UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Turlock Irrigation District	)	
	)	
and	)	Project No. 2299
	)	
Modesto Irrigation District	)	

2008 LOWER TUOLUMNE RIVER ANNUAL REPORT

Report 2008-5

2008 Snorkel Report and Summary Update

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and

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SUMMARY

In 2008, an "early summer" snorkel survey was conducted on 17-19 June within a 20-mile reach of the Tuolumne River below La Grange Dam. Preliminary USGS flow at La Grange was about 92-107 cfs and water temperature ranged from 12.1°C (53.8 F) to 26.6°C (79.9 F). A total of 43 juvenile Chinook salmon and 232 rainbow trout were observed in various habitats. Chinook salmon were observed downstream to Riffle 3B (River Mile or "RM" 49.1) and rainbow trout downstream to Riffle 21 (RM 42.9). Other native fish species observed were Sacramento sucker, Sacramento pikeminnow, hardhead, and riffle sculpin with the non-native species recorded being largemouth bass, smallmouth bass, redear sunfish and bluegill.

Early summer surveys conducted in June/July have been done in most years since 1986 except in years with high flows (1995, 1998, 2005, 2006) that precluded the surveys. In 1986 rainbow trout were observed at Riffle 4B (RM 48.4). From 1987 to 1995 rainbow trout were mostly absent during the surveys. Higher numbers of rainbow trout were observed beginning in 1996 and they were often observed downstream to Riffle 23C (RM 42.3). Some Chinook salmon were observed in all surveyed years of the 1986-2008 period except 1991, 1992 and 1994. Chinook salmon were also commonly observed downstream to R23C (RM 42.3) similar to rainbow trout.

Summer distribution of non-salmonid species (species other than trout or salmon) also changed starting in 1996. Prior to then, warmwater species (e.g. common carp, goldfish, catfish species, and sunfish species) were commonly observed, even upstream to Riffle 2 (RM 49.9). After that these species were observed less frequently and typically only further downstream. The change in species distribution coincided with higher required summer flows and associated cooler water temperatures occurring in non-flood release years.

CONTENTS

1 INTRODUCTION

The Turlock and Modesto irrigation districts (Districts) Tuolumne River snorkel surveys began in 1982 and the number, location, area sampled by site and season having varied over the years. The surveys done in 1982-87 were in limited locations and in varying seasons. A June/July snorkel survey has often been done since 1986 to evaluate the abundance, size, and distribution of salmonids and other fish species in "early summer" when required flow releases are less than in other seasons and is after the primary outmigration period of juvenile salmon. "Summer" surveys during June through September have been conducted in most years since 1988, although very wet years with high summer flows were not sampled. The surveys in 1988-1994 were part of the Districts' "summer flow" studies while those since 1996 were part of the Don Pedro Project FERC monitoring program. A total of 12 sites per survey have been done since 2001 and a comparable September snorkel survey was done in 2001-2007 when feasible.

Locations were selected to include a range of habitat types (i.e., riffles, runs, pools) at sites where salmonids may occur and are spaced at intervals down the river in general areas of suitable access. The overall river section examined is limited to the reach with suitable underwater visibility, this generally being about a 20-mile section from La Grange Dam downstream to near Waterford, although one site near River Mile (RM) 25 was sampled in 1988-93. The Districts had environmental consultant Stillwater Sciences conduct the 2008 snorkel survey.

1.1 2008 STUDY SITES

The area studied was the Tuolumne River from La Grange Dam (river mile [RM] 52.0) to Hickman Bridge (RM 31.5) (Fig. 1). A total of twelve sites sampled are listed below. Riffle names are interchangeably designated with a "R" in this report (i.e. R21 = Riffle 21).

Site	Location	River Mile[a]
1	Old La Grange Bridge (Riffle A7)	50.7
2	Riffle 2	49.9
3	Riffle 3B	49.1
4	Basso Bridge (R5B)	47.9
5	Riffle 7	46.9
6	Zanker Farm (R13B)	45.5
7	Bobcat Flat (R21)	42.9
8	Tuolumne River Resort (R23C)	42.3
9	7/11 Gravel (R31)	38.0
10	Santa Fe Gravel (R35A)	37.1
11	Deardorff Farm (R41A)	35.3
12	Hickman Bridge (R57)	31.5

[a] derived from topographic maps as distance from confluence with the San Joaquin River

1.2 2008 SAMPLING CONDITIONS

The flow at La Grange during 17-19 June was about 92-107 cfs (Fig. 2). Water temperature ranged from 12.1 °C (53.8 °F) at Riffle A7 on 17 June to 26.6 °C (79.9 °F) at Riffle 57 on 19 June.

2 METHODS

Underwater observations were conducted using an effort-based method where a snorkeler examined within a specified area for a given period of time and recorded the species, numbers, and size estimates of fish observed. A combination of different habitat types was observed, including riffles, runs, and pools. The overall river section examined is limited to the reach with suitable underwater visibility, this generally being a 20-mile section below La Grange Dam downstream to Waterford. The snorkeling method provided an index of species abundance and these surveys can be referred to as "reference counts".

Each habitat type sampled usually involved one observer who snorkeled the specified habitat area for a certain time period. Whenever feasible, the surveys were conducted moving upstream against the current. A side-to-side (zigzag) pattern was used as the width of the survey section required. Occasionally, two snorkelers moved upstream in tandem, with each person counting fish on their side of the center of the survey section. Whenever possible, the entire width of the habitat section selected was carefully surveyed. The only exceptions were the habitat areas that were too wide to effectively cover. If high water velocity precluded upstream movement, snorkelers would float downstream with the current, remaining as motionless as possible through the study area, although stream margins at those sites would still be viewed in an upstream direction.

Usually the total length of an observed fish was estimated using a ruler outlined on the diving slate to the nearest 10 mm. For some larger fish, the lengths may be estimated by viewing the fish in reference to adjacent objects and then measuring that estimated length. In cases where larger numbers of fish are observed, the observer estimated the length range and number of fish in the group. Care was taken to observe and count each fish just once in the survey area.

Other data recorded for each location included water temperature, electrical conductivity, turbidity, and horizontal visibility. Site-specific data that was recorded included area sampled, average depth, sample time, general habitat type, and substrate type.

3 RESULTS AND DISCUSSION

Survey conditions and fish observations from the snorkel survey conducted on 17-19 June are summarized in Table 1. The six native fish species observed were characteristic of the lower elevation zone adjacent to the Sierra foothills. These species were Chinook salmon, rainbow trout, Sacramento sucker, Sacramento pikeminnow, hardhead, and riffle sculpin. The introduced (non-native) species observed were largemouth bass, smallmouth bass, redear sunfish and

bluegill. Chinook salmon were observed downstream to R3B (RM 49.1) and rainbow trout to R21 (RM 42.9).

There were 43 juvenile Chinook salmon observed in riffle and run habitats at RA7 (RM 50.7) and R3B (RM 49.1) and they ranged in size from 50-90 mm total length (TL). A total of 210 juvenile (<150 mm TL) and 22 adult rainbow trout were observed between RA7 (RM 50.7) and R21 (RM 42.9). Water temperature at those locations ranged from 12.1 ºC (53.8 F) to 21.9 ºC (71.4 F) The rainbow trout ranged in estimated size from 50-480 mm TL and were seen in riffle, run, and pool habitats. Sacramento sucker, Sacramento pikeminnow (and hardhead downstream from RM 45.5 only) were mostly co-occurring while riffle sculpin were observed at 4 locations in low numbers usually hidden under cobble/boulder substrate.

Introduced species were observed from R5 (RM 47.9) downstream to Hickman Bridge (RM 31.5). Largemouth and smallmouth bass co-occurred in three sites and predominately in run habitat. Bluegill or redear sunfish were observed only at two downstream sites from R35A (RM 37.1) to Hickman Bridge (RM 31.5).

4 COMPARISON WITH OTHER YEARS

4.1 Rainbow trout and Chinook salmon: 1982-2008

Tables 2 & 3 summarize rainbow trout and Chinook salmon observations for all snorkel surveys conducted between 1982 and 2008. Some rainbow trout were observed downstream to R5 (RM 48.0) in limited surveys from 1982 to 1986. Rainbow trout were almost entirely absent during 1987 to 1995 surveys. Beginning in 1996 the number and distribution of rainbow trout increased and they were always observed since 1998 downstream to RM 42.9 or RM 42.3. For the 1982-2008 period, Chinook salmon were recorded in all years except 1991 and 1992 although in some years their counts were very low after May. Chinook salmon were also commonly seen downstream to about RM 42.9. Figures 3 & 4 graphically represent Tables 2 & 3 for the June-September period, only. Dates and locations where rainbow trout and Chinook salmon were observed for the same period are in Figs. 5 & 6.

June/July Surveys

The numbers of rainbow trout and Chinook salmon observed during the 1986 to 2008 period were graphed by location for the June/July surveys (Figs. 7 & 8). The observation of rainbow trout downstream of R23C (RM 42.3) was rare. The only years when they were seen in this section were 2000 and 2007. They were commonly observed in the upper 10 miles of river below the La Grange Dam. This was similar to the distribution of Chinook salmon although Chinook were occasionally seen as far downstream as Charles Road (RM 24.9). Large numbers of Chinook salmon (>100) were more commonly observed than rainbow trout.

August/September Surveys

The number of rainbow trout and Chinook salmon observed during the 1982 to 2007 period were graphed by location for the August/September surveys (Figs. 9 & 10). Rainbow trout were commonly observed in all years since 2001 when September surveys began. Chinook salmon were observed less frequently during this period and had a greater decline in numbers than rainbow trout when compared to June/July reference counts.

