

Technical Memorandum

Date 15 September 2014

To: Dan Pfeifer
City of Ventura

From: Rosie Thompson

RE: **2014 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary.**

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1.0 Introduction

As a condition of the City of Ventura's National Pollution Discharge Elimination System (NPDES) discharge permit, the population status of the federally listed as endangered tidewater goby (*Eucyclogobius newberryi*) in the Santa Clara River Estuary is regularly monitored in relation to the City's wastewater discharge to the estuary. The estuary is located approximately 1.4 kilometers (km) south of the Ventura Harbor mouth and adjacent to Harbor Boulevard in the City of Ventura, Ventura County, California (34° 13' 54" N, 119° 15' 42" W). The wastewater outfall discharges tertiary treated water to a series of ponds which drain into a channel (approximately 500 meters [m] long) located on the northwest side of the estuary (Figure 1). The confluence of the channel with the estuary is immediately adjacent to the ocean beach at the northwestern corner of the estuary.

Cardno ENTRIX performed these surveys bi-annually from 2004 through 2008. Only one tidewater goby survey was required yearly by the NPDES discharge permit for 2009 through 2014. The surveys have been performed concurrently with benthic macroinvertebrate (BMI) sampling by Aquatic Bioassay and Consulting (ABC), also supported by the City. This report presents the results of the 2014 annual survey, completed on August 19, 2014.

2.0 Description of the Area

At the time of the survey, the water level in the lagoon was high; similar to what has been encountered in the last several years' surveys, particularly 2012 and 2013 (ENTRIX 2008, ENTRIX 2009, Cardno ENTRIX 2011, Cardno ENTRIX 2012, Cardno ENTRIX 2013). The high water level has resulted in flooding of parts of McGrath State Park and closure of the park. At the time of survey the estuary was approximately 1.2 km long, was triangular or delta shaped, and was impounded from the beach to upstream of the Harbor Boulevard Bridge. At the western end of the estuary, adjacent to the Pacific Ocean, a long sand berm and beach formed a barrier between the estuary and the sea. The estuary body was approximately 750 m wide along the beach berm, with a narrow finger (approximately 300

m) continuing south along the beach berm (Figure 1).

The southeastern estuary shoreline, from approximately 300 m downstream of Harbor Boulevard, upstream to the river interface, was composed of sand and gravel bars. Very dense stands of willow (*Salix* sp.), up to 4 m high, were present along the wetted shoreline in this area, extending 10s of meters back from the wetted edges. Downstream of these bars and the bridge, the southeastern shore was densely covered with giant reed (*Arundo donax*) for approximately 170 m. Continuing west, in the vicinity of McGrath State Park, a large flat expanse of low salt marsh consisting of grasses, sedges, and pickleweed (*Salicornia* sp.), was present for approximately 85 m, followed by an expanse of dense bullrush (*Scirpus* sp.) for an additional 45 m. The remaining shoreline on the south side of the estuary was comprised of steep, sandy bluffs measuring 3 to 4 m high and extending to the southwestern corner and southern arm of the estuary. The northern shore of the estuary, from the river interface to the ocean and in the vicinity of the wastewater outfall, had gently sloping shorelines vegetated with willow, giant reed, and bullrush. Vegetation was generally restricted to the shorelines with the exception of the southeastern side and far northwestern corner, just downstream of the wastewater treatment plant outflow channel, where large expanses of giant reed and patches of bullrush were inundated by water. The beach sand berm was devoid of any vegetation. Filamentous green algae were abundant in shallow water along the beach berm and southeastern side of the estuary with patches of emergent aquatic plants in shallow water. Algal mats lined the channel of the southern arm of the estuary.

At least 50 percent or more of the estuary was more than 1.5 m deep and an estimated 30 percent of the estuary was less than about 60 centimeters (cm) deep at the time of the survey. Along the beach berm, the water was estimated to be greater than 1.5 m deep along the northern approximately 700 m of shoreline, but became progressively shallower within the arm extending south at the south-western corner of the estuary. Depth became abruptly deeper along the southern perimeter in the area where steep sandy bluffs bordered the shoreline, west of McGrath State Park. Depths became gradually shallower proceeding east towards the State Park. Much of the area between the State Park and Harbor Boulevard Bridge was too deep to wade (more than 100 cm deep). Depths immediately adjacent to the bridge support piers at the north and south sides of Harbor Boulevard Bridge over the main river channel ranged from approximately 30-70 cm but sloped rapidly to deeper (over 100 cm). Much of the area under the south side of the bridge for about 300 m from the main channel was flooded. Substrate in the estuary was predominantly sand along the beach berm, but finer silts and decaying organics were the dominant substrates at the Harbor Boulevard Bridge sampling stations. The water throughout the estuary was very brown colored, apparently from algal matter suspended through the water column, and visibility was limited to less than approximately 15 cm.

