

NAPA RIVER SALMON MONITORING PROGRAM

SPAWNING YEAR 2006 REPORT



CHINOOK SALMON – NAPA RIVER (DECEMBER, 2006)

NAPA COUNTY, CALIFORNIA

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PREPARED BY



NAPA COUNTY RESOURCE CONSERVATION DISTRICT

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This report and reports from previous years are available online at <http://www.napawatersheds.org>

BACKGROUND

During the past five years, an estimated run of 400-600 fall-run Chinook salmon (*Oncorhynchus tshawytscha*) have spawned annually in the mainstem Napa River and several tributary streams (Koehler 2005; Koehler 2006). The Napa County Resource Conservation District (RCD) initiated an ongoing salmon monitoring program in 2003 to assess Chinook abundance, distribution, and spawning success within the Napa River basin. This year's monitoring included genetic analysis of tissue samples collected from recovered carcasses to determine the relationship between Napa River Chinook and other known stocks.

Very little is known about historical Chinook salmon abundance and distribution in Bay Area streams. In a recent review of existing fisheries information, no conclusive evidence of historical Chinook salmon populations could be found for the Napa River basin (Leidy et al., 2005). However, based on analysis of natural channel form, hydrology, and ecology, the Napa River likely supported a large, sustainable population of Chinook salmon under historical conditions (Stillwater Sciences, 2002). Additionally, the geographic location of the Napa River at the entrance to the Sacramento/San Joaquin River systems makes it likely that wild Chinook salmon would naturally stray into the Napa River during favorable periods.

During the past 150 years, a combination of factors including reduction in spawning habitat, channel and floodplain alterations, and the introduction of exotic predatory fishes have all reduced the river's potential to support a viable population of Chinook salmon. Today, there are approximately 25 miles of suitable Chinook spawning habitat in the mainstem Napa River and an additional 15 miles within low gradient reaches of several large tributaries.

METHODS

Spawner surveys were conducted following California Department of Fish & Game protocols as described in the California Salmonid Stream Habitat Restoration Manual (Appendix A). Redd locations were recorded using a handheld Garmin GPS unit and marked with flagging. The excavated redd area was measured using a graduated gaff hook handle, and the specific type of habitat (pool, glide, riffle, run) where the redd was constructed was also recorded. Surveys were conducted in three survey reaches of the Napa River (Figure 1).

A snorkel survey was conducted in the mainstem Napa River between the Oakville Crossroad and Oak Knoll Avenue in May, 2007 to document the fish community in this reach with emphasis on the abundance and distribution of salmonids.