4.2 Recent surveys: 2001-2008

The locations sampled since 2001 were the same each year and these surveys were the most comparable. June surveys were conducted in all years except 2005 and 2006 when high flows precluded them. Rainbow trout counts increased from 2001 to 2005 and were much higher beginning in 2006 (Fig. 11). Chinook salmon reference counts (Fig. 12) in June were much higher during in 2001-2004, but were low in September surveys. Although June surveys weren't done in 2005 and 2006, the salmon numbers were lower in 2007 and 2008. The reduction in juvenile salmon counted in 2005-2008 appears related to much fewer adult spawners during the preceding fall of 2004-2007.

4.3 Other species observed: 1986-2008

The distribution and abundance of non-salmonid fish species observed during the summer snorkel surveys has changed over time. Prior to 1996, more introduced warmwater species were commonly seen with goldfish, common carp, brown bullhead, white catfish, and various sunfish species usually observed (Table 4). After 1996 these species were often absent at upstream sites or observed in lower numbers. The change in species distribution of warmwater species appears to be associated with higher minimum summer flow releases.

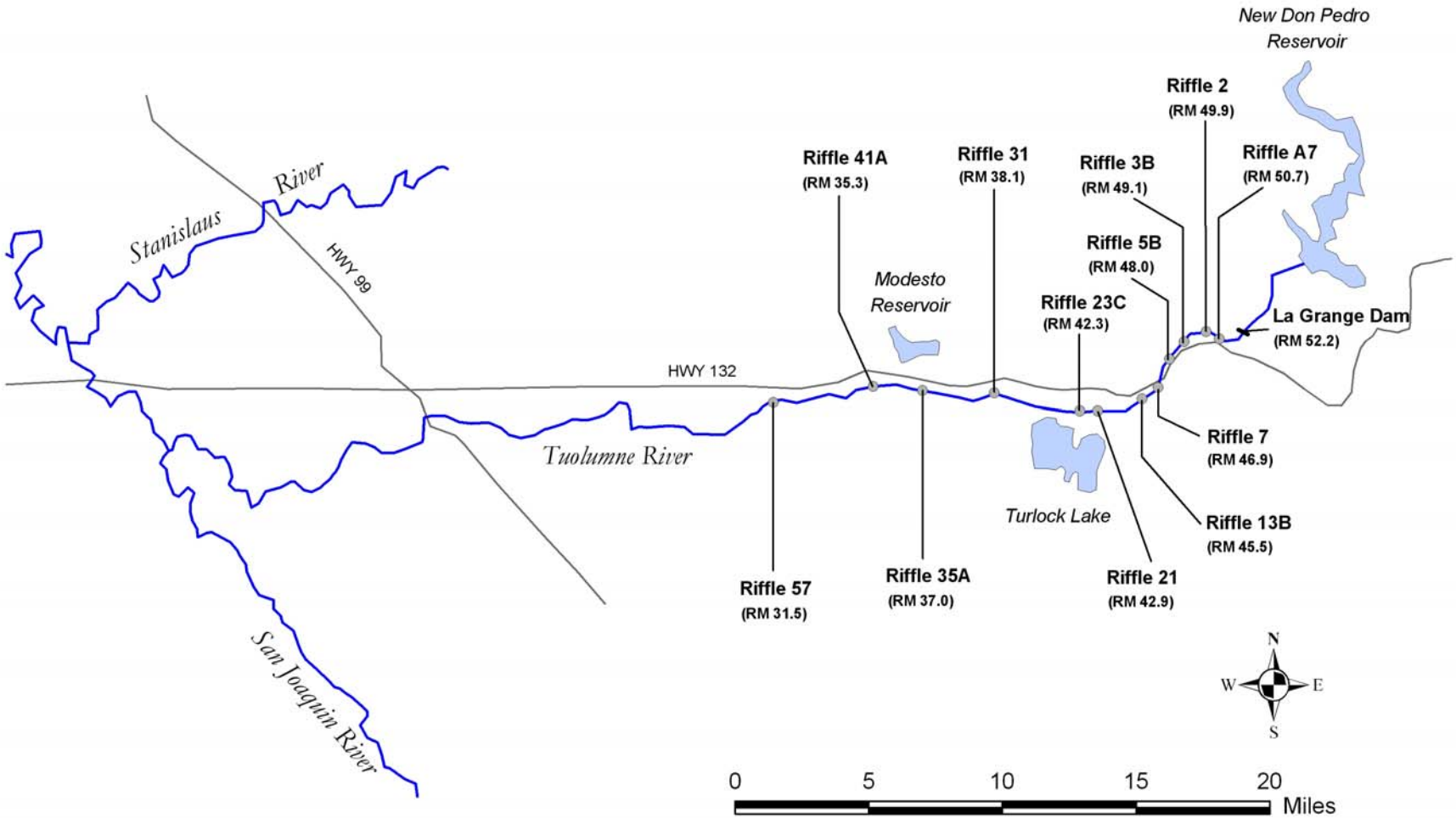

Figure 1. Locations of snorkel survey sites on the lower Tuolumne River, 2008.

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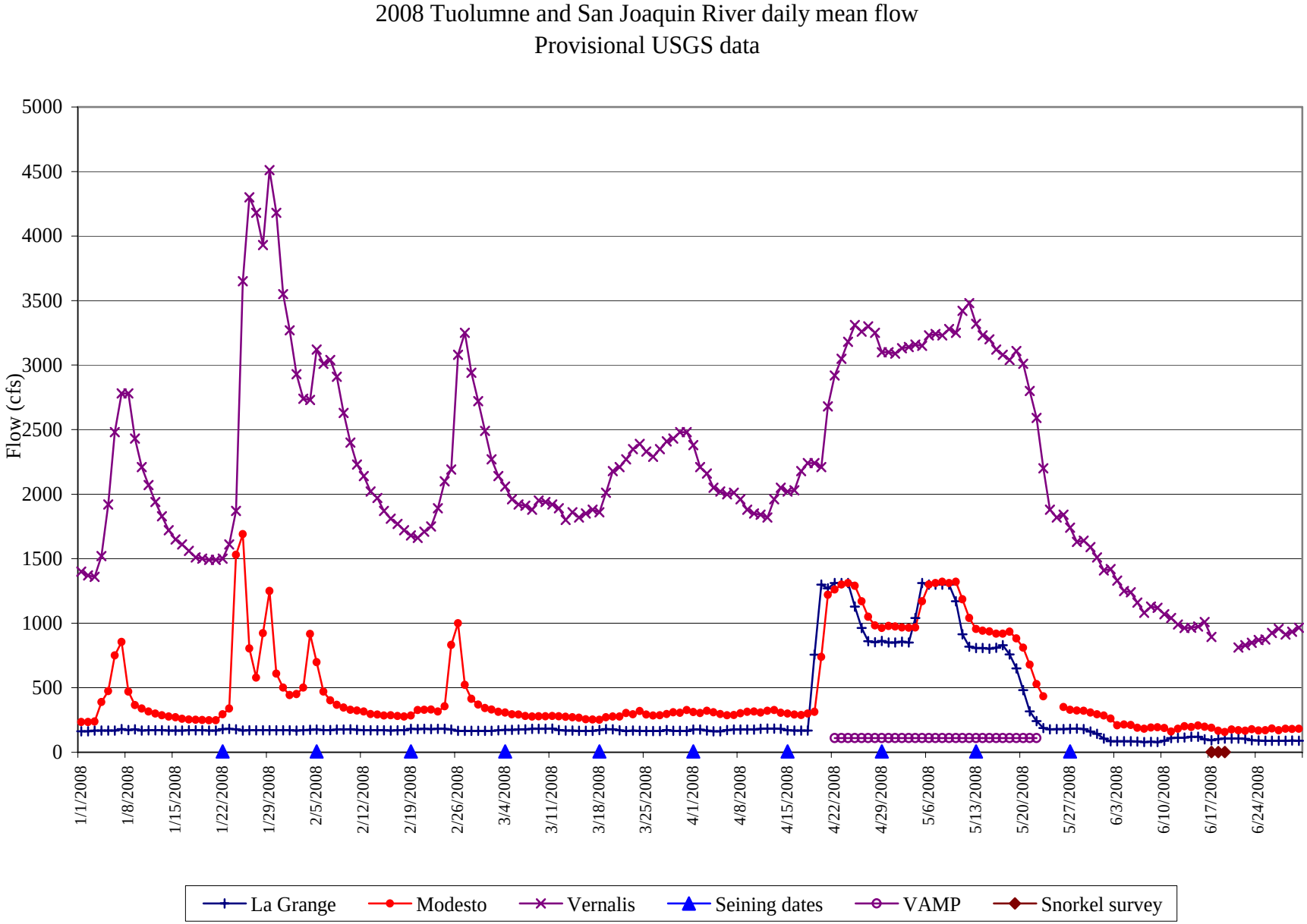


Figure 2. 2008 Tuolumne and San Joaquin River flows.

