Creek	8	0				0
949	Stanley Creek	29	0				0
951	Baker Creek	62	3	3	1.0	non-natal	0
956	Thompson Creek	65	3	5	1.7	non-natal	0
958	Yew Creek	39	0				0
Totals		894	46	108	2.1		67
Incidental Surveys – non-GRTS Reaches							
308	Mattole River	40	5	11	2.2	non-natal	5
311	Mattole River	41	33	119	3.6	natal	0
939	Mill Creek	9	1	1	1	non-natal	0
963	Lost River	35	0				0
972	Ancestor Creek	17	0				0

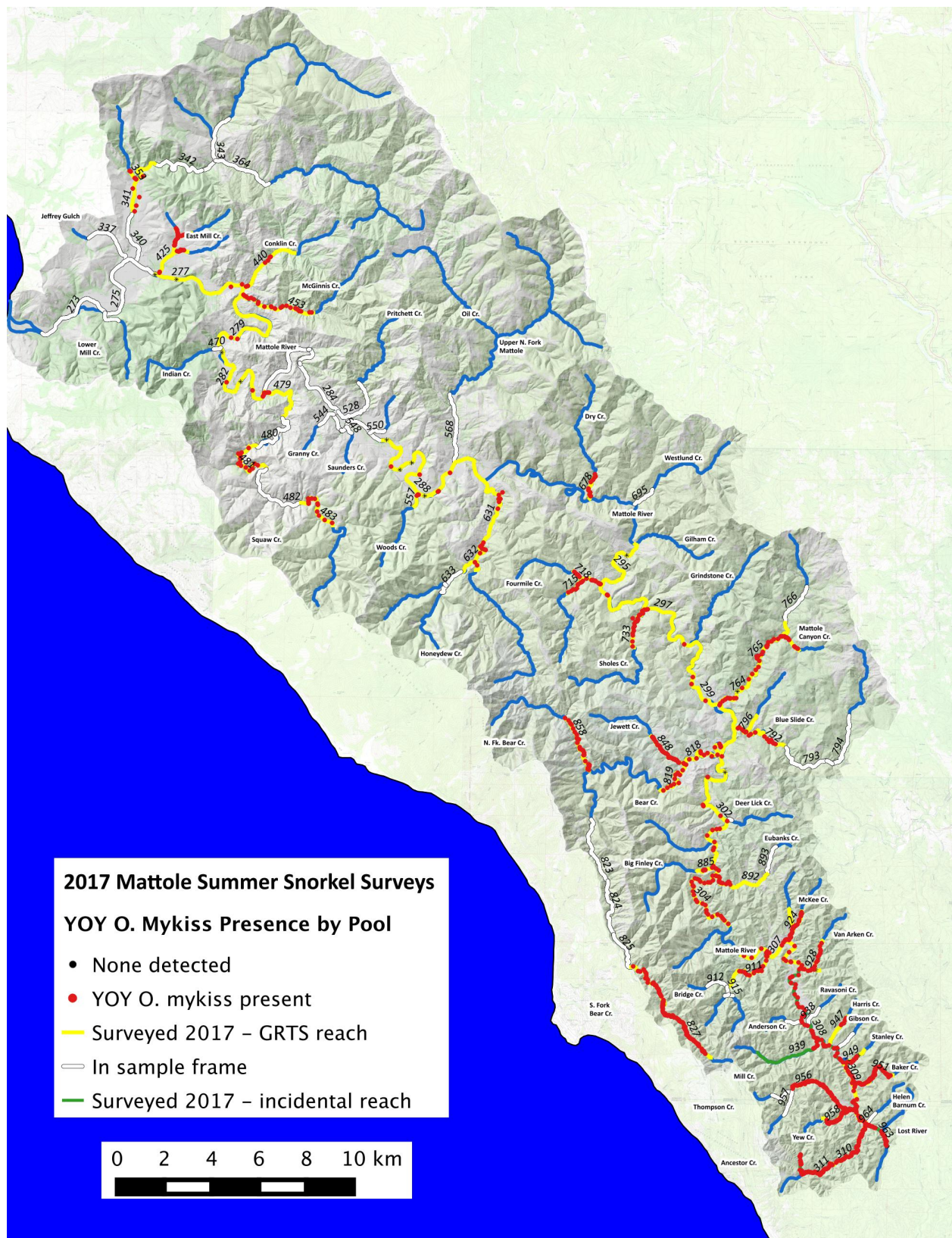


Figure 4. All pools surveyed and YOY trout detections, 2017.

