TECHNICAL MEMORANDUM

TO: Chris Berry
City of Santa Cruz Water Department

FROM: Jeff Hagar
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DATE: January 15, 2010

PROJECT: City of Santa Cruz Habitat Conservation Plan, Lagoon Fish Population Sampling

Fish population and steelhead rearing were assessed in Laguna Creek lagoon and the San Lorenzo River lagoon during the summer of 2009. Surveys were conducted in the early summer and again in the fall using large seines. In Laguna Creek a 100 foot long by 6 foot deep seine with a bag and ¼ inch mesh was used. In the San Lorenzo River lagoon we used both the 100 foot seine and a 150 foot long by 8 foot deep seine with ¼ inch mesh. The larger seine was used in deeper water and at higher lagoon stages. A small 15 foot long by 4 foot deep seine with 1/8 inch mesh was used in both lagoons to sample for gobies. A summary of the results of the survey follows.

Laguna Creek

Spring (June 16)

- Site Conditions
  - Mouth closed (closed in late May or early June, before June 9)
  - Depth to about 4-4.5 feet near mouth and up to YSI site.
  - Salinity <2 ppt at depth 3 feet and less, ~8.5 ppt at bottom in 4 feet of water near mouth.
  - Temperature 18.5-19.5 C in fresh water column, 25.2-26.6 at bottom in higher salinity
  - DO 7.6- 8.8 in freshwater layer; 14.4-15.5 in higher salinity layer at bottom.
  - Water clear, bottom clearly visible in 3.5 feet.
- Survey results
  - 100 ft. by 6 ft by ¼ inch mesh bag seine:
    - 8 hauls
    - Steelhead catch included a single young-of-year in the 40-50 mm fork length (FL) size class, larger juveniles (90-169mm) likely including both 1+ and 2+. Surprising that larger individuals had not left lagoon.
  - 15 ft. by 4 ft by 1/8 inch mesh seine
    - 6 hauls
    - Tidewater goby at all sites sampled but most abundant at Station 1.5 (edge of beach) and Station 1.

Fall (September 30)

- Site Conditions
    - Mouth closed
    - Depth to about 6 feet near mouth and up to about 4 feet near YSI site.
    - Temperature 15-18 C at surface
    - Visibility good.
- Survey results
    - 100 ft. by 6 ft by ¼ inch mesh bag seine:
        - 8 hauls
        - Steelhead catch included fish from 150mm to 230mm (FL) likely including both 1+ and 2+. Steelhead catch per haul was higher than in June. Fall CPUE best since 2005 survey.
    - 15 ft. by 4 ft by 1/8 inch mesh seine
        - No hauls
        - Tidewater goby were seen at lower lagoon sites (1, 1.5, 2) and very abundant closer to mouth (~100 per square meter in some places).

Table 1. Fish catch in Laguna Creek lagoon, June 2009.

Species	LA-1	LA-1.5	LA-2	LA-3	Grand Total
	100 ft by 6 ft bag seine				
# Hauls	4	2	1	1	8
steelhead	31	16	10	0	57
tidewater goby		1			1
staghorn sculpin	6		1		7
starry flounder	1				1
stickleback	1				1
crab	1				1
	15 ft by 4 ft beach seine				
# Hauls	3	1		2	
tidewater goby	19	40		5	64
prickly sculpin				1	1
shrimp		2			2