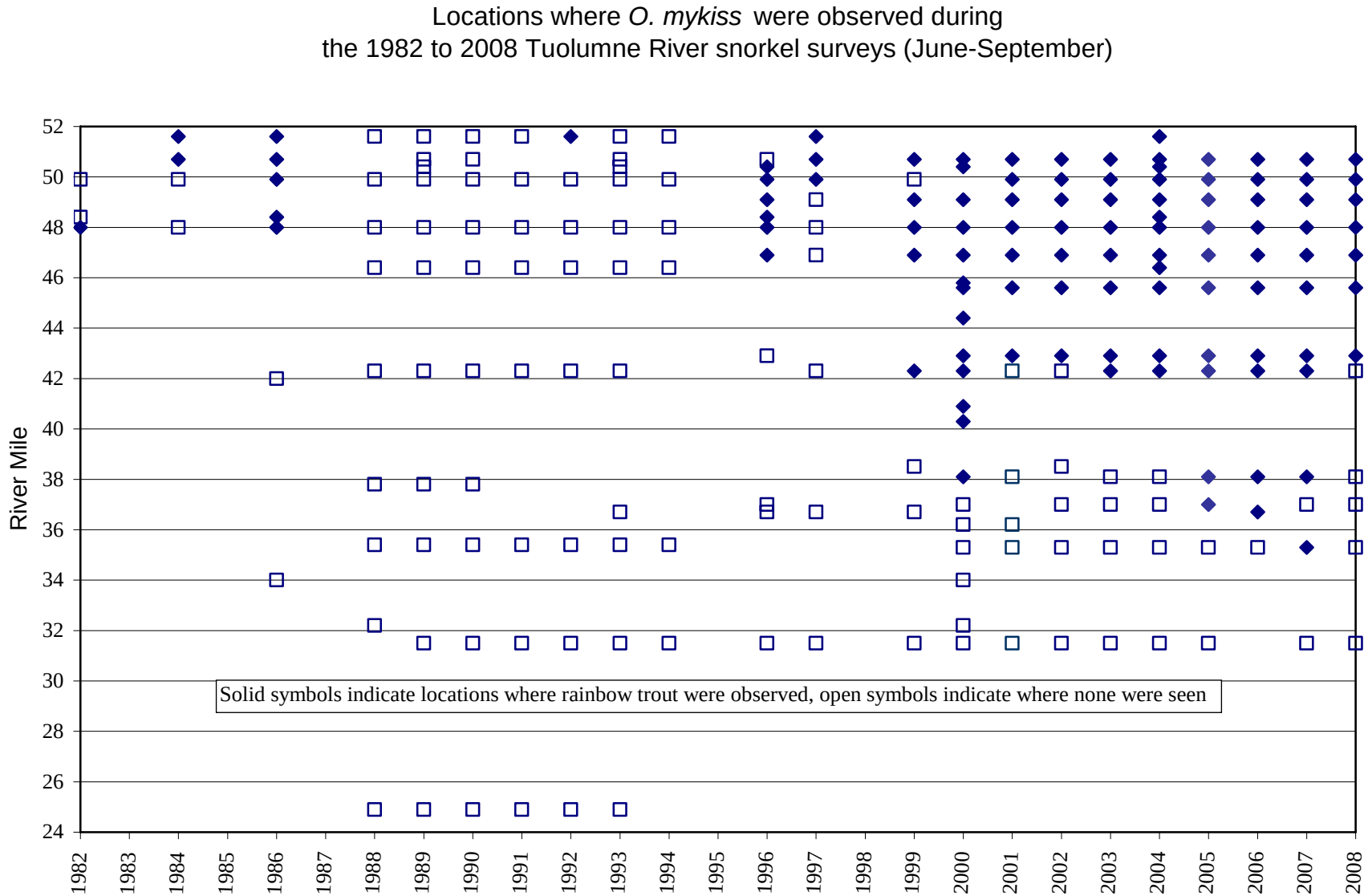


Figure 3. Locations where *O. mykiss* were observed.

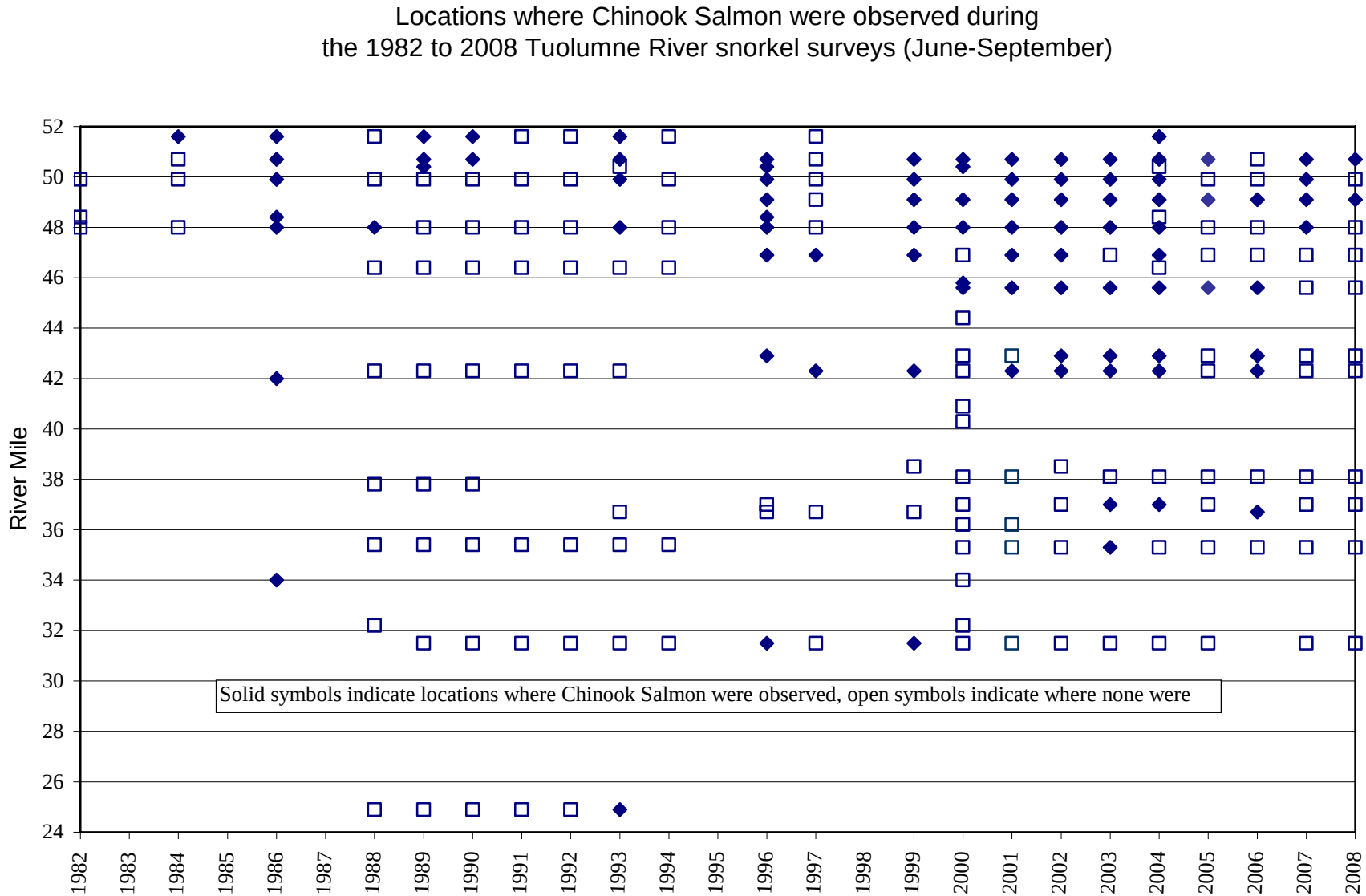


Figure 4. Locations where Chinook salmon were observed.

Figure 5. Dates and locations when *O.mykiss* were observed during the 1982 to 2008 Tuolumne River snorkel surveys

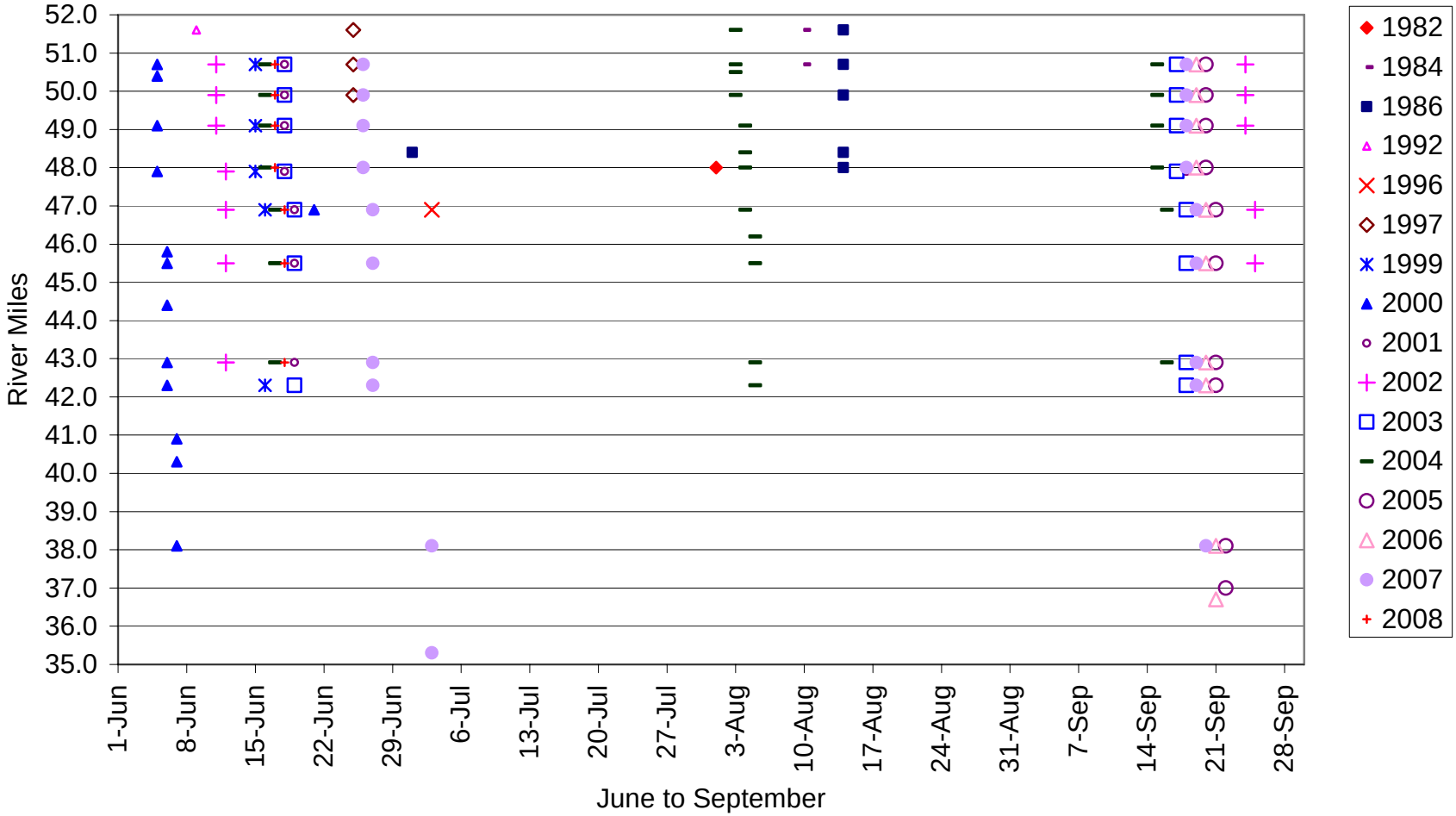


Figure 6. Dates and locations when Chinook Salmon were observed during the 1984 to 2008 Tuolumne River snorkel surveys