Estimate of coho abundance

In 2017, the sum of all coho observed with 53% of the frame surveyed was 108, resulting in a naïve abundance estimate of 393 individuals within the watershed. This total is much lower than in each of the previous four years. In 2016, 2015, 2014, and 2013 estimates were 4,060, 6,294, 2,851 and 3,072, respectively.

Discussion

Patterns of coho distribution and abundance in the Mattole watershed 2013-2017

From 2013-2017, 74 unique reaches were surveyed under this protocol. Coho were detected at least once in 24 of the 78 reaches. Observations from all five years (2013-2017) of surveys completed using this protocol show that coho salmon distribution in the Mattole watershed is limited to less than 15% of the potentially suitable habitat. In all five years, the vast majority of coho have been concentrated within a core area in the southernmost portion of the watershed, upstream of Bridge Creek and the town of Thorn Junction. Within this area (about 10% of the entire Mattole watershed), there were 11 stream reaches where coho were detected in multiple years, but only 5 stream reaches where more than 100 individuals were tallied in multiple years (Table 4). Just seven reaches – 308, 309, 951, and mainstem reaches 310, 311, Ancestor Creek 972, and Thompson Creek 956 – contained over 93% of all the coho observed in the five years of surveys. In 2017, mainstem reaches 310 and 311 alone contained over 85% of all the coho observed in 58 reaches surveyed.

While direct comparisons to pre-2013 data are somewhat difficult due to differences in survey effort and protocol, the apparent lack of spawning in even a single tributary stream appears unprecedented, and seems to indicate a new low in the species' ongoing decline. Between 2000 and 2008, both adult spawner survey and summer snorkel survey data indicates that coho spawning occurred annually in Bridge, Mill, Thompson, Baker, Ancestor, and South Fork Bear Creeks, as well as the mainstem in the Whitethorn valley (Mattole River and Range Partnership 2011, Mattole Salmon Group unpublished data). The winter of 2008-2009 brought notably lower returns, as well as less consistent coho presence in the aforementioned tributaries, although there was indication of spawning activity in at least several tributaries, as well as the mainstem, every year, until this year.

The continued decline of coho distribution and abundance in the Mattole raises questions about how long the population will persist. Without exceptionally high parr-smolt and smolt-adult survival, it seems unlikely that there will be spawning coho salmon in the Mattole watershed in the winter of 2019-2020.

Table 4. Comparison of coho counts by reach, 2013-2017

Reach ID	Stream Name	2013	2014	2015	2016	2017
273	Mattole River		0	0	0	
275	Mattole River		1*	0		
277	Mattole River		0	0	0	0
279	Mattole River					0
282	Mattole River		0			0
284	Mattole River	0		0	1	
288	Mattole River		0	0		0
291	Mattole River	0	0	0		
293	Mattole River		0	0		
295	Mattole River		0		0	0
297	Mattole River	0		0		0
299	Mattole River	1		0		0
302	Mattole River	3**	24			1
304	Mattole River		3**	0	8	0
307	Mattole River	10	2**	6	7	0
308	Mattole River	86**	32	175	156	11
309	Mattole River	150**	290	925	195	9
310	Mattole River		1	72	220	88
311	Mattole River		14	367	89	119
328	Lower Mill Creek	0	0	0	0	
340	Lower N. Fork Mattole		0	0	0	
341	Lower N. Fork Mattole	0				0
353	Grizzly Creek	0				0
425	East Mill Creek	0		0	0	0
428	South Branch, East Mill Creek	0			0	0
430	East Mill Creek				0	0
432	East Mill Creek				0	0
440	Conklin Creek				0	0
453	McGinnis Creek		1		0	1
479	Squaw Creek				0	0

Technical Report - Mattole River Juvenile Coho Salmon Distribution Monitoring 2017