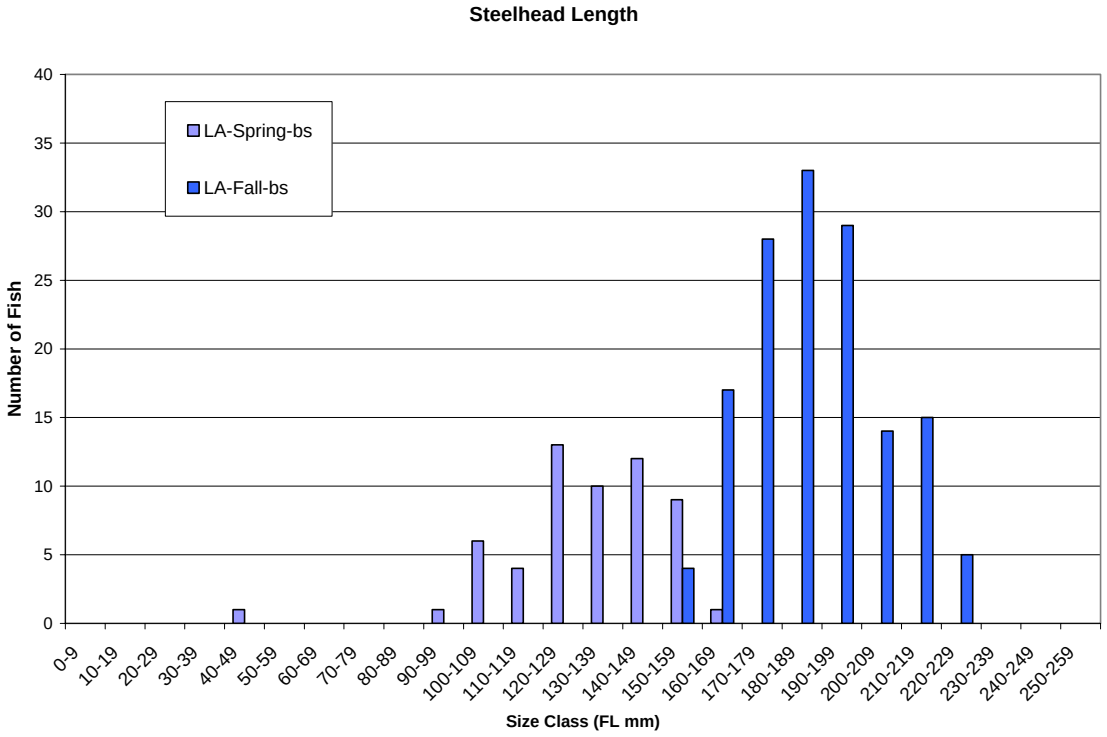
Note: See Figures for sample site locations.

Table 2. Fish catch in Laguna Creek lagoon, September 2009.

Species	LA-1	LA-1.5	LA-2	LA-3	LA-4.25	LA-4	LA-5	Grand Total
	100 ft by 6 ft bag seine							
# Hauls	2	3	2	1				8
steelhead	67	63	19					149
tidewater goby	20	0						20
starry flounder	1							1
stickleback	600	300						900
	Snorkel							
steelhead					15	8	3	26

Table 3. Steelhead and coho salmon catch per seine haul in Laguna Creek lagoon at consistently sampled sites (data from 2NDNATURE 2006b, Ellen Freund (NOAA Fisheries), and HES 2009).

	Location	Steelhead Catch per Haul						Coho Catch per Haul		
2004		May	Jun	Jul	Sep	Oct	Nov	May	Jul	Sep
	LA-1			0						
	LA-1.5			0	0					
	LA-2									
	LA-3			0	0					
	LA-4.5									
	LA-5			7	0					
	LA-6			5	0					
2005										
	LA-1	0		9.3	33		46	5.5	0	0
	LA-1.5									
	LA-2	0		16	50		5	14	6	0
	LA-3	7		40	51		15	30	6	0.5
	LA-4.5									
	LA-5	26		25	8		0	24	6	0
	LA-6	11		10	0		0	32	7	0
2008										
	LA-1		1		0.5					
	LA-1.5		18		10.5					
	LA-2		22		15					
	LA-3		0		0					
	LA-4.5				0					
	LA-5				0					
	LA-6				3					
	Overall		11		6					
2009										
	LA-1		8		34					
	LA-1.5		8		21					
	LA-2		10		10					
	LA-3		0		0					
	LA-4.5									
	LA-5									
	LA-6									
	Overall		7		19					


Steelhead Length
LA-Spring-bs
LA-Fall-bs
Number of Fish
0
5
10
15
20
25
30
35
40
0-9
10-19
20-29
30-39
40-49
50-59
60-69
70-79
80-89
90-99
100-109
110-119
120-129
130-139
140-149
150-159
160-169
170-179
180-189
190-199
200-209
210-219
220-229
230-239
240-249
250-259
Size Class (FL mm)