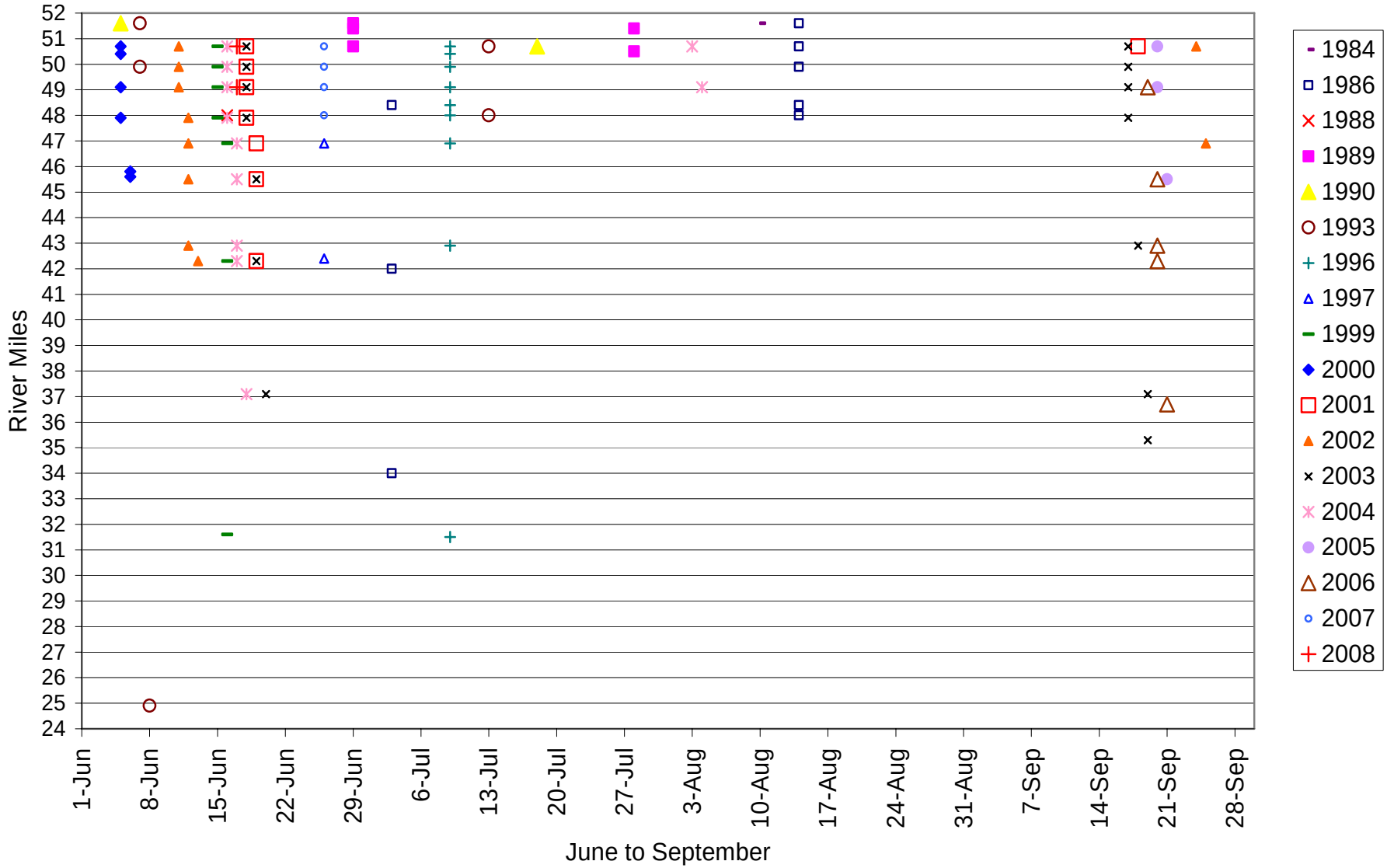


Figure 7. Number of *O. mykiss* observed, by location, during the 1986 to 2008 Tuolumne River June/July snorkel surveys

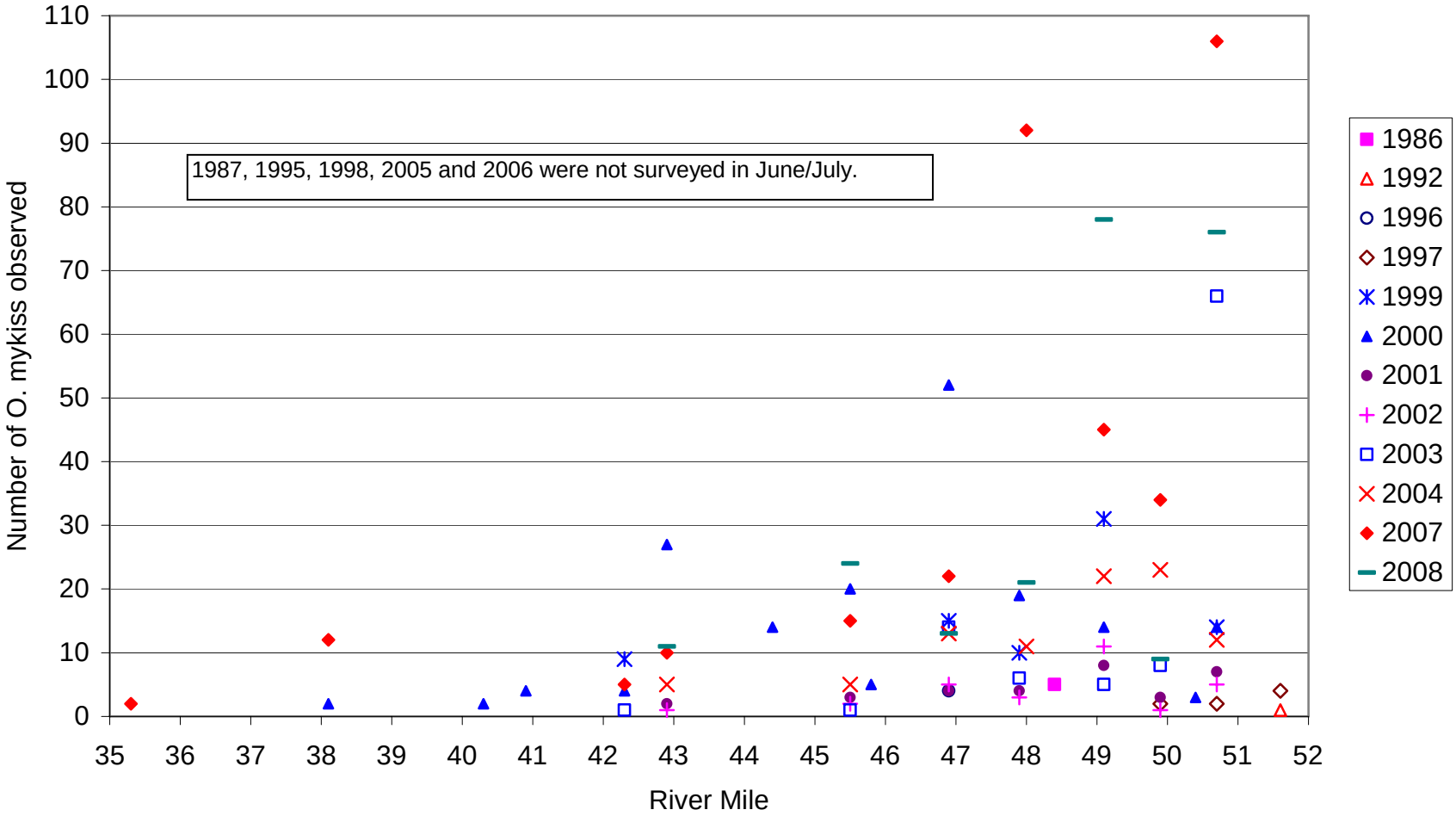


Figure 8. Number of Chinook Salmon observed, by location, during the 1986 to 2008 Tuolumne River June/July snorkel surveys