Reach ID	Stream Name	2013	2014	2015	2016	2017
481	Squaw Creek	3			0	0
483	Squaw Creek	0		0		0
544	Granny Creek	0		0	0	
548	Saunders Creek	0				
557	Woods Creek		0	0		0
631	Honeydew Creek					0
632	Honeydew Creek	0		0	0	0
633	Honeydew Creek		0	0		
641	Honeydew Creek, East Fork	0		0	0	0
646	Honeydew Creek, West Fork			0		
678	Dry Creek					0
715	Fourmile Creek		0	0	2	0
718	Fourmile Creek, N. Fork		0	0	0	0
733	Sholes Creek	1		0	0	0
764	Mattole Canyon Creek		0		0	0
765	Mattole Canyon Creek		0	0	0	0
770	Panther Creek			0	0	0
792	Blue Slide Creek			0	0	0
796	Crooked Prairie Creek			0	0	0
818	Bear Creek		46	0		0
819	Bear Creek		7	0	0	1
823	Bear Creek, S. Fork	0			0	
824	Bear Creek, S. Fork		0			
825	Bear Creek, S. Fork		0	0		
826	Bear Creek, S. Fork		0	0	0	0
827	Bear Creek, S. Fork	0		0		0
848	Jewett Creek		0	0	0	0
858	Bear Creek, N. Fork	0		0	0	0
885	Big Finley Creek		0			0
892	Eubanks Creek		0	0		0
893	Eubanks Creek	0			0	
911	Bridge Creek		1		0	0

Technical Report - Mattole River Juvenile Coho Salmon Distribution Monitoring 2017

Reach ID	Stream Name	2013	2014	2015	2016	2017
924	McKee Creek		0	0	0	0
926	Painter Creek				0	0
928	Van Arken Creek	0		0		0
930	Van Arken Creek, South Fork			0		0
937	Anderson Creek		0	0	0	
938	Ravishoni Creek		0		0	
939	Upper Mill Creek		1	2	5	1
947	Harris Creek		0	0		0
949	Stanley Creek					0
951	Baker Creek	717	228	30	258	3
956	Thompson Creek	249	20	5	15	5
957	Thompson Creek	10		0	0	
958	Yew Creek		10		59	0
963	Lost River		0	93	4	0
964	Helen Barnum Creek		0	0	0	
972	Ancestor Creek	213	9	37	51	0

*Coho seen outside of sample unit

**Reach not surveyed using spatial structure protocol, total shown from MSG Summer Steelhead Dive

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Appendix A – Drainage area, length surveyed, # of units surveyed, and coho occupancy and Chinook presence by reach, 2013-2016

2013 Results

Reach ID	Stream Name	Drainage area km ²	Length surveyed (m)	# of units in reach	# of units occupied by coho	Total # coho observed **	Mean coho count per pool	Suspected coho rearing type	Chinook presence
279	Mattole River	616.6	8084	0	---	---	---		
284	Mattole River	522.4	10821	2	0	0	---		yes
292	Mattole River	357.1	9421	0	---	---	---		
299	Mattole River	261.9	10733	2	1	1	1	non-natal	
307	Mattole River	79.4	4867	24	8	10	1.3	non-natal	yes
341	Lower N. Fork Mattole	94.9	2152	4	0	0	---		
353	Grizzly Creek	5.4	520	4	0	0	---		
425	East Mill Creek	7.4	1238	23	0	0	---		
428	East Mill Creek, S. Branch	2.1	794	3	0	0	---		
481	Squaw Creek	37.0	2130	14	1	3	3	natal	yes
483	Squaw Creek	18.9	2417	21	0	0	---		
544	Granny Creek	2.4	914	5	0	0	---		yes
548	Saunders Creek	2.2	311	5	0	0	---		yes
632	Honeydew Creek	33.8	2539	11	0	0	---		yes
641	Honeydew Creek, Lower E. Fork	13.5	583	7	0	0	---		
733	Sholes Creek	10.5	2270	31	1	1	1	non-natal	yes
749	Grindstone Creek	9.9	2370	26	0	0	---		
822	S. Fork Bear Creek	22	2758	26	0	0	---		yes
823	S. Fork Bear Creek	15.3	2986	22	0	0	---		yes
827	S. Fork Bear Creek	4.0	3522	102	7	20	2.9	non-natal*	
858	N. Fork Bear Creek	13.4	2990	21	0	0	---		
893	Eubanks Creek	3.8	1178	14	0	0	---		
928	Van Arken Creek	5.2	1926	35	0	0	---		
956	Thompson Creek	9.5	3565	79	53	249	4.7	natal	yes
957	Thompson Creek	2.3	1120	46	8	10	1.3	natal	yes
972	Ancestor Creek	2.6	449	18	18	213	11.8	natal	
Totals				545	97	507			