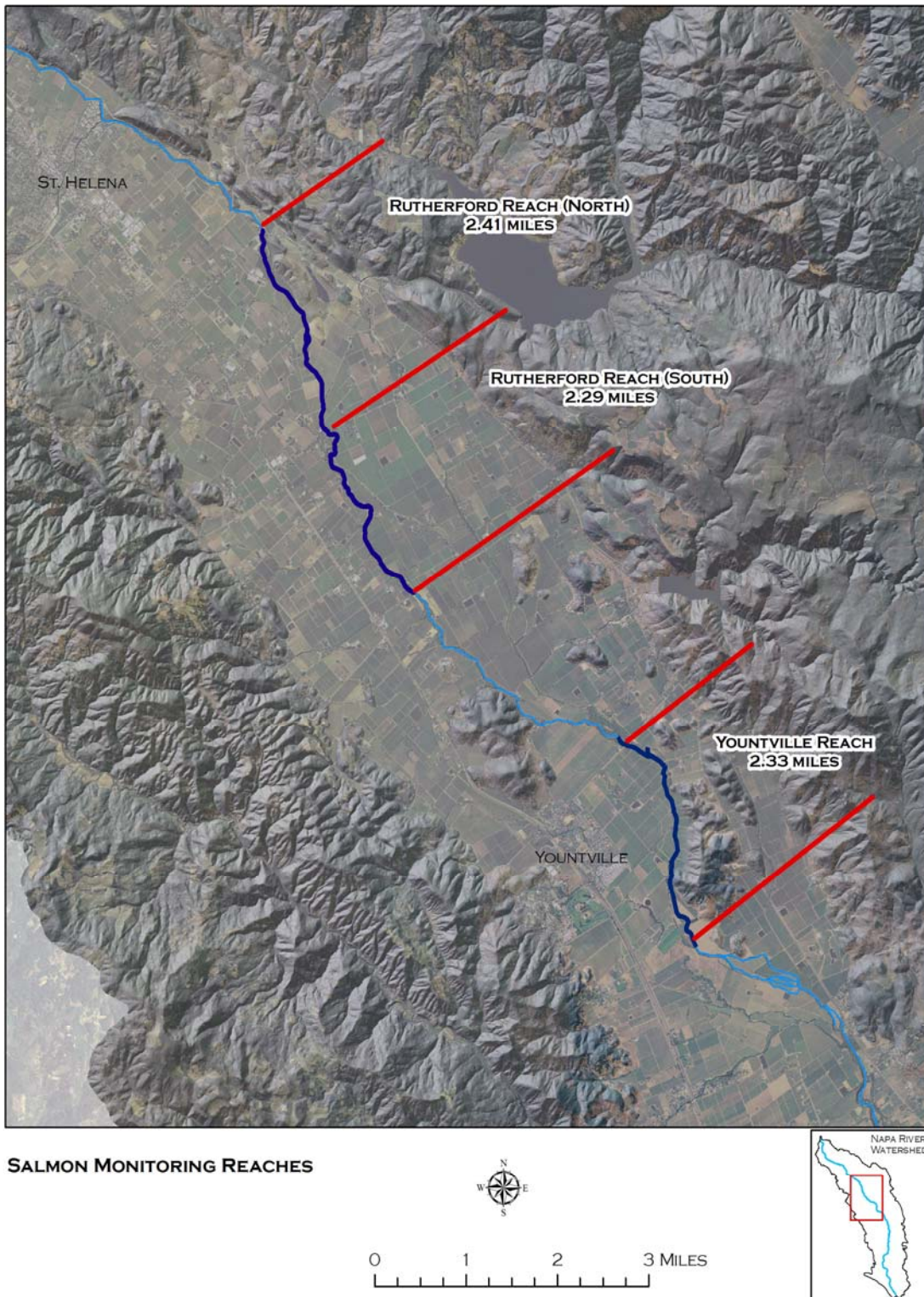


Figure 1. Location Map showing three sampling reaches along the mainstem Napa River. Note: a snorkel survey was conducted beyond these reaches between Oakville Crossroad and Oak Knoll Ave.

RESULTS AND DISCUSSION

Napa RCD staff conducted a total of nine spawner surveys in three sampling reaches of the Napa River between December 1, 2006 and January 12, 2007. We counted a total of 128 redds in approximately seven stream miles, which was the highest count in three years of monitoring. When compared with previous years, redd counts in the 4.7 mile Rutherford reach show a stable or slight upward trend, suggesting that a small self-sustaining run of salmon is present in the Napa River (Figure 2).

Much of this year's spawning activity was in our northern-most sampling reach, with the highest spawning densities just downstream of the Zinfandel Lane Bridge (Figure 5). Consistent with observations in 2004 and 2005, the majority of salmon were unable to pass the concrete bridge apron during low flows and eventually spawned in the downstream vicinity of the bridge. Work is currently underway by the RCD and others to improve fish passage at Zinfandel Lane.

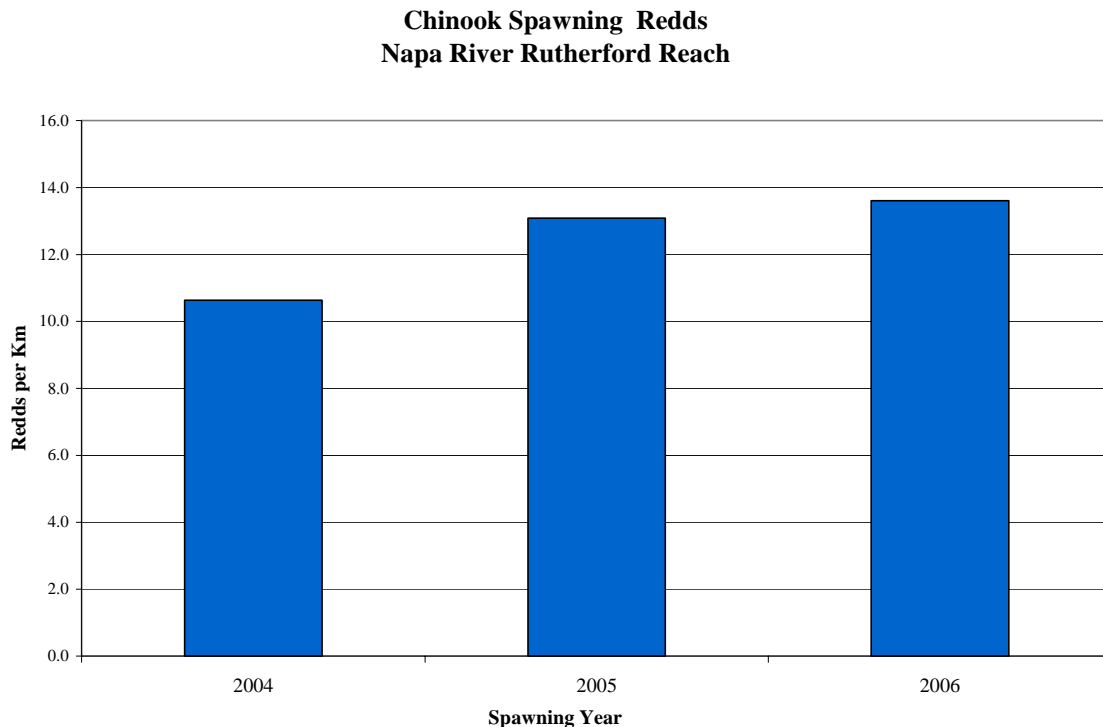


Figure 2. Redd density data from the Napa River Rutherford reach from 2004-2006. Note this does not include data from the Yountville reach, as this is the first year we have monitored that section of the river. (1km = 0.62 miles)

Spawning redds were built most frequently in riffles and pool tail crests (Figure 3). The median redd size was 6 m², with a range of 1m² -30m² (larger redds were typically counted as multiple redd complexes if several clearly defined excavation holes were apparent). Most redds were constructed in areas with gravel and small cobble substrates, however several redds, specifically those in glide habitats, were observed in areas with primarily sand and small gravel substrates.