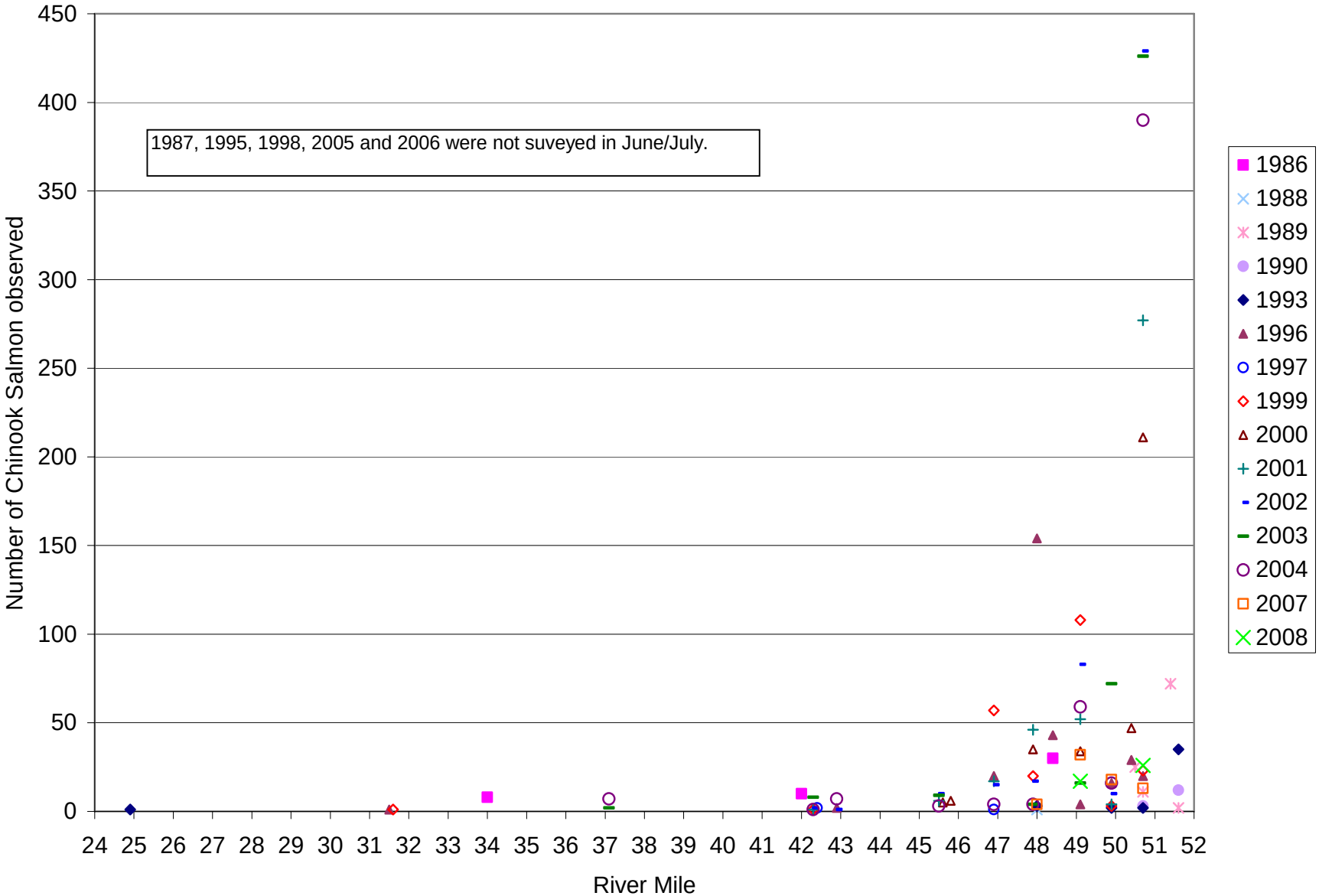


Figure 9. Number of *O. mykiss* observed, by location, during the 1982 to 2007 Tuolumne River August/September snorkel surveys

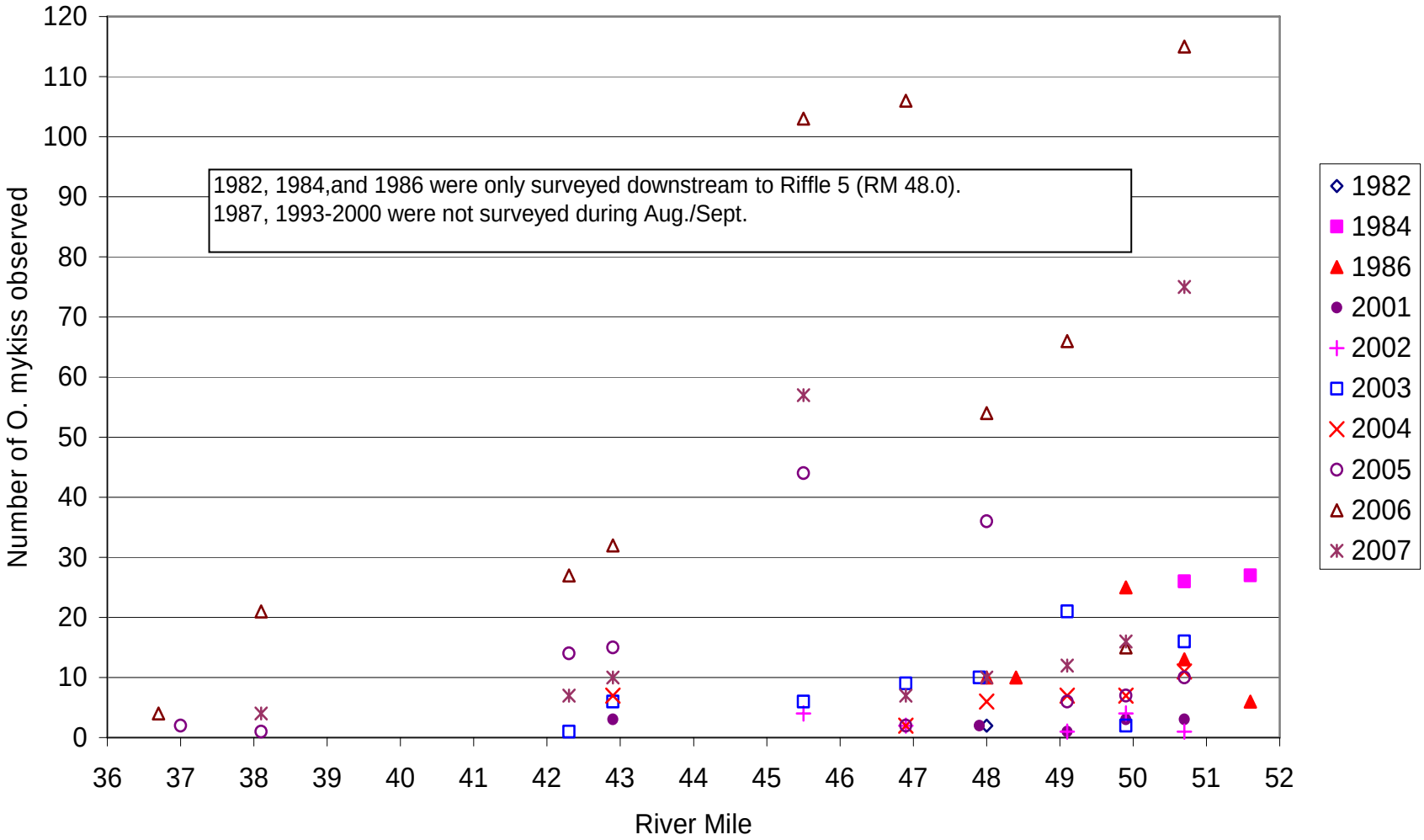
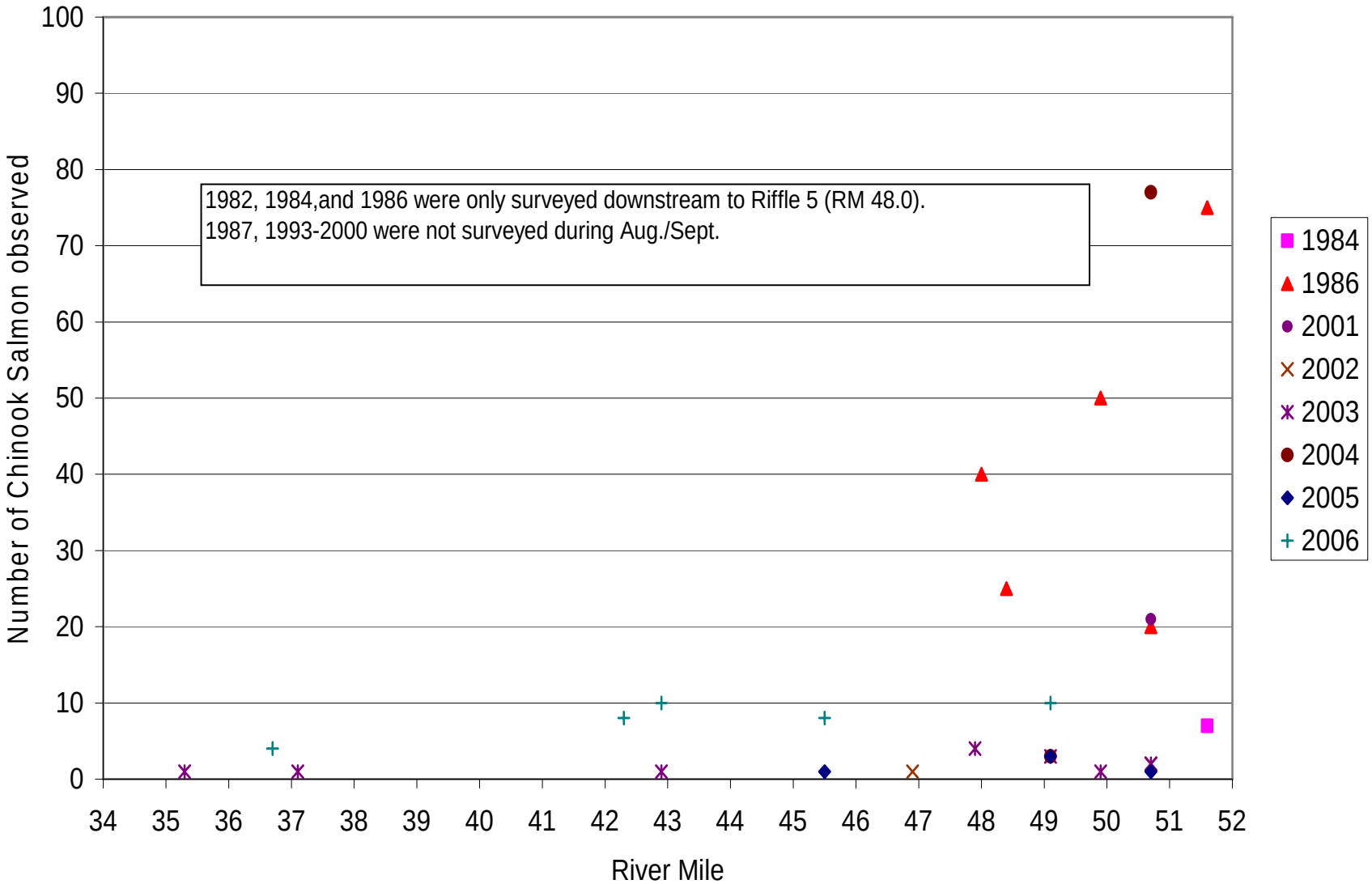