*Coho observed in reach #827 were relocated there from Baker Creek due to de-watering associated with a restoration project.

**In double-dive pass units, the maximum count was used.

Appendix A – Drainage area, length surveyed, # of units surveyed, and coho occupancy and Chinook presence by reach, 2013-2016

2014 Results

Reach ID	Stream Name	Drainage area km ²	Length surveyed (m)	# of units in reach	# of units occupied by coho	Total # coho observed**	Mean coho unit count	Suspected coho rearing type	Chinook presence
273	Mattole River	762.5	3990	11	0	0			yes
275	Mattole River	748.0	4701	10	0	0			yes
277	Mattole River	633.8	4609	5	0	0			yes
282	Mattole River	572.4	4192	2	0	0			yes
288	Mattole River	490.4	10534	13	0	0			
302	Mattole River	126.1	8549	10	4	24	6.0	natal?	yes
308	Mattole River	52.3	6351	41	12	32	2.7	non-natal	
309	Mattole River	30.3	3828	34	26	290	11.2	natal	
310	Mattole River	9.3	2430	43	1	1	1.0	*natal	
311	Mattole River	5.8	2013	27	9	14	1.6	*natal	
328	Lower Mill Creek	5.4	1152	36	0	0			
340	Lower N. Fork Mattole	97.6	1900	5	0	0			
453	McGinnis Creek	15.6	2516	18	1	1	1.0	non-natal	
557	Woods Creek	5.1	180	1	0	0			
633	Honeydew Creek	17.9	1528	12	0	0			
715	Fourmile Creek	14.1	2067	13	0	0			
718	Fourmile Creek, N. Fork	4.6	614	8	0	0			
764	Mattole Canyon Creek	26.8	490	4	0	0			
765	Mattole Canyon Creek	24.2	2868	31	0	0			
818	Bear Creek	55.4	3392	10	5	46	9.2	natal	
819	Bear Creek	45.3	2154	9	4	7	1.8	natal	yes
824	Bear Creek, S. Fork	11.9	2795	27	0	0			
825	Bear Creek, S. Fork	9.1	1323	17	0	0			
826	Bear Creek, S. Fork	6.7	2717	32	0	0			
848	Jewett Creek	6.1	2135	17	0	0			
885	Big Finley Creek	8.2	638	5	0	0			
892	Eubanks Creek	8.9	1500	30	0	0			
911	Bridge Creek	11.1	2400	18	1	1	1.0	non-natal	
924	McKee Creek	5.4	970	15	0	0			
925	McKee Creek	2.4	217	8	0	0			
937	Anderson Creek	1.8	732	20	0	0			
938	Ravishoni (E. Anderson)	1.8	290	4	0	0			
939	Upper Mill Creek	6	1598	30	1	1	1.0	non-natal	
947	Harris Creek	2.5	480	13	0	0			
951	Baker Creek	4	2359	73	27	228	8.4	natal	
958	Yew Creek	2.4	1565	35	4	10	2.5	natal	
963	Lost River	5.1	1300	28	0	0			
964	Helen Barnum Creek	1.6	557	17	0	0			
965	Lost River, S. Fork	1.8	502	17	0	0			
Totals				749	95	655			

*Coho observed in reach #'s 310 and 311 were exclusively 1+ fish, as were 84 of the coho observed in reach #951.