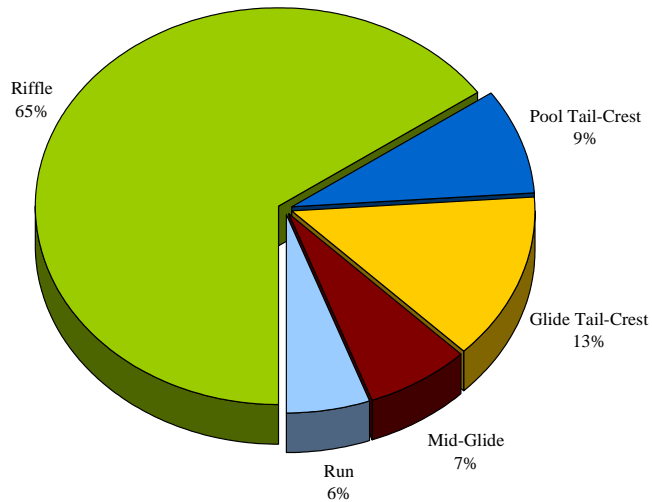


Figure 3. Redds by Habitat Type. Habitat type definitions given by the California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual, 2002. Tail-crest refers to the area at the downstream end of a pool or glide unit where it transitions into moving water (e.g. riffle, run, etc.).

A total of 244 live adult salmon¹ and 45 carcasses were observed during our surveys (Table 1). No carcasses or live fish had visible hatchery markings (i.e. clipped adipose fin or other fin clips). Tissue samples were collected from 40 of the carcasses and sent to the National Marine Fisheries Service lab in Santa Cruz for genetic analysis. Tissue samples will be compared to other salmon stocks to determine whether Napa fish are descended from known populations or represent a unique local strain. Additional genetic analysis for Single Nucleotide Polymorphisms (SNPs) will be conducted to begin building a parent database for Napa River salmon. Results from these analyses will be available in late 2007.

¹ Cumulative live fish counts during spawner surveys are not an accurate measure of population size because fish may be counted multiple times during consecutive surveys.

Survey Date	1-Dec-2006	5-Dec-2006	7-Dec-2006	15-Dec-2006	18-Dec-2006	20-Dec-2006	3-Jan-2007	5-Jan-2007	12-Jan-2007
Sampling Reach	NR-Y	NR-S	NR-N	NR-Y	NR-S	NR-N	NR-S	NR-N	NR-N
Survey distance (ft)	12,302	12,110	12,724	12,302	12,110	12,724	12,110	12,724	12,724
Live Chinook observed	8	12	0	26	18	141	3	30	6
Chinook carcasses	4	2	0	1	3	6	2	17	10
Mean fork length (cm)	83	83	N/A	68	84	73	87	81	76
Range fork length (cm)	80-85	83	N/A	68	77-90	57-90	86-88	63-101	64-86
Fin clipped fish	0	0	0	0	0	0	0	0	0
Skeletons	0	1	0	1	3	0	4	14	8
Newly constructed redd count	7	6	0	18	26	69	0	2	0

Table 1. Summarized salmon spawner/redd survey data. NR-Y = Yountville Reach, NR-N = Rutherford Reach North, NR-S = Rutherford Reach South.

RCD staff conducted a snorkel survey of the Napa River on May 8-9, 2007, between Oakville Crossroad and Oak Knoll Avenue. This reach is approximately 8.5 miles long. The purpose of the survey was to document the fish community of the river in this reach and observe relative density and distribution of juvenile salmonids. Water temperatures during the snorkel survey ranged from 18° - 19.5° C, and most pools felt thermally stratified. Flow was approximately 18 cfs, as measured at the USGS streamgage at Oak Knoll Ave.

Chinook salmon parr were abundant throughout the survey reach, and appeared to be highly associated with moving water habitats (e.g. riffles, runs). Small groups of parr were typically seen holding in feeding lanes at the tops of swift-water habitats mixed with schools of native minnows and suckers. The average size of most Chinook parr observed was approximately 90mm (~3.5 inches). Very few parr were observed in the deepwater areas of pools or glides, where we documented consistently large schools of Sacramento pikeminnow (*Ptychocheilus grandis*), hardhead (*Mylopharodon conocephalus*), and Sacramento sucker (*Catostomus occidentalis*).



Figure 4. Juvenile Chinook salmon captured (and released) in the Napa River near Yount Mill Road. (May 12, 2007)

Average densities of juvenile salmon ranged from about 15-20 fish per riffle/run sequence in the upstream sections of the survey to about 20-30 fish per riffle/run sequence near the downstream end. The higher densities we observed in downstream reaches coupled with the silvery appearance of most fish suggests that active outmigration was occurring at the time of survey. Based on favorably mild hydrologic conditions during the incubation period (January – March) and the high number of juvenile salmon observed in late spring, it appears that reproductive and early rearing success for the 2006 cohort was relatively high.