San Lorenzo River

Spring (June 10-11)

- Site Conditions
    - Lagoon open, visibility good
    - Salinity 7ppt at surface and 29ppt at bottom near mouth;
    - Surface temperature 16°C near mouth in morning to 22°C upstream of Riverside Bridge in the afternoon;
    - Surface DO greater than 7 mg/l and bottom DO greater than 5 mg/l at all stations.
    - Visibility good.
- Survey results
    - 100 ft. by 6 ft by ¼ inch mesh bag seine:
        - 13 hauls
        - Only 4 steelhead found, all in the lower lagoon downstream of the water quality monitoring station; 3 fish were in the 60-80mm length class and one was in the 120-129 mm size class.
        - Catch of other species very diverse including staghorn sculpin, starry flounder, topsmelt, juvenile rockfish, bay pipefish, arrow goby, prickly sculpin, stickleback, large numbers of small shrimp, marine and estuarine isopods, juvenile crabs, nudibranchs, and ctenophores.
    - 15 ft. by 4 ft by 1/8 inch mesh seine
        - 9 hauls at sites 2 and 3 (from downstream of trestle to water quality monitor)
        - Catch included starry flounder, bay pipefish, and some small marine or estuarine sculpins.
    - 25 ft. by 6 ft by 1/8 inch mesh bag seine
        - 3 hauls at sites 6 and 9 (upstream of Riverside Drive and near the Branciforte Creek confluence)
        - Catch included prickly sculpin, young-of-year sacramento sucker, staghorn sculpin, tidewater goby, topsmelt, and small shrimp.

Fall (September 16, mouth closed)

- Site Conditions
    - Lagoon closed
    - Salinity 3.2ppt at surface and 5.5ppt at bottom near mouth;
    - Surface temperature 19.6°C, bottom temperature 21.9 near mouth in morning; surface temperature 18.5 mid-morning near pedestrian bridge.
    - Surface DO 6.5 mg/l and bottom DO 5.2 mg/l near mouth in morning.
    - Visibility good.
    - Sampling difficult due to high lagoon stage, lack of beach areas.
- Survey results
    - 100 ft. by 6 ft by ¼ inch mesh bag seine:
        - 3 hauls, haul near pedestrian bridge (area 9) ineffective due to snagging on debris.
        - 2 steelhead juveniles were captured downstream of the trestle, 115 and 134 mm FL.
        - Catch of other species very diverse including staghorn sculpin, starry flounder, topsmelt, arrow goby, prickly sculpin, stickleback, small shrimp, and juvenile crabs.

Fall (October 21, mouth open)

- Site Conditions
    - Lagoon open, flow in San Lorenzo River 29 cfs at Tait Street (USGS provisional data).
    - Surface temperature 14°C-15°C near mouth in morning;
    - Afternoon upstream of Riverside had strong current with16.2°C at surface and 15.2°C at bottom, DO 8.3 at surface 8.4 at bottom,, salinity 4.7 ppt at surface 28 ppt at bottom.
    - Visibility good.
- Survey results
    - 100 ft. by 6 ft by ¼ inch mesh bag seine:
        - 10 hauls, only 8 were counted due to net malfunction on other 2.
        - Only 4 steelhead found, 1 near the trestle and the others upstream of Riverside Bridge; three fish were in the 130-139mm length class and one was in the 110-119 mm size class.
        - Only topsmelt, threespine stickleback, and a crab were captured in addition to the steelhead.

Table 4. Fish catch in San Lorenzo River lagoon, June 2009.