**In double-dive pass units, the maximum count was used

Appendix A – Drainage area, length surveyed, # of units surveyed, and coho occupancy and Chinook presence by reach, 2013-2016

2015 Results

Reach ID	Stream Name	Drainage area km ²	Length surveyed (m)	# of units in reach	# of units occupied by coho	Total # coho observed**	Mean coho count per pool	Suspected coho rearing type	Chinook presence
273	Mattole River	762.5	3990	25	0				X
275	Mattole River	748	5237	8	0				x
277	Mattole River	633.8	4699	10	0				x
279	Mattole River	616.6	8288	9	0				
284	Mattole River	522.4	11580	10	0				
288	Mattole River	490.4	11251	13	0				x
291	Mattole River	357.11	6883	0	0				
297	Mattole River	277.7	6384	2	0				
299	Mattole River	254.9	7290	4	0				x
304	Mattole River	126.1	2504	20	0				x
307	Mattole River	79.4	5091	24	4	6	1.5	non-natal	x
308	Mattole River	52.3	6731	42	25	175	7.0	natal	x
309	Mattole River	30.3	3513	32	29	925	31.9	natal	x
311	Mattole River	5.8	1594	44	37	367	9.9	natal	x
328	Lower Mill Creek	5.4	912	22	0				
340	Lower N. Fork Mattole	97.6	1900	5	0				
425	East Mill Creek	7.4	456	4	0				
440	Conklin Creek	14.4	757	3	0				
483	Squaw Creek	18.9	2618	20	0				
544	Granny Creek	2.4	889	2	0				x
557	Woods Creek	5.1	180	1	0				
631	Honeydew Creek	44.3	946	6	0				
632	Honeydew Creek	33.8	2540	8	0				
633	Honeydew Creek	17.9	1465	8	0				
641	Honeydew Creek, Lower E. Fork	13.5	579	6	0				
646	West Fork Honeydew Creek	5.9	115	2	0				
678	Dry Creek	14.8	1385	12	0				
715	Fourmile Creek	14.1	2072	17	0				
718	Fourmile Creek, N. Fork	4.6	560	7	0				
733	Sholes Creek	10.5	2268	26	0				x
765	Mattole Canyon Creek	24.2	3218	22	0				
770	Panther Creek	6.7	996	7	0				
792	Blue Slide Creek	25.8	1934	15	0				
796	Crooked Prairie (Bick's) Creek	2.4	245	1	0				
818	Bear Creek	55.4	3114	16	0				x
819	Bear Creek	45.3	2177	11	0				
825	Bear Creek, S. Fork	9.1	1981	17	0				

Appendix A – Drainage area, length surveyed, # of units surveyed, and coho occupancy and Chinook presence by reach, 2013-2016

826	Bear Creek, S. Fork	6.7	2911	40	0					
827	S. Fork Bear Creek	4	3477	90	0					
848	Jewett Creek	6.1	2177	20	0				x	
858	N. Fork Bear Creek	13.4	3040	23	0					
892	Eubanks Creek	8.9	1500	18	0					
924	McKee Creek	5.4	1405	28	0					
928	Van Arken Creek	5.2	1967	41	0					
930	South Fork Van Arken Creek	1.5	289	6	0					
937	Anderson Creek	1.8	755	12	0					
939	Upper Mill Creek	6	731	15	2	2	1.0	non-natal		
947	Harris Creek	2.5	667	20	0					
957	Thompson Creek	2.3	1159	49	0					
963	Lost River Helen Barnum Creek	5.1	1367	34	12	93	7.8	natal	x	
964	Creek	1.6	583	16	0					
972	Ancestor Creek	2.6	778	22	12	37	3.1	natal	x	
Totals				915	121	1605				
Incidental Surveys – non-GRTS Reaches										
293	Mattole River	345.2	5619	1	0				x	
310	Mattole River	9.3	2721	43	16	72	4.5	natal	x	
951	Baker Creek	4.0	1200	25	9	30	3.3	non-natal	x	
956	Thompson Creek	9.5	2845	35	1	5	5.0	non-natal	x	
966	Lost River, N. Fork	1.6	580	16	0					

Appendix A – Drainage area, length surveyed, # of units surveyed, and coho occupancy and Chinook presence by reach, 2013-2016