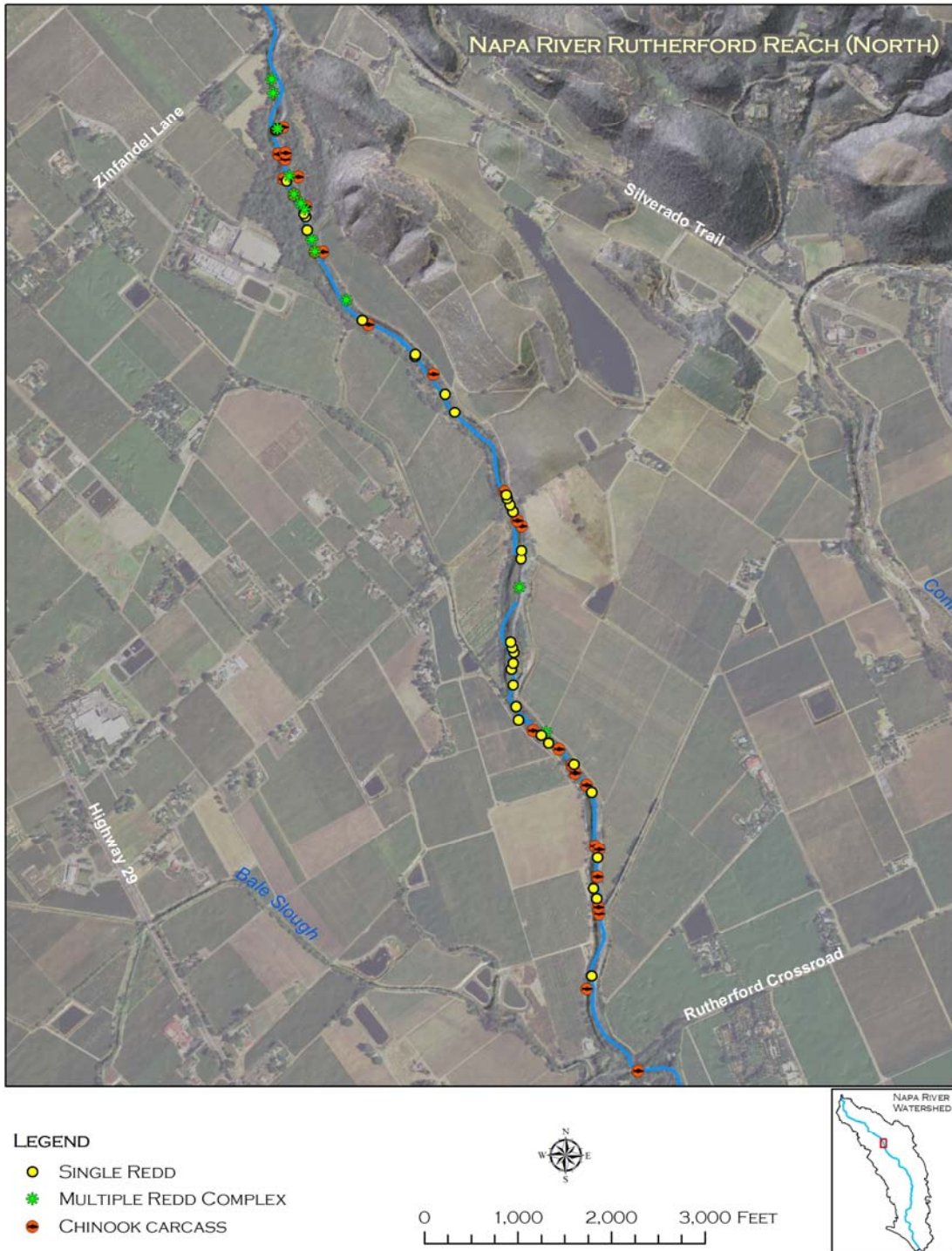


Figure 5. Chinook spawning redd locations on the Napa River between the Zinfandel Lane Bridge and the Rutherford Crossroad Bridge. Note the high density of redds and multiple redd complexes at northern end of this reach, which is likely due to limited passage at Zinfandel Lane Bridge.