3.0 Methodology

All fish handling was performed under the supervision of Cardno ENTRIX biologist Rosie Thompson, who holds a Section 10(a)1(A) permit (Permit Number TE815144-8) from the U.S. Fish and Wildlife Service for tidewater goby and a current California Department of Fish and Wildlife Scientific Collecting Permit (SC-2731). Dr. Thompson was assisted by Cardno ENTRIX biologist Megan Olesen. Sampling began at 7:45 AM and finished at 3:00 PM.

The estuary was surveyed visually and with a beach seine measuring 3 X 1 m with 3 millimeter (mm) mesh. Sampling at the north end of the Harbor Boulevard Bridge was coordinated with a BMI study performed by ABC. The three BMI sampling sites, however, were not assessed for tidewater gobies due to water depth that required the BMI samples to be taken from a boat. Dr. Thompson was in communication with ABC and asked their staff to contact her immediately if any fish were found when the samples were being screened to make sure no tidewater gobies had been captured in the small dredge. The tidewater goby survey began at the north side of the river under Harbor Boulevard Bridge, progressed southeast along the beach berm, then north towards McGrath State Park, and finished along the southeast bank under Harbor Boulevard Bridge. Water depths, very soft, silty substrate, and swampy adjacent upland areas, made sampling along the eastern shore, from McGrath State Park to Harbor Boulevard Bridge, and along the western shore, from the outfall channel to Harbor Boulevard Bridge, infeasible.

Figure 1 presents the locations of each seine haul and each location is numbered by the order in which the seine hauls were performed so that data for locations could be easily compared. All fish captured were identified and counted (estimates were made when large numbers of non-native species were collected). Native species were released alive back into the estuary while non-native species were sacrificed.

4.0 Results

A total of 21 seine hauls were performed throughout the eastern and western sides of the estuary (Figure 1). Table 1 presents the results of the seine hauls. An additional several dip net sweeps were conducted at the east end of the northern bridge pier due to branches and other debris that precluded seining. No tidewater gobies or other native species were captured during seining or dip netting. Non-native species captured included mosquitofish (*Gambusia affinis*), Mississippi silverside (*Menidia audens*), green sunfish (*Lepomis cyanellus*), red swamp crayfish (*Procambarus clarkii*), and African clawed frog (*Xaenopus laevis*).

Mosquitofish were found primarily under Harbor Boulevard Bridge and at the wastewater outfall confluence with the estuary. The Mississippi silversides were mostly small juveniles under 2-5 cm, although several larger individuals (to 8 cm) were present. This species was found throughout the estuary. Small (primarily less than 2 cm) juvenile green sunfish were captured throughout the estuary, with most found at the Harbor Boulevard Bridge. Two African clawed frog larvae were captured along the sand berm and approximately 100 were found in a flooded area under the south side of the Harbor Boulevard Bridge (Station 20).

Table 2 presents the results of the water quality sampling undertaken by ABC.

5.0 Discussion

No tidewater gobies were observed in the BMI samples taken by ABC, and impacts to tidewater gobies from the sample dredge are unlikely to have occurred.

Surveys are completed in the fall when the greatest abundance of gobies is expected to inhabit the estuary. However, this year no tidewater gobies were captured in any part of the estuary. Last year's surveys also reported no tidewater gobies (Table 3).

The reason for the lack of tidewater gobies encountered during the August 2014 (and September 2013) survey is unknown. Possibly, the lack of estuary breaching for more than a year has led to water quality conditions that are unsuitable for tidewater gobies. The water column was observed to be particularly cloudy and turbid with brownish algal growth this year. Additionally, the water quality parameters over the past three years have not been conducive to spawning. Studies have shown tidewater gobies reproduce in water with salinities of 2 to 27 parts per thousand (ppt) and between 9 to 25 degrees Celsius (Swenson 1999, as cited in FWS 2007). The salinity in the estuary was measured below 2 ppt during the fall 2014 survey and over the past three years (2011-2013) and the water temperature has increased to an average of 24.4°C in 2012, 24.6 C in 2013, and 23.5°C in 2014, up from 18.3°C in 2010 and 19.7°C in 2011 (Cardno ENTRIX 2010, Cardno ENTRIX 2011, Cardno ENTRIX 2012, Cardno ENTRIX 2013). Higher water temperatures coupled with low salinity may contribute to the reduced numbers, or lack, of tidewater gobies captured over the past three years, though the Aquatic Research Specialists (ARS) results from June 2013 suggest that at least some reproduction occurred that summer, and temperatures are still within the reported range for successful breeding. It is also possible that tidewater gobies had moved into deeper water in August, possibly to escape warmer surface temperatures, making their capture using a 1-m deep beach seine unlikely.