Figure 10. Number of Chinook Salmon observed, by location, during the 1982 to 2007 Tuolumne River August/September snorkel surveys



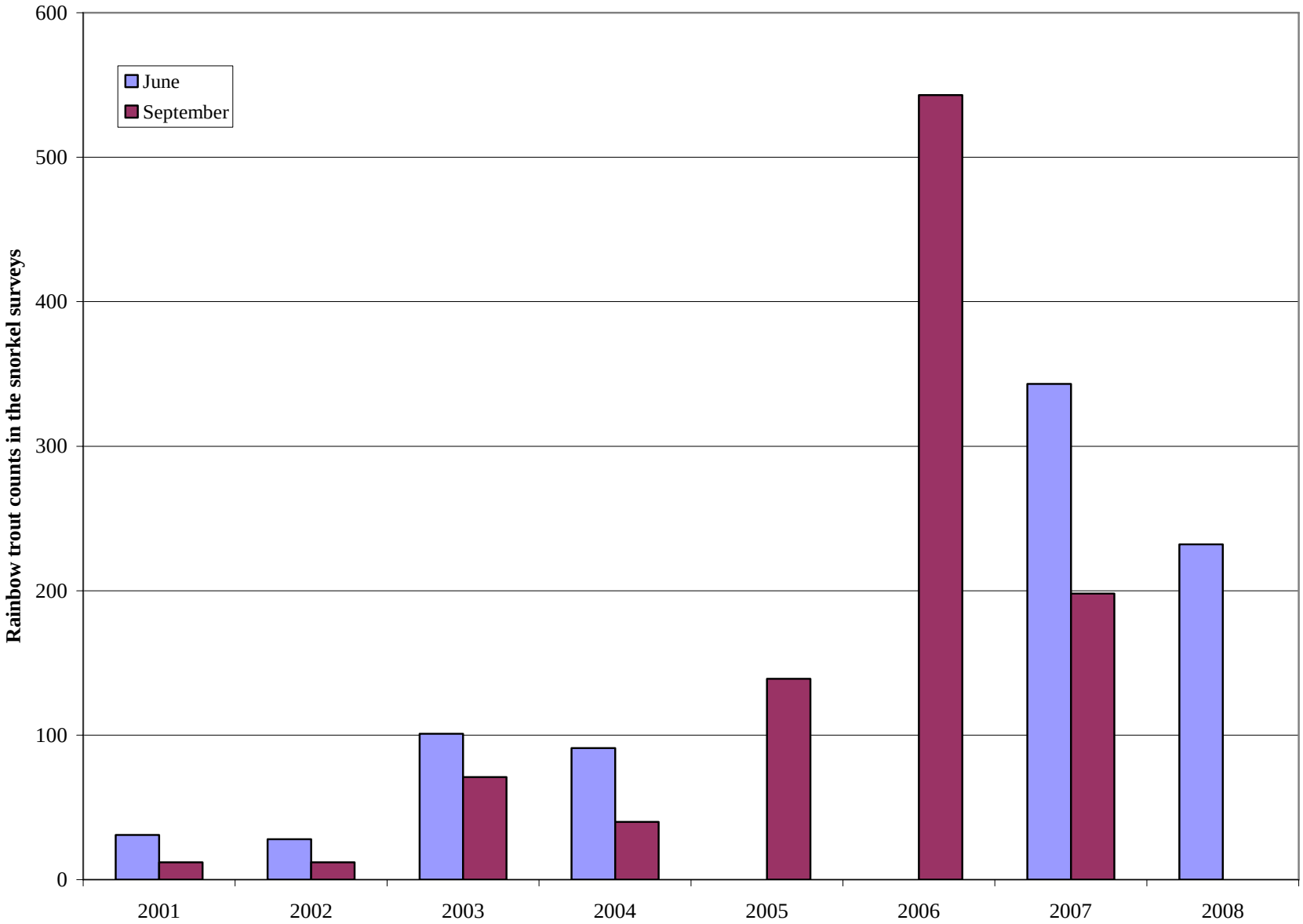


Figure 11. Rainbow trout counts during the June and September snorkel surveys.

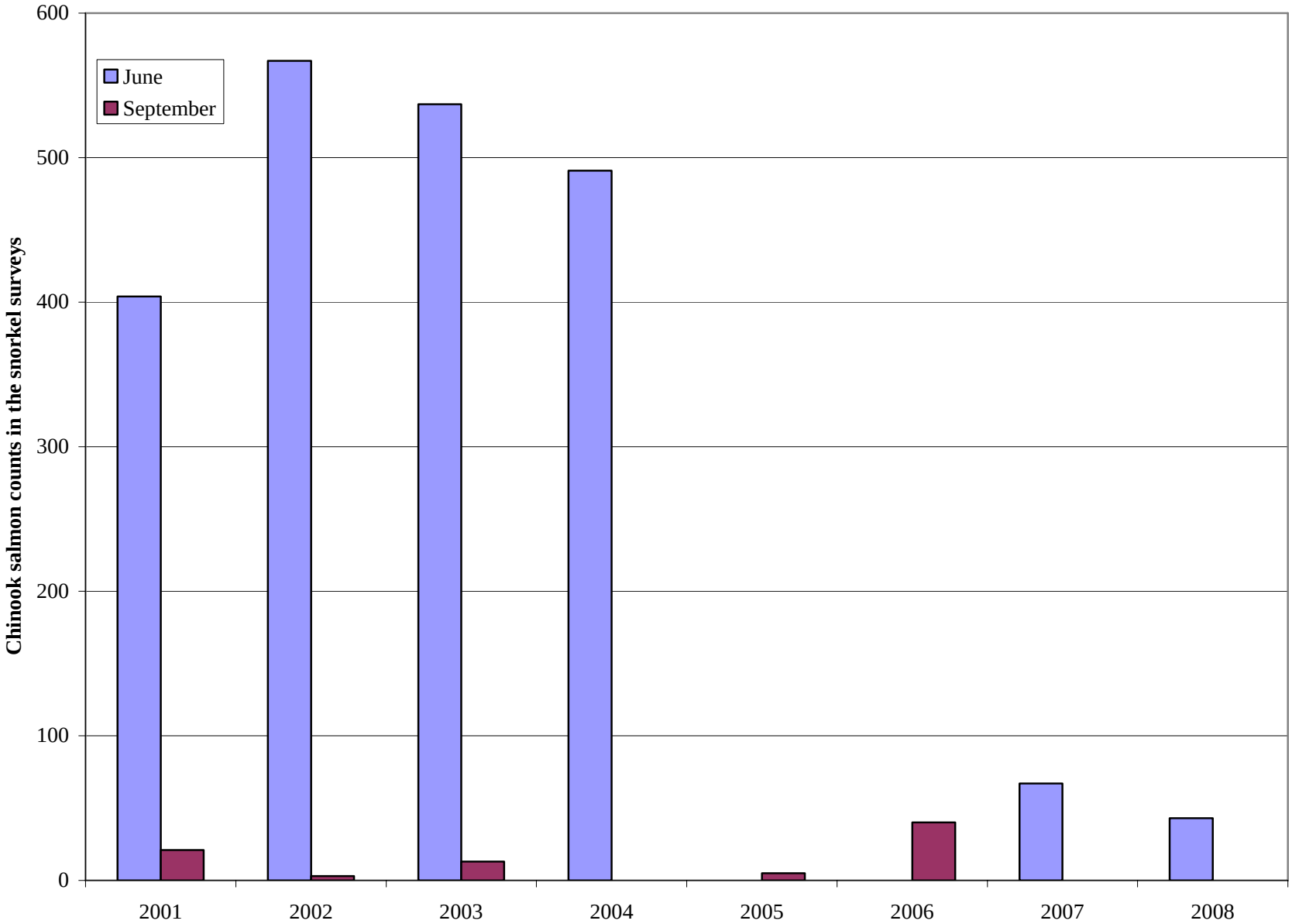


Figure 12. Chinook salmon counts during the June and September snorkel surveys.