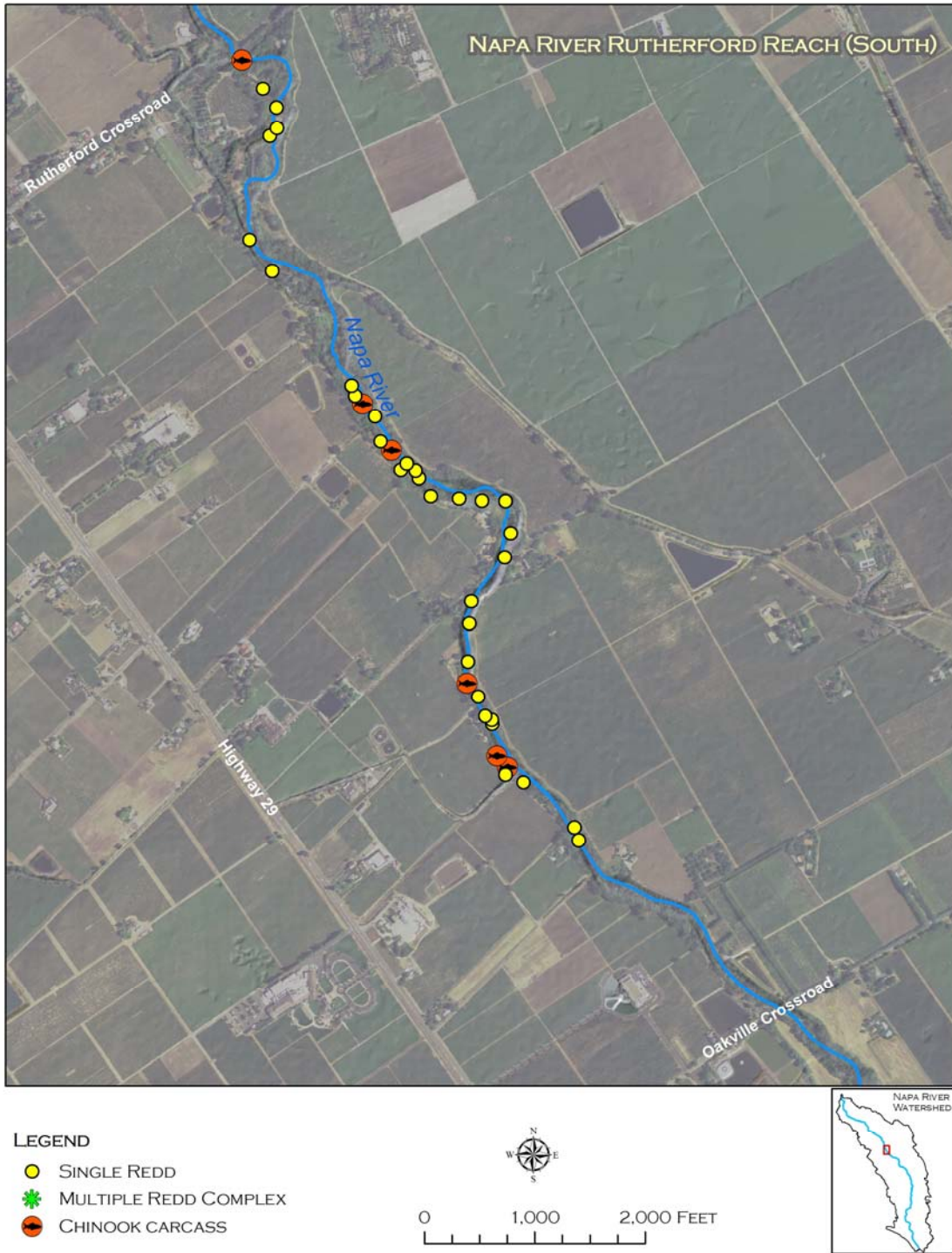


Figure 6. Chinook spawning redd locations on the Napa River between the Rutherford Crossroad and the Oakville Crossroad.