Species	Around Trestle (2)	Between Trestle and WQ site (3)	Upstream of Riverside Bridge (5)	Bend near Laurel Ave. (6)	Around Branciforte Confluence (9)	Grand Total
	100 ft by 6 ft bag seine					
# Hauls	4	4	2	2	0	13
steelhead	3	1				4
arrow goby				present		present
bay pipefish	present	present				present
topsmelt	present	present		present		present
staghorn sculpin	present	present		present		present
starry flounder	present	present	present	present		present
grass rockfish	present					present
unid. goby		present				present
prickly sculpin		present	present			present
stickleback		present				present
shrimp	present	present	present	present		present
crab	present	present				present
kelp isopod	present					present
isopod	present					present
ctenophore	present					present
nudibranch	present	present				present
	25 ft by 6 ft bag seine					
# Hauls	0	0	0	1	2	3
topsmelt				present		present
staghorn sculpin				present	present	present
starry flounder				present	present	present
tidewater goby				present	present	present
sculpin				present		present
prickly sculpin					present	present
Sacramento sucker					present	present
shrimp				present	present	present
	15 ft by 4 ft beach seine					
# Hauls	6	3	0	0	0	9
bay pipefish		present				present
staghorn sculpin	present	present				present
starry flounder	present	present				present
unid. sculpin b	present					present
unid. sculpin a	present					present
prickly sculpin		present				present
shrimp	present	present				present
crab	present					present

Table 5. Fish catch in San Lorenzo River lagoon, September 2009, lagoon closed.

Species	Around Trestle (2)	Between Trestle and WQ site (3)	Upstream of Riverside Bridge (5)	Bend near Laurel Ave. (6)	Around Branciforte Confluence (9)	Grand Total
	100 ft by 6 ft bag seine					
# Hauls	2	0	0	0	1	present
steelhead	2					present
arrow goby	present					present
shiner surfperch	present					present
staghorn sculpin					present	present
starry flounder					present	present
stickleback	present					present
topsmelt	abundant					abundant
sculpin	present					present
crab	present					present
shrimp	present					present

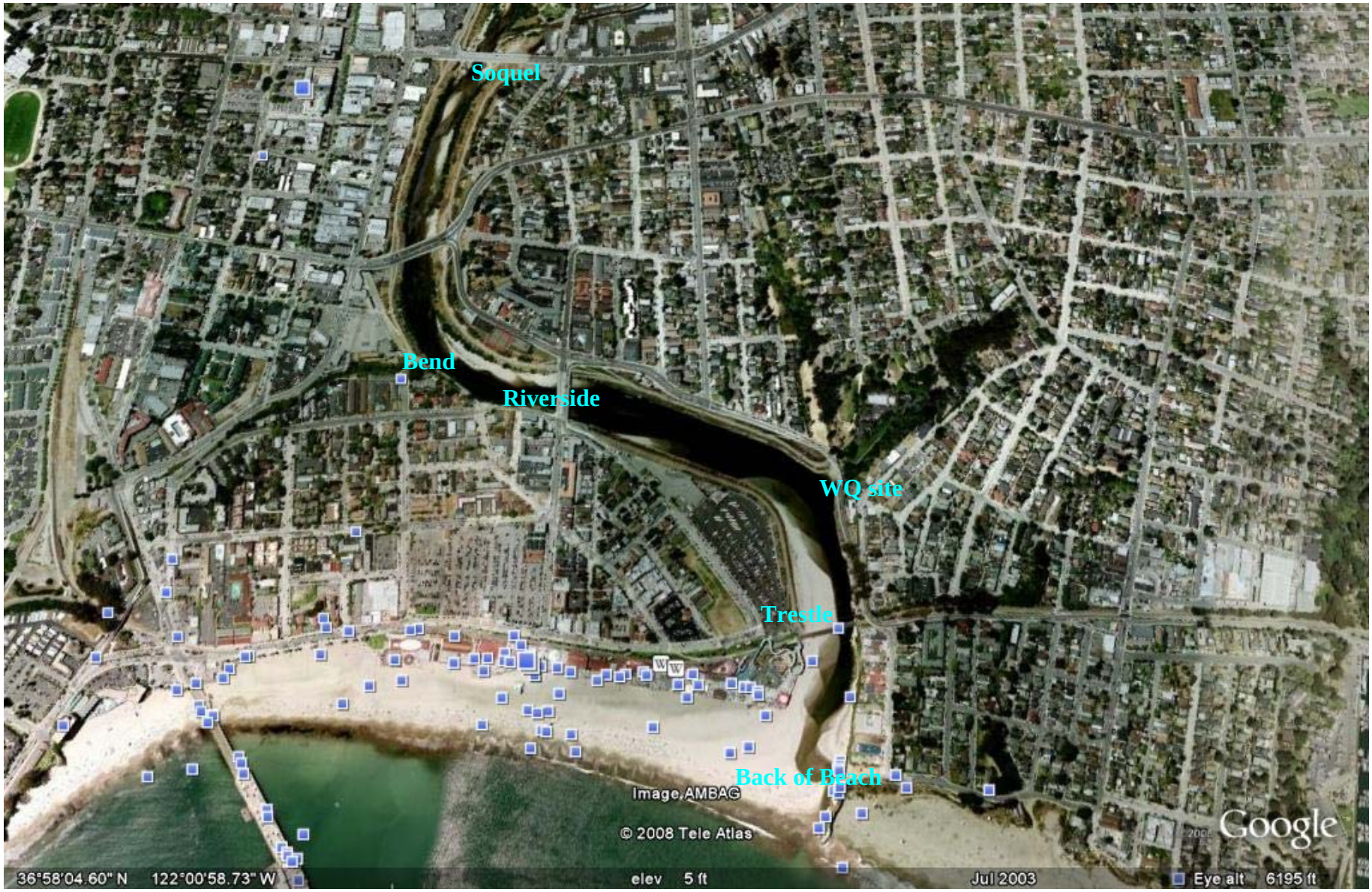
Table 6. Fish catch in San Lorenzo River lagoon, October 2009, lagoon mouth open.