TABLE 1. 2008 TUOLUMNE RIVER SNORKEL SUMMARY (TID/MID)

															NUMBER COUNTED (ESTIMATED TOTAL LENGTH OR SIZE RANGE IN MM)										
DATE	START TIME	LOCATION	RIVER MILE	SITE	AREA (Sq. Ft.)	AVG. DEPTH (FEET)	TIME (Min.)	HABITAT	SUBSTRATE	WATER TEMP. (C)	DO (mg/l)	EC	TURB. (NTU)	HORIZ. VISIB. (FEET)	CHINOOK count/est.	CHINOOK size	RAINBOW count/est.	RAINBOW size	(1) SACRAMENTO SUCKER	SACRAMENTO PIKEMINNOW	HARDHEAD	RIFFLE SCULPIN	LARGEMOUTH BASS	SMALLMOUTH BASS	REDEAR OR BLUEGILL SUNFISH
17JUN	0950	Riffle A7	50.7	1	6,000	1.3	22.0	Riffle	cobble,gravel,bedrock	12.1	10.9	38	1.0	20.0	16	(50-60)	42	(50-80)							
	0957			2	4,000	3.5	21.0	Run	cobble,gravel,sand						10	(70-90)	32	(70-120)							
																	2	(425,480)							
17JUN	1115	Riffle 2	49.9	1	6,000	1.2	28.0	Riffle	cobble,gravel,sand	15.2	11.6	38	1.1	18.0					(500,525,550)			(70,80)			
	1135			2	4,800	6.5	23.0	Pool	bedrock,boulder,cobble								1	(90)							
																	4	(300-450)	13(500-800)	(450)					
	1140			3	9,375	4.0	16.0	Run	cobble,sand,bedrock								4	(230-300)	6(500-600)						
17JUN	1336	Riffle 3B	49.1	1	4,400	1.5	23.0	Riffle	cobble,gravel,sand	17.2	11.5	40	1.2	16.0	15	(60-90)	50	(60-100)	(650)			(80)			
																	3	(140,300,320)							
	1335			2	11,500	3.0	24.0	Run-Riffle	cobble,boulder,bedrock						2	(70,80)	25	(70-120)	(300)	(420)		(80)			
17JUN	1447	Riffle 5B	47.9	1	2,400	1.5	16.0	Riffle	cobble,gravel,sand	19.5	12.1	47	1.3	15.0			17	(70-100)	7(500-650)						
																	1	(400)							
	1524			2	12,000	4.0	32.0	Run	cobble,bedrock,sand										20(60-80),6(600-700)	10(60-80)			(110)		
	1449			3	12,000	4.0	20.0	Run-Pool	bedrock,cobble,sand								3	(140,300,320)	12(600-700)	(180),9(300-500)			8(150-250)	6(100-170)	
					72,475		225.0		**Subtotal**						**43**		**184**		**69**	**22**		**4**	**9**	**6**	
18JUN	0950	Riffle 7	46.9	1	5,625	1.3	23.0	Riffle	cobble,gravel,sand	16.5	10.2	42	1.5	14.0			12	(70-140)							
	0950			2	8,000	4.0	24.0	Run	bedrock,cobble,sand								1	(450)	45(500-700)	10(320-700)					
18JUN	1121	Riffle 13B	45.5	1	3,750	1.5	21.0	Riffle-Run	sand,cobble,gravel	20.0	10.2	43	1.2	14.0			9	(70-140)	12(125-150)	25(110-225)	10(110-225)				
	1123			2	3,000	1.5	18.0	Riffle	gravel,cobble,sand								15	(70-120)	(100)	7(70-110)		(70)			
18JUN	1325	Riffle 21	42.9	1	3,750	1.3	20.0	Riffle	cobble,gravel,sand	21.9	10.7	50	N.T.	10.0			11	(70-300)		18(150-280)					
	1328			2	5,400	3.5	18.0	Run-Pool	cobble,sand,vegetation											30(90-160), 20(180-250)	50(90-250)		(90,100)		
18JUN	1445	Riffle 23C	42.3	1	3,750	3.0	21.0	Run	cobble,sand,bedrock	23.0	11.6	54	2.0	10.0					12(160-200)	125(100-270)	50(100-270)				
	1450			2	4,500	1.5	20.0	Riffle	cobble,gravel,bedrock										(100,180)	30(70-120), (220)	60(70-100)				
					37,775		165.0		**Subtotal**						**0**		**48**		**72**	**266**	**170**	**1**	**2**		
19JUN	0924	Riffle 31	38.0	1	4,800	1.5	19.0	Riffle	cobble,gravel,sand	22.0	8.5	68	1.9	12.0					3(100-110), 4(600-750)	16(110-140)	16(90-120)				
	0925			2	14,000	2.8	15.0	Run-Pool	cobble,gravel,sand										(650,700)	80(100-300)	40(100-300)				
19JUN	1038	Riffle 35A	37.1	1	6,000	1.8	18.0	Riffle-Run	cobble,gravel,bedrock	23.4	9.8	71	1.4	15.0					(100,120,700)	80(70-180), 10(200-300)	80(70-140)		(100,120)		BG(180,200)
	1036			2	12,500	2.5	18.0	Run	cobble,gravel,sand														(160,170)		
19JUN	1316	Riffle 41A	35.3	1	3,750	2.8	15.0	Run-Riffle	cobble,gravel,sand	24.2	9.7	73	1.7	13.0					5(150-200)	45(100-300)	15(100-300)			(140,160)	
	1313			2	2,000	4.0	6.0	Run-Pool	sand,gravel,cobble											5(90-110)			(120)	(110,140,320)	
	1319			3	6,000	1.5	10.0	Riffle	cobble,gravel,sand										(700)	15(100-160)	15(100-160)	(90)			
19JUN	1425	Riffle 57	31.5	1	4,500	1.3	15.0	Riffle	cobble,gravel,sand	26.6	12.3	82	2.4	12.0						70(125-325)	30(125-325)				
	1426			2	7,000	2.2	16.0	Riffle-Run	cobble,bedrock,sand											(90,110)			(YOY,90,100)	4(110-160)	RSF(100,110)
					60,550		132.0		**Subtotal**						**0**		**0**		**18**	**323**	**196**	**1**	**7**	**9**	**4**
									TOTAL#						**43**		**232**		**159**	**611**	**366**	**6**	**18**	**15**	**4**

(1) YOY Sacramento sucker were common or abundant at most locations.

Table 2. Tuolumne River snorkel survey locations (1982-2008) with number of O. mykiss observed, otherwise none were seen.

	1982	1984		1985	1986		1987			1988					1989				1990				1991		1992	
	AUG	APR	AUG	MAR	JUL	AUG	JAN	APR	OCT	MAY	JUN	JUL	AUG	SEP	MAY	JUN	JUL	SEP	MAY	JUN	JUL	SEP	JUN	SEP	JUN	SEP
LOCATIONS																										
Riffle A3/A4 (RM 51.6)			27	2		6			X	X				X	X	X	X	X	X	X	X	X	X	X	1	X
Riffle A7 (RM 50.7)			26			13			X						X	X		X	X		X					
Riffle 1A (RM 50.4)								X									X									
Riffle 2 (RM 49.9)	X		X			25	X	X		X				X	X			X	X	X		X	X	X	X	X
Riffle 3B (RM 49.1)																										
Riffle 4B (RM 48.4)	X	12		X	5	10																				
Riffle 5B (RM 48.0)	2	X	X	X		10	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Riffle 7 (RM 46.9)																										
Riffle 9 (RM 46.4)										X				X	X			X		X		X	X	X	X	X
Riffle 12 (RM 45.8)																										
Riffle 13A-B (RM 45.6)																										
Riffle 17A2 (RM 44.4)																										
Riffle 21 (RM 42.9)																										
Riffle 23B-C (RM 42.3)										X				X	X			X		X		X	X	X	X	X
Riffle 24 (RM 42.0)					X																					
Riffle 26 (RM 40.9)																										
Riffle 27(RM 40.3)																										
Riffle 30B (RM 38.5)																										
Riffle 31 (RM 38.1)																										
Riffle 33 (RM 37.8)										X				X	X			X		X		X				
Riffle 35A (RM 37.0)																										
Riffle 36A (RM 36.7)																										
Riffle 37 (RM 36.2)								X																		
Riffle 39-40 (RM 35.4)										X				X	X			X		X		X	X	X	X	X
Riffle 41A (RM 35.3)																										
Riffle 46 (RM 34.0)					X		X																			
Riffle 52B (RM 32.2)										X				X												
Riffle 57-58 (RM 31.5)		X		X											X			X		X		X	X	X	X	X
Charles (RM 24.9)										X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Total O.mykiss	2	12	53	2	5	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Table 2. Tuolumne River snorkel survey locations (1982-2008) with number of O. mykiss observed, otherwise none were seen.