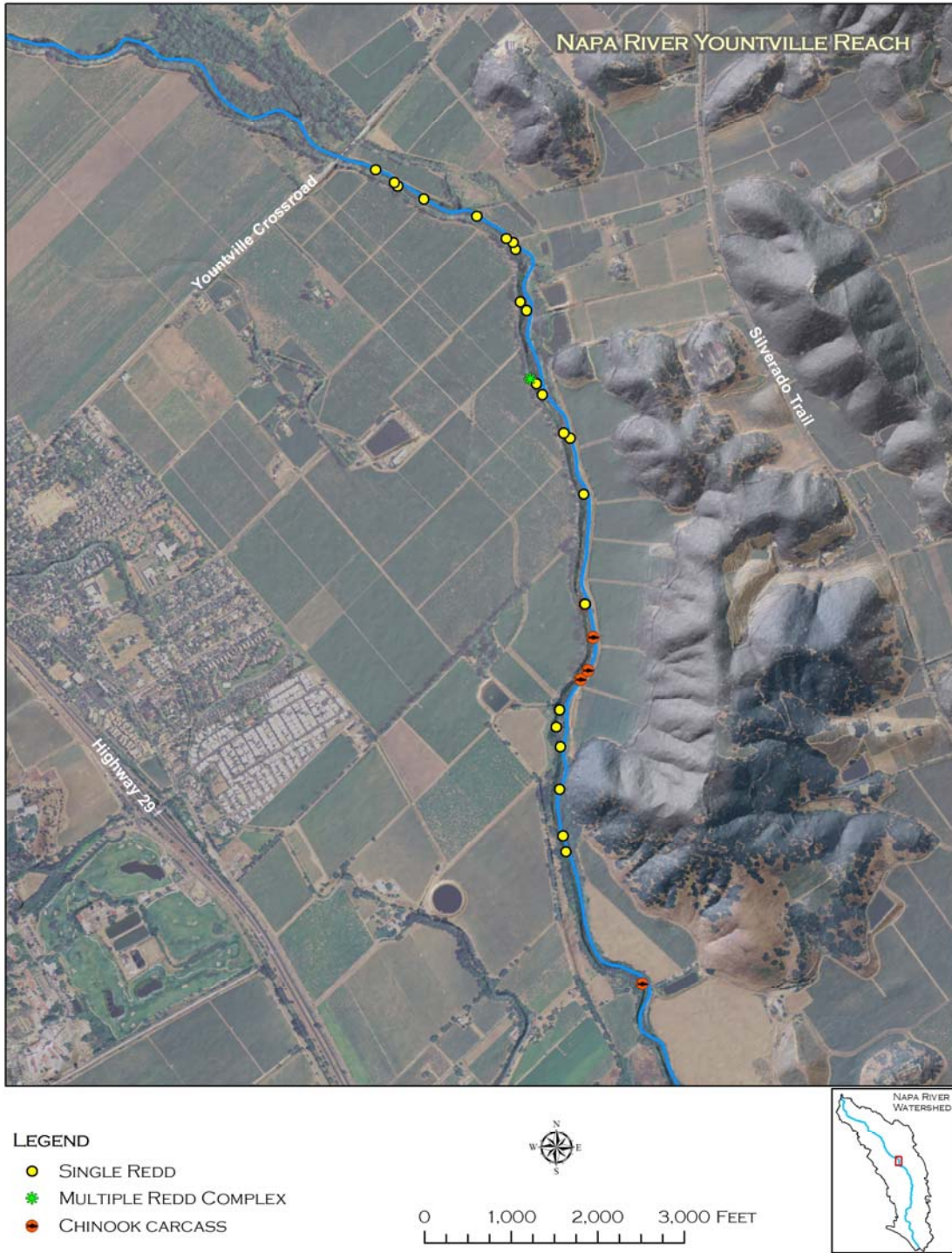


Figure 7. Chinook spawning redd locations on the Napa River downstream of Yountville Crossroad.



Figure 8. Female Chinook salmon carcass (unspawned) recovered in the Napa River near Yountville Crossroad. (December 1, 2006)



Figure 9. Collecting a tissue sample for genetic analysis from a decaying salmon carcass. (January 5, 2007)



Figure 10. Female Chinook salmon freshly killed, presumably by a coyote observed by the field crew. Note eggs on the ground near the carcass. (December 5, 2006)



Figure 11. Typical male Chinook salmon carcass. (December 20, 2006)

CONCLUSIONS AND RECOMMENDATIONS

It is difficult to determine the current population status of Chinook salmon in the Napa River basin given the limited data available. Based on our juvenile and adult surveys, it appears that a reproducing, broadly dispersed, population of Chinook salmon is now established in the Napa River basin, and that there is sufficient habitat available in the mainstem and lower reaches of several large tributaries to support this small run of fish.

Further monitoring efforts, including quantitative measurements of smolt production, are needed to examine long-term trends and spawning success of Chinook salmon in the Napa River. This monitoring strategy should include the following components:

- Continue annual spawner surveys using established protocols in the Rutherford reach and other reaches as landowner permission allows.
- Conduct outmigrant trapping in the mainstem Napa River to generate smolt production estimates and details on smolt size and timing.
- Continue collecting genetic data, specifically SNP information, which can be used to gauge spawning success and life history details that are currently unknown.
- Expand the geographic scope of spawner surveys to include 5-10 additional miles of the Napa River between St. Helena and Calistoga.
- If outmigrant trapping is not funded, continue annual snorkel surveys in spring within the established sampling reaches.

REFERENCES

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APPENDICES

APPENDIX A: SALMON SPAWNER SURVEYS

CALIFORNIA SALMONID STREAM HABITAT RESTORATION MANUAL FISH SAMPLING METHODS IV-7

California Dept. of Fish & Game

Salmon spawner surveys (also called salmon carcass surveys) are stream bank or above-water surveys. Surveyors usually walk along the stream bank and record the number of spawned salmon carcasses, redds, and live adults. This information is useful to:

- Determine if adults are returning to and spawning within a stream reach or basin area;
- Determine which species or races are utilizing the sample area;
- Determine relative abundance and distribution of carcasses, redds or live fish within a sample area;
- Recover and record marked fish for mark studies;
- Identify preferred spawning habitat area.

Stream flow conditions can alter the timing and distribution of spawning activity from one year to the next. For annual *comparison of data it is recommended that weekly surveys be conducted throughout the entire potential time range of spawning activity.

Descriptions of spawning distribution within a basin should not rely on carcass counts conducted only during the assumed week of peak spawning. Spawner distribution within a stream system may be different for early versus late spawners.

The typical method for conducting spawner surveys is to walk along the stream bank or wade in the stream counting and recording all carcasses, redds and live fish observed. Carcasses are examined to determine species, sex, and/or missing fins. The fork lengths (FL) of fish are measured from the tip of the snout to middle of the tail to the nearest centimeter (cm). Counted carcasses are either cut in half or marked with a hog ring to eliminate being counted in subsequent surveys. With prior DFG approval, the heads of carcasses with missing adipose (Ad) fins, will be removed and retained for coded-wire-tag (CWT) extraction by DFG. All data is recorded on the Daily Salmon Spawning Stock Survey Field Form as indicated below.