Table 5

2016 Results

Reach ID	Stream Name	Drainage area km ²	Length surveyed (m)	# of units in reach	# of units occupied by coho	Total # coho observed**	Mean coho count per pool	Suspected coho rearing type	Chinook presence
273	Mattole River	762.5	3990	12	0				X
277	Mattole River	633.8	4699	4	0				x
282	Mattole River	572.4	4602	6					
284	Mattole River	522.4	11580	10	1	1	1	non-natal	x
295	Mattole River	306.1	5118	0	0				
304	Mattole River	126.1	3504	21	5	8	1.6	non-natal	x
307	Mattole River	79.4	5091	25	5	7	1.4	non-natal	x
308	Mattole River	52.3	6731	40	21	156	7.4	natal	
309	Mattole River	30.3	3513	32	26	195	7.5	natal	
310	Mattole River	9.3	2721	44	38	220	5.8	natal	
328	Lower Mill Creek Lower N. Fork	5.4	912	9	0				
340	Mattole	97.6	1900	4	0				
425	East Mill Creek	7.4	456	11	0				
428	East Mill Creek	2.1	699	8	0				
430	East Mill Creek	2.1	386	8	0				
432	East Mill Creek	2.3	619	3	0				
440	Conklin Creek	14.4	757	5	0				
453	McGinnis Creek	15.6	3719	26	0				
479	Squaw Creek	42.5	345	4	0				
481	Squaw Creek	37.0	2590	18	0				
544	Granny Creek	2.4	889	9	0				
632	Honeydew Creek	33.8	2540	10	0				x
641	Honeydew Creek, Lower E. Fork	13.5	579	4	0				
678	Dry Creek	14.8	1385	11	0				
715	Fourmile Creek	14.1	2072	17	2	2	1	non-natal	
718	Fourmile Creek, N. Fork	4.6	560	7	0				
733	Sholes Creek	10.5	2268	21	0				
764	Mattole Canyon Creek	26.8	3050	15					
765	Mattole Canyon Creek	24.2	3218	25	0				
770	Panther Creek	6.7	996	13	0				
792	Blue Slide Creek	25.8	2163	23	0				
796	Crooked Prairie (Bick's) Creek	2.4	245	1	0				
819	Bear Creek	45.3	2177	5	0				
823	Bear Creek, S. Fork	15.3	2986	29					
826	Bear Creek, S. Fork	6.7	2911	43	0				

Appendix A – Drainage area, length surveyed, # of units surveyed, and coho occupancy and Chinook presence by reach, 2013-2016

2016 Results

Reach ID	Stream Name	Drainage area km ²	Length surveyed (m)	# of units in reach	# of units occupied by coho	Total # coho observed**	Mean coho count per pool	Suspected coho rearing type	Chinook presence
848	Jewett Creek	6.1	2177	26	0				
858	N. Fork Bear Creek	13.4	3040	22	0				
893	Eubanks Creek	3.8	1178	14	0				
924	McKee Creek	5.4	915	12	0				x
926	Painter Creek	1.6	70	3	0				
937	Anderson Creek	1.8	755	19	0				
938	Ravishoni (East Anderson) Creek	1.8	290	7	0				
939	Upper Mill Creek	6.0	1170	22	2	5	2.5	non-natal	
951	Baker Creek	4.0	2501	69	42	258	6.1	natal	
956	Thompson Creek	9.5	2845	65	4	15	3.8	non-natal	x
957	Thompson Creek	2.3	1159	49	0				
963	Lost River	5.1	1367	34	3	4	1.3	non-natal	
964	Helen Barnum Creek	1.6	583	10	0				
Totals				875	149	871			

Incidental Surveys – non-GRTS Reaches

311	Mattole River	5.8	1594	44	26	89	3.4	natal	
908	Buck/Sinkyone Creek	1.9	610	12	0				
911	Bridge Creek	11.1	2400	14	0				x
958	Yew Creek	2.4	657	13	11	59	5.4	natal	
972	Ancestor Creek	2.6	778	16	10	51	5.1	natal	

Appendix B. Presence of coho salmon juveniles by survey reach, 1980-2015. Data from 1980-2011 from Garwood (2012a and 2012b). Data encompasses multiple survey techniques and varying levels of survey effort.