	1993				1994			1995	1996	1997	1999	2000	2001		2002		2003		2004			2005	2006	2007		2008
	MAY	JUN	JUL	OCT	MAY	JUL	OCT	NOV	JUL	JUN	JUN	JUN	JUN	SEP	JUN	SEP	JUN	SEP	JUN	AUG	SEP	SEP	SEP	JUN	SEP	JUN
LOCATIONS																										
Riffle A3/A4 (RM 51.6)	X	X	X	X		X	X	X		4										5						
Riffle A7 (RM 50.7)	X	X	X	X	X			1	**X**	2	14	14	7	3	5	1	66	16	12	6	11	10	115	106	75	76
Riffle 1A (RM 50.4)	X	X		X					**51**			3								4						
Riffle 2 (RM 49.9)	X	X		X		X	X		**91**	2	X		3	3	1	4	8	2	23	2	7	7	15	34	16	9
Riffle 3B (RM 49.1)									**138**	X	31	14	8	1	11	1	5	21	22	5	7	6	66	45	12	78
Riffle 4B (RM 48.4)	X								**55**											8						
Riffle 5B (RM 48.0)	X		X		X	X	X	2	**45**	X	10	19	4	2	3	X	6	10	11	15	6	36	54	92	10	21
Riffle 7 (RM 46.9)									4	X	15	52	4	X	5	2	14	9	13	5	2	2	106	22	7	13
Riffle 9 (RM 46.4)	X	X		X		X	X													3						
Riffle 12 (RM 45.8)												5														
Riffle 13A-B (RM 45.6)	X											20	3	X	2	4	1	6	5	13	X	46	103	15	57	24
Riffle 17A2 (RM 44.4)												14														
Riffle 21 (RM 42.9)									X			27	2	3	1	X	X	6	5	9	7	15	32	10	10	11
Riffle 23B-C (RM 42.3)			X		X					X	9	4	X	X	X	X	1	1	X	1	X	14	27	5	7	X
Riffle 24 (RM 42.0)	X							X																		
Riffle 26 (RM 40.9)												4														
Riffle 27(RM 40.3)												2														
Riffle 30B (RM 38.5)											X				X	X										
Riffle 31 (RM 38.1)												2	X	X			X	X	X	X	X	1	21	12	4	X
Riffle 33 (RM 37.8)																										
Riffle 35A (RM 37.0)									X			X			X	X	X	X	X	X	X	2		X	X	X
Riffle 36A (RM 36.7)	X		X		X				X	X	X												4			
Riffle 37 (RM 36.2)												X	X	X												
Riffle 39-40 (RM 35.4)		X		X		X	X																			
Riffle 41A (RM 35.3)												X	X	X	X	X	X	X	X	X	X	X	X	2	X	X
Riffle 46 (RM 34.0)												X														
Riffle 52B (RM 32.2)												X														
Riffle 57-58 (RM 31.5)	X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Charles (RM 24.9)		X		X			X																			
Total O.mykiss	0	0	0	0	0	0	0	3	**384**	8	79	180	31	12	28	12	101	71	91	76	40	139	543	343	198	232

Data in bold type (JUL96, RA7 to R5B) was collected by CDFG using different survey methods that are not comparable

Table 3. Tuolumne River snorkel survey locations (1982-2008) with number of Chinook Salmon observed, otherwise none were seen.

	1982	1984		1985	1986		1987			1988					1989				1990				1991		1992	
	AUG	APR	AUG	MAR	JUL	AUG	JAN	APR	OCT	MAY	JUN	JUL	AUG	SEP	MAY	JUN	JUL	SEP	MAY	JUN	JUL	SEP	JUN	SEP	JUN	SEP
LOCATIONS																										
Riffle A3/A4 (RM 51.6)			7	X		75			X	3				X	127	56	18	X	135	12	X	X	X	X	X	X
Riffle A7 (RM 50.7)			X			20			X						X	11		X	144		3					
Riffle 1A (RM 50.4)								150		22							25									
Riffle 2 (RM 49.9)	?		X			50	100+	100+		1				X	X			X	11	X		X	X	X	X	X
Riffle 3B (RM 49.1)										1																
Riffle 4B (RM 48.4)	?	?		60	30	25				1																
Riffle 5B (RM 48.0)	?	?	X	X		40	130	400		129	1	X	X	X	X	X	X	X	4	X	X	X	X	X	X	X
Riffle 7 (RM 46.9)																										
Riffle 9 (RM 46.4)										3				X	X			X		X		X	X	X	X	X
Riffle 12 (RM 45.8)																										
Riffle 13A-B (RM 45.6)																										
Riffle 17A2 (RM 44.4)																										
Riffle 21 (RM 42.9)																										
Riffle 23B-C (RM 42.3)										X				X	X			X		X		X	X	X	X	X
Riffle 24 (RM 42.0)					10																					
Riffle 26 (RM 40.9)																										
Riffle 27(RM 40.3)																										
Riffle 30B (RM 38.5)																										
Riffle 31 (RM 38.1)																										
Riffle 33 (RM 37.8)										1				X	X			X		X		X				
Riffle 35A (RM 37.0)																										
Riffle 36A (RM 36.7)																										
Riffle 37 (RM 36.2)								40																		
Riffle 39-40 (RM 35.4)										X				X	X			X		X		X	X	X	X	X
Riffle 41A (RM 35.3)																										
Riffle 46 (RM 34.0)					8		800+																			
Riffle 52B (RM 32.2)										X				X												
Riffle 57-58 (RM 31.5)		?		40											X			X		X		X	X	X	X	X
Charles (RM 24.9)										X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Total Chinook Salmon	0	0	7	100	48	210	1030+	690+	0	161	1	0	0	0	127	67	43	0	294	12	3	0	0	0	0	0

Table 3. Tuolumne River snorkel survey locations (1982-2008) with number of Chinook Salmon observed, otherwise none were seen.

	1993				1994			1995	1996	1997	1999	2000	2001		2002		2003		2004			2005	2006	2007		2008
	MAY	JUN	JUL	OCT	MAY	JUL	OCT	NOV	JUL	JUN	JUN	JUN	JUN	SEP	JUN	SEP	JUN	SEP	JUN	AUG	SEP	SEP	SEP	JUN	SEP	JUN
LOCATIONS																										
Riffle A3/A4 (RM 51.6)	9	35	X	10		X	X	2		X										X						
Riffle A7 (RM 50.7)	54	X	2	7	X			17	**20**	X	23	211	277	21	429	2	426	2	390	77	X	1	X	13	X	26
Riffle 1A (RM 50.4)	14	X		7					**29**			47								X						
Riffle 2 (RM 49.9)	6	2		11		X	X		**16**	X	3		4	X	10	X	72	1	16	X	X	X	X	18	X	X
Riffle 3B (RM 49.1)									**4**	X	108	34	52	X	83	X	16	3	59	3	X	3	10	32	X	17
Riffle 4B (RM 48.4)	5								**43**											X						
Riffle 5B (RM 48.0)	33		3	3	29	X	X	3	**154**	X	20	35	47	X	17	X	4	4	4	X	X	X	X	4	X	X
Riffle 7 (RM 46.9)									20	1	57	X	17	X	15	1	X	X	4	X	X	X	X	X	X	X
Riffle 9 (RM 46.4)	3	X		7		X	X													X						
Riffle 12 (RM 45.8)												6														
Riffle 13A-B (RM 45.6)	X	X		X								5	6	X	10	X	9	X	3	X	X	1	8	X	X	X
Riffle 17A2 (RM 44.4)												X														
Riffle 21 (RM 42.9)									2			X	X	X	1	X	X	1	7	X	X	X	10	X	X	X
Riffle 23B-C (RM 42.3)			X	X	2			1		2	1	X	1	X	2	X	8	X	1	X	X	X	8	X	X	X
Riffle 24 (RM 42.0)	X	X						1																		
Riffle 26 (RM 40.9)												X														
Riffle 27(RM 40.3)												X														
Riffle 30B (RM 38.5)											X				X	X										
Riffle 31 (RM 38.1)												X	X	X			X	X	X	X	X	X	X	X	X	X
Riffle 33 (RM 37.8)																										
Riffle 35A (RM 37.0)					X				X			X			X	X	2	1	7	X	X	X		X	X	X
Riffle 36A (RM 36.7)	8		X	X	X				X	X	X												4			
Riffle 37 (RM 36.2)												X	X	X												
Riffle 39-40 (RM 35.4)		X		X		X	X																			
Riffle 41A (RM 35.3)												X	X	X	X	X	X	1	X	X	X	X	X	X	X	X
Riffle 46 (RM 34.0)												X														
Riffle 52B (RM 32.2)												X														
Riffle 57-58 (RM 31.5)	X	X		X	5	X	X		1	X	1	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Charles (RM 24.9)		1		X			X																			
Total Chinook Salmon	132	38	5	45	36	0	0	24	**289**	3	213	338	404	21	567	3	537	13	491	80	0	5	40	67	0	43

Data in bold type (JUL96, RA7 to R5B) was collected by CDFG using different survey methods that are not comparable

Table 4. Fish species observed in the Tuolumne River snorkel surveys during the June-September period.

Summary table of fish species observed in the Tuolumne River snorkel studies 1986 to 2008, June to September survey period.

FAMILY	COMMON NAME	NATIVE SPECIES	ABBREV.	1986	1988	1989	1990	1991	1992	1993	1994	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Petromyzontidae	Pacific lamprey	N	LP	X										X					X				
Salmonidae	Chinook salmon	N	CS	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Salmonidae	rainbow trout	N	RT	X					X			X	X	X	X	X	X	X	X	X	X	X	X
Cyprinidae	goldfish		GF		X	X	X	X	X	X	X												
Cyprinidae	carp		CP	X	X	X	X	X	X	X	X						X	X					
Cyprinidae	hardhead	N	HH	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X		X	X
Cyprinidae	Sacramento pikeminnow	N	PM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Catostomidae	Sacramento sucker	N	SKR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ictaluridae	brown bullhead		BBH				X	X	X														
Ictaluridae	white catfish		WCF		X	X	X	X	X	X	X								X			X	
Centrarchidae	green sunfish		GSF		X	X	X	X	X		X												
Centrarchidae	bluegill		BG	X	X	X	X	X	X		X						X	X	X			X	X
Centrarchidae	redear sunfish		RSF		X	X	X	X	X	X	X		X				X	X	X				X
Centrarchidae	warmouth		WM						X														
Centrarchidae	largemouth bass		LMB	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Centrarchidae	smallmouth bass		SMB	X	X	X	X	X	X	X	X					X	X	X	X	X		X	X
Cottidae	riffle sculpin	N	RSCP	X	X		X	X		X			X	X	X	X	X	X	X	X	X	X	X

(List includes all species observed during 1986-2008 snorkel studies)