Tools and Supplies Needed

- Thermometer
- Gaff hook, handle marked. in centimeters
- Waders with non-slip soles
- Pencils
- Waterproof field record form
- Waterproof ID tags_ for fish heads (Figure 11)
- Plastic "Ziploc" bags for fish heads
- Machete – and file or hog-ring-pliers and hog rings

- Vest or day pack'
- Polarized glasses
- Stream map to indicate location of spawning activity
- Drinking water and food

Instructions for Completing Daily Salmon Spawning. Stock Survey Field Form

- 1) **Stream** - Print the stream name.
- 2) **T-R-S** - Enter the township, section and range from the USGS quadrangle.
- 3) **Lat** - Latitude of the confluence of the stream determined from a 7.5-minute USGS quadrangle.
- 4) **Long** - Longitude of the confluence of the stream determined from a 7.5-minute USGS quadrangle.
- 5) **Quad** - Name of the USGS 7.5-minute quadrangle containing the confluence of the stream.
- 6) **Drainage** - Print the drainage name.
- 7) **County** - Enter the county in which the stream. is located
- 8) **Starting location** - Enter the starting point of the survey; for example, the confluence with another stream, a highway mileage marker, a bridge, etc.
- 9) **Lat and Long of the starting location** - Taken from a 7.5-minutes USGS quadrangle.
- 10) **Ending Location** - Enter the ending point of the survey; for example, the confluence with another stream, a highway mileage marker, a bridge, etc.
- 11) **Lat and Long of the ending location** - Taken from the 7.5-minute USGS quadrangle.
- 12) **Feet/miles surveyed** - Determine the distance of the survey using a map measurement device and a 7.5-minute USGS quadrangle. If the distance surveyed was measured using a hip chain, enter the distance in feet.
- 13) **Date of survey** - Enter the day's date: nm/dd/yy.
- 14) **Weather,-** Make a check mark to indicate weather conditions: clear, overcast, rain. If weather conditions change during the survey, note this in the remarks section at the end of the page.
- 15) **Water clarity** -Estimate water clarity at the beginning of the survey. If water clarity changes during the survey, note this in the remarks section at the end of the page.
- 16) **Water temperature** -Water temperature is taken in degrees Fahrenheit at the beginning of the survey.
- 17) **Air temperature** - Air temperature is to be taken in degrees Fahrenheit- at the beginning of the survey.
- 18) **Time** - Time when temperatures were taken.
- 19) **Crew** - Enter the names of the persons doing the survey.
- 20) **Number of live fish observed** - Enter the number of live chinook adults, chinook jacks (< 55 cm FL), coho, and steelhead observed. Identification of live fish can be very difficult. If positive identification is not possible, record the fish as an unknown.
- 21) **Number of carcasses examined** - Identify all carcasses to species and sex. Measure fork length in centimeters and record on the form. Examine all carcasses for adipose fin clips or any other fin clip. Mark all the carcasses using hog rings or cut carcasses in half after examination.
- 22) **Tag number of adipose-clipped fish and snout recoveries** - All carcasses must be examined for adipose fin clips. If the adipose fin is missing, the carcass may contain a CWT and the snout must be cut off and retained. Remove the snout by cutting across the head in the vicinity of the eyes; cut straight down from the eyes through the upper jaw and into the mouth cavity. Remove the snout in one piece. If unsure of the removal procedure; take the entire head. It is important not to lose the tag due to an improper cut. The project name, the recovery location, the species, length and sex of the fish, date and other relevant information must be recorded on a tag and wired to the snout. The project name will be recorded on the tag for later reference. The

snout or head must be frozen in a zip-lock bag and taken to DFG, where the coded-wire tags will be excised and decoded. Snouts must be individually bagged.

23) **Other fin clips observed** - Record any fin clips observed other than adipose fins.