0=coho not detected, 1=coho present, unclear if natal or non-natal; 2=present, suspected natal; 3=present, suspected non-natal

Reach ID #	Stream	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
273*	Mattole River																																					0	0
275*	Mattole River																								1				2	2								3	0
277*	Mattole River																																				0	0	
279*	Mattole River																																					0	
282*	Mattole River																																				0		
284*	Mattole River																								1											0	0		
288*	Mattole River																																				0	0	
291*	Mattole River																																				0	0	
293*	Mattole River																																				0	0	
295*	Mattole River																																						
297*	Mattole River																																			0	0		
299*	Mattole River																																			3	0		
302	Mattole River																								1		1		0	0	0	1			3	1			
304	Mattole River																																				0		
307	Mattole River																				0	1	1	1	1		3	0	1	1	0	0	0	1	3	3			
308	Mattole River																					2	1		2	1	2	1	1	1	1	3	3	1	2	3	2		
309	Mattole River																				1	1	1	2	2	2	2	2	2	1	1	1	3	1	1	2	2	2	
310	Mattole River																				1	1	2	2	2	2	2	2	2	1	2	2	1	1	1	2	1	2	
311	Mattole																				1	2	1	2		1			1	0	1	2	2		1	2			

Appendix B. Presence of coho salmon juveniles by survey reach, 1980-2015. Data from 1980-2011 from Garwood (2012a and 2012b). Data encompasses multiple survey techniques and varying levels of survey effort.

Reach ID #	Stream	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
915	Bridge Creek																						2	2	1						0	2							
916	Bridge Creek																																						
924	McKee Creek		1	1												0	0					0	1	0	1	1			1	0	0	0				0	0		
926	Painter Creek		0																																				
928	Van Arken Creek				0						1	0				0	0	0	0	0	0	0	3	0	1	1			1	0	0	0	0	0	0	0	0		
930	S. Fork Van Arken Creek																																				0		
937	Anderson Creek															0	1								0	0				0						0	0		
938	E. Anderson Creek																						1	1													0		
939	Mill Creek			1											0		0					0	0	1	2	2	2			0	1	1	0	0		3	3		
947	Harris Creek		0	0																																	0	0	
948	Gibson Creek																							0															
951	Stanley Creek			1																																			
951	Baker Creek			1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	2	2	2			2	2	2	0	0		2	2	3	
956	Thompson Creek		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2			2	2	2	2	2	2	2	1	3	
957	Thompson Creek																								2	2	2						2	2		3		0	
958	Yew Creek			0				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2			2	2	2	0	0		0	2		
960	Danny's Creek																		0	1	0	1	0	2	2	2						1	2						
963	Lost River														0				1	1	1			2	2	2			1	1	0		0			0	2		
964	Helen Barnum							0							0		0							1	1	1			0			0				0	0		
966	N Fork Lost																																					0	0
972	Ancestor Creek						1	1								0	0		0					2	2	2			2	2	2	2	1		2	1	2		
	# Reaches Surveyed	1	10	17	0	1	4	4	5	7	8	10	10	10	14	14	15	22	21	26	31	28	36	45	43	16	5	14	36	33	32	26	23	6	32	40	52		
	# Reaches Coho Present	0	3	7	0	1	2	3	4	7	6	5	5	4	4	6	6	7	7	10	13	12	18	23	24	16	5	7	14	14	8	9	12	6	12	15	10		

Appendix B. Presence of coho salmon juveniles by survey reach, 1980-2015. Data from 1980-2011 from Garwood (2012a and 2012b). Data encompasses multiple survey techniques and varying levels of survey effort.

Reach ID #	Stream	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015					
	Proportion reach occupancy	0	0	0	0.3	0.41	1	0	0.5	0.75	0.8	1	0	0.75	0.5	0.5	0.4	0.29	0.43	0.4	0.32	0.33	0.38	0.42	0.43	0.5	0.51	0.56	1	0.01	0.00	0.5	0.39	0.42	0.25	0.35	0.52	1	0.00	0.38	0.38	0.19

0=coho not detected, 1=coho present, unclear if natal or non-natal; 2=present, suspected natal; 3=present, suspected non-natal

*Did not display non-detections prior to 2013, due to differing methodology. Most pre-2013 surveys of these large mainstem reaches have targeted other species, such as summer steelhead, and divers were not necessarily seeking out likely coho habitat.