Also notably absent were native sculpins, specifically staghorn sculpin (*Leptocottus armatus*) and prickly sculpin (*Cottus asper*), partially-armored threespine stickleback (*Gasterosteus aculeatus microcephalus*), California killifish (*Fundulus parvipinnis*), and topsmelt (*Atherinops affinis*), all of which have been captured in previous surveys. Stickleback and staghorn sculpin were detected in June 2013 by ARS, however. Non-native species detected previously but absent during this survey included arroyo chub (*Gila orcutti*) and common carp (*Cyprinus carpio*) (ENTRIX 2008, ENTRIX 2009, Cardno ENTRIX 2010, Cardno ENTRIX 2011).

Non-native species were prevalent, representing all of the fish captured. The most abundant non-native species captured were Mississippi silversides. Mississippi silverside juveniles were very abundant and, judging by their size, were likely the result of successful reproduction over the summer. The Mississippi silverside was introduced to northern California in the 1960s, became widespread in the San Francisco Bay and delta, and dispersed down the California aqueduct in the early 1990s (Moyle 2002) and have become common in the lower Santa Clara River and the estuary (ENTRIX 2008, ENTRIX 2009, Cardno ENTRIX 2010, Cardno ENTRIX 2011) as well as at a few other coastal estuarine sites in southern California.

Water quality results (Table 2) indicated that the estuary appeared to be essentially freshwater throughout (salinity less than 2 ppt at all sampling stations and depths) as expected due to the high water levels that come from freshwater input and lack of breaching, even with sampling at 2.8 m (Station R-003); stratification could exist at depths greater than those sampled, especially in the central part of the estuary. Temperatures were relatively uniform from surface to bottom at sampling Station R-003 indicating the water was well mixed throughout the at least the upper 1 to 3 m of the water column. Station WQ-004 had noticeably lower temperatures, pH, and dissolved oxygen (DO) as in 2013. The other stations have inflowing water while the sand berm location was essentially ponded due to the berm closure, possibly explaining the lower DO, temperature, and pH values. The latter station also is heavily used by birds.



6.0 References

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- Cardno ENTRIX. 2011. 2011 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary. City of Ventura, Ventura County, California. November 11.
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- United States Fish and Wildlife Service (FWS). 2007. Tidewater Goby (*Eucyclogobius newberryi*) 5-Year Review: Summary and Evaluation. September.
- Moyle, P.B. 2002. Inland fishes of California. University of California Press, Berkeley, CA. 502 pp.