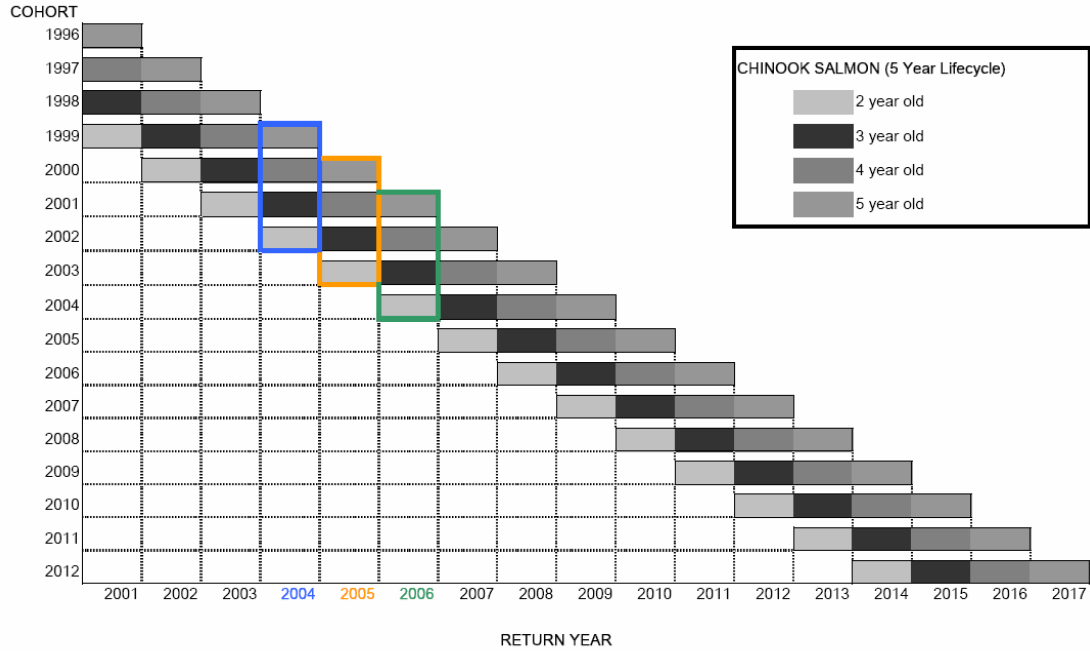
24) **Number of skeletons observed** - Any fish that cannot be measured, or any identifiable parts of fish found are considered skeletons.- If it is possible to identify the species, record it appropriately; if not, record it as unknown.

25) **Number of redds observed** - Record the number and location of observed redds. This can be difficult in areas of heavy spawning due to multiple redds and superimposition of redds.

26) **Remarks** - Add any, information discovered during the. survey such as barriers, landslides, etc. Include any information necessary to clarify other entries on the field form.

Salmon CWT Recovery Tag			
Tag No.			
Project			
Location:			
Lat			
Long			
Species			
Race	Fall	Win	Spr
Sex	M	F	U
Recovery method			
Date			

APPENDIX B: Chinook Salmon Return Year Diagram



Chinook salmon return-year diagram depicting typical age class structure for returning adults. Salmon observed during the 2006 spawning year were comprised of fish from the 2001 through 2004 cohorts.

APPENDIX C: Spawner Survey Details

	SURVEY 1	SURVEY 2	SURVEY 3	SURVEY 4	SURVEY 5	SURVEY 6	SURVEY 7	SURVEY 8	SURVEY 9
Date	12/1/2006	12/5/2006	12/7/2006	12/15/2007	12/18/2006	12/20/2006	1/3/2007	1/5/2007	1/12/2007
Stream	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River
Start time	9:10 AM	9:00 AM	9:15 AM	12:55 PM	10:00 AM	9:20 AM	9:00 AM	1:40 PM	11:15 AM
End time	12:10 PM	11:10 AM	11:25 AM	4:00 PM	1:20 PM	12:35 PM	11:00 AM	4:10 PM	1:15 PM
Drainage	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River	Napa River
County	Napa County	Napa County	Napa County	Napa County	Napa County	Napa County	Napa County	Napa County	Napa County
Start location	Mondavi Vnyds (pump)	Oakville x-rd	Rutherford x-rd	Mondavi Vnyds (pump)	Oakville x-rd	Rutherford x-rd	Oakville x-rd	Rutherford x-rd	Rutherford x-rd
End location	Yountville x-rd.	Rutherford x-rd	Zinfandel Lane	Yountville x-rd	Rutherford x-rd	Zinfandel Lane	Rutherford x-rd	Zinfandel Lane	Zinfandel Lane
Start latitude	38.39213	38.44664	38.46452	38.39213	38.44664	38.46452	38.44664	38.46452	38.46452
Start longitude	-122.33941	-122.38222	-122.41202	-122.33944	-122.38222	-122.41202	-122.38222	-122.41202	-122.41202
End latitude	38.41825	38.46452	38.49512	38.41825	38.46452	38.49512	38.46452	38.49512	38.49512
End longitude	-122.35191	-122.41202	-122.42582	-122.35191	-122.41202	-122.42582	-122.41202	-122.42582	-122.42582
Survey Distance (feet)	12302	12110	12724	12302	12110	12724	12110	12724	12724
Survey Distance (miles)	2.33	2.29	2.41	2.33	2.29	2.41	2.29	2.41	2.41
Weather	clear	clear	clear	overcast	clear	overcast	overcast / light rain	clear	clear
Water clarity	> 4 ft.	> 4 ft.	> 4 ft.	2-4 ft.	> 4 ft.	> 4 ft.	> 4 ft.	> 4 ft.	> 4 ft.
Air temp (c)	9	10	8.5	15	8.5	3	N/A	11	7
Water temp (c)	7	10.5	7	12.5	7	6	N/A	9	6
Crew:	Jonathan Koehler, Chad Edwards	Jonathan Koehler, Chad Edwards	Jonathan Koehler, Chad Edwards, Shannon Fiala	Jonathan Koehler, Chad Edwards	Jonathan Koehler, Chad Edwards	Jonathan Koehler, Chad Edwards, Mike Napolitano, Anna Holder	Jonathan Koehler, Chad Edwards	Jonathan Koehler, Chad Edwards	Jonathan Koehler, Chad Edwards