Species	Around Trestle (2)	Between Trestle and WQ site (3)	Upstream of Riverside Bridge (5)	Bend near Laurel Ave. (6)	Around Branciforte Confluence (9)	Grand Total
	100 ft by 6 ft bag seine					
# Hauls	4/6	0	2	2	0	8/10
steelhead	1			3		
topsmelt	95					
stickleback			4	19		
crab				1		

Table 7. Steelhead catch per haul for the San Lorenzo River lagoon during recent sampling events (data from H.T. Harvey aand Associates 2003b, 2NDNATURE 2006b, and HES 2009).

Site	Location	Steelhead Catch per Haul					
2002						1 Oct	20 Nov
SL-2	RR Trestle						0.0
SL-3	Near YSI Site					5.5	
SL-4	Below Riverside						
SL-5	Riverside Drive						9.0
SL-7	Laurel St.						1.0
SL-8	Soquel Ave.					20.0	0.3
2004			6 July		21 Sep	29 Sep	
SL-1	Near Mouth				0.0	0.0	
SL-2	RR Trestle		24.5			0.5	
SL-3	Near YSI Site		20.0				
SL-4	Below Riverside		0.0				
SL-5	Riverside Drive		62.0		0.0	0.0	
SL-6	U/S Bank Restoration		3.0			0.0	
SL-7	Laurel St.		3.0				
SL-8	Soquel Ave.				0.0	0.0	
2005		14 Jun	14 Jul	16 Aug		5 Oct	
SL-1	Near Mouth	0.0	0.0	1.7		0.0	
SL-2	RR Trestle	28.0	5.3	179.5		0.0	
SL-5	Riverside Drive	0.0	12.3	10.7		62.7	
SL-8	Soquel Ave.	7.7	1.0	0.0		0.0	
2008		8, 19 Jun				7-8 Oct	
SL-1	Near Mouth	0				0	
SL-2	RR Trestle	9				.3	
SL-3	Near YSI Site	0				0	
SL-5	Riverside Drive	0				0	
SL-6	U/S Bank Restoration	0				0	
SL-8	Soquel Ave.	0				0	
2009		10-11 Jun			16 Sep	21 Oct	
SL-2	RR Trestle	0.75			1	0.25	
SL-3	Near YSI Site	0.25					
SL-5	Riverside Drive	0				0	
SL-6	U/S Bank Restoration	0				1.5	

Laguna Creek Lagoon sampling sites.



San Lorenzo River lagoon sampling sites.