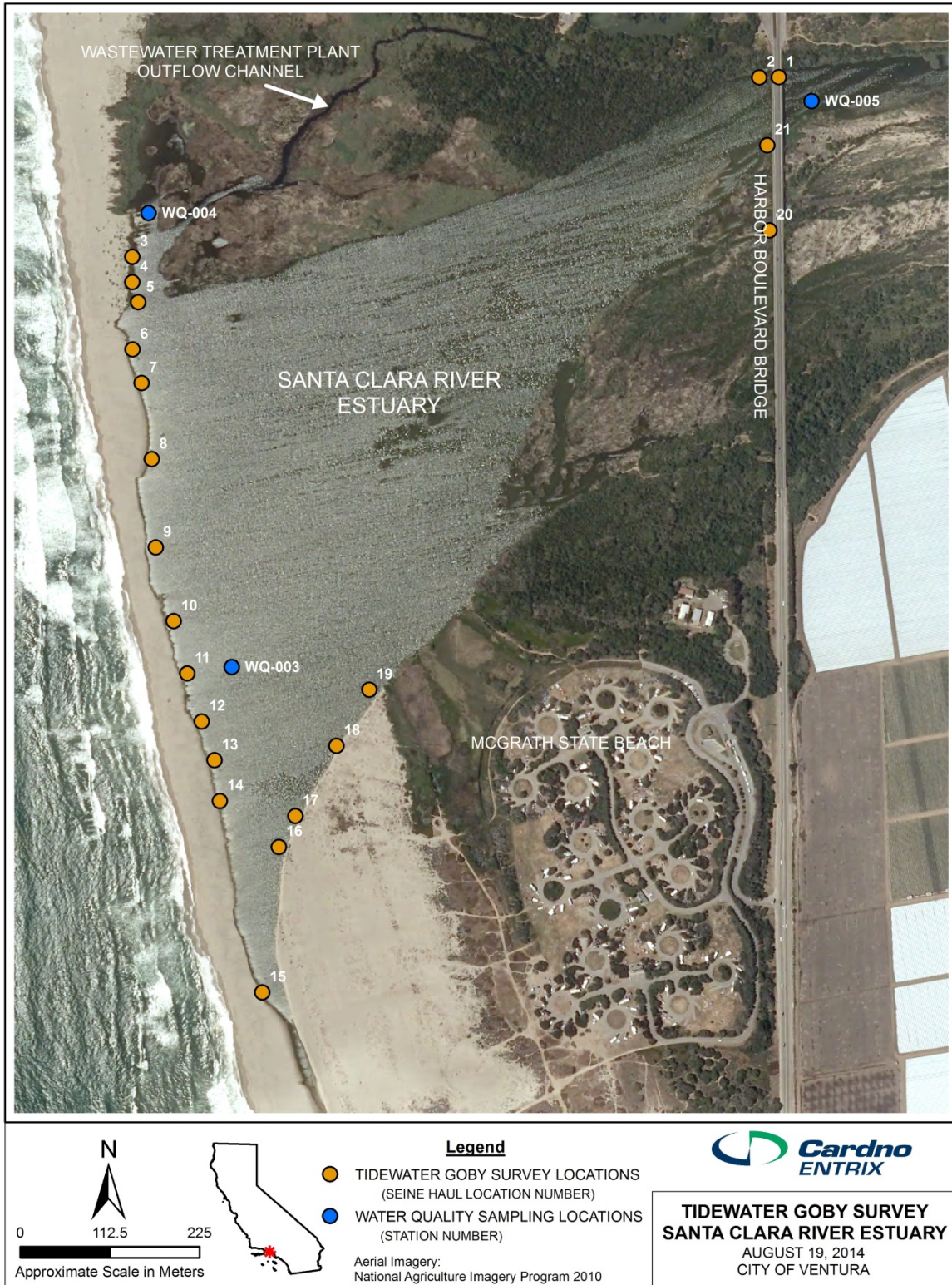


Figure 1. Tidewater goby survey locations.

Australia • Belgium • Canada • Colombia • Ecuador • Germany • Indonesia • Italy • Kenya • New Zealand • Papua New Guinea • Peru • Tanzania • United Arab Emirates • United Kingdom • United States • Operations in 85 countries

Tables

15 September 2014
2014 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary.

Table 1 – Results of fish survey in Santa Clara River Estuary, August 19, 2014.

Seine Haul	Area (m ²)	<i>Xaenopus laevis</i> African clawed frog	<i>Gambusia affinis</i> mosquitofish	<i>Menidia audens</i> Mississippi silverside	<i>Lepomis cyanellus</i> green sunfish	<i>Procambarus clarkii</i> red swamp crayfish	TOTAL
1	23	--	33	37	37	--	107
2	7	--	50	11	12	1	74
3	11	--	60	3	5	--	68
4	30	--	2	100	--	--	102
5	37	--	91	250+	8	--	349
6	30	1	3	300	--	--	304
7	26	--	8	38	--	--	46
8	30	--	5	150	--	--	155
9	30	--	4	3	--	--	7
10	15	--	2	45	--	--	47
11	23	--	1	47	--	--	48
12	23	1	--	20	--	--	21
13	28	--	--	50	2	--	52
14	23	--	2	57	2	--	61
15	30	--	6	170	1	--	177
16	15	--	24	17	8	--	49
17	15	--	7	91	15	--	113
18	30	--	3	38	4	--	45
19	30	--	2	162	2	--	166
20	16	100	10	--	--	--	110
21	20	1	30	100	50	--	181
TOTAL	-	103	343	1,689	146	1	2,282

Note: Numbers of 100 or more are estimates

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Water Quality Station	Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Salinity (ppt)
R-003	Surface	23.4	14.85	8.98	2553	1.32
	2.8	23.3	14.77	8.89	2553	1.32
R-004	Surface	22.9	3.08	7.56	2262	1.16
R-005	Surface	14.1	19.67	8.99	2563	1.32

Table 3 – Results of fish surveys in Santa Clara River Estuary, 2008 - 2014.

Year	Seine Halls	tidewater goby	mullet	common carp	California killifish	mosquitofish	partially armored threespine stickleback	arroyo chub	Mississippi silverside	green sunfish	topsmelt	staghorn sculpin	prickly sculpin	fathead minnow	TOTAL
2008	35	462	3	4	--	63	--	2	60	1	47	--	--	6	648
2009	38	186	--	3	--	297	1	1	339	8	--	--	1	30	866
2010	28	1855	--	97	1	51	10	15	15	114	--	2	63	102	2325
2011	25	244	--	27	2	2	17	3	75	--	--	--	--	--	370
2012	18	139	--	1	>5	27	8	>51	>6	1	p	--	--	1	>239
2013	21	--	--	5	--	68	--	--	813	38	--	--	--	3	927
2014	21	--	--	--	--	343	--	--	1689	146	--	--	--	--	2178
TOTAL	-	2886	3	137	8	851	36	73	2997	308	47	2	64	141	7553

*p indicates that species was present but not counted due to large numbers