

Technical Memorandum



Date: 18 September 2012

To: Dan Pfeifer
City of Ventura

From: Rosie Thompson

RE: **September 2012 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 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. This report presents the results of the 2012 annual survey, completed on September 29, 2012.

2.0 Description of the Area

At the time of the survey, water levels were higher than what has been encountered in the last few years of surveys (ENTRIX 2008 and 2009, Cardno ENTRIX 2010, Cardno ENTRIX 2011). The estuary closed in the spring of 2012 and water had re-filled much of the estuary. 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 ocean. The estuary body was approximately 750 m wide along the beach berm, with a narrow finger (approximately 1,000 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 open with flat, exposed sand and gravel bars. Large areas of cattails (*Typha* sp.) and tules (*Scirpus* sp.) existed along the banks. Downstream of these bars, the southeastern shore was densely covered with giant reed (*Arundo donax*) for approximately 170 m. Continuing west, in the vicinity of McGrath Beach 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 tules 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, (*Salix* sp.), giant reed, and tules. 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 tules were inundated by the high water. The beach sand berm was devoid of any vegetation. Algae were abundant in shallow water along the beach berm and southeastern side of the estuary. Algal mats filled the channel of the southern arm of the estuary.

The estuary was more than 1.5 m deep at the time of the survey with shallower water along the margins. Substrate throughout the estuary was virtually 100 percent sand, though some finer silt/clay was present in the slough channel. The water throughout the estuary was slightly greenish-brown colored, and visibility was limited to less than 30 cm.

3.0 Methodology

All fish handling was performed under the supervision of Cardno ENTRIX senior biologist Rosemary Thompson, Ph.D., 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 Game Scientific Collecting Permit (SC-002731).

The estuary was surveyed visually and with a beach seine measuring 3 X 1 meters with 3 millimeter mesh. Sampling in the morning was coordinated with a benthic macroinvertebrate (BMI) study performed by Aquatic Bioassay and Consulting (ABC). The 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. in the slough at the park boundary and then proceeded to the southwest corner of the estuary where it continued northeastward to near the slough. Sampling was then conducted on the east side of the river under the Harbor Boulevard Bridge, on the west side of the bridge, followed by southward along the beach sand berm. Sampling was conducted by Dr. Thompson and Sarah Horwath (Cardno ENTRIX). Figure 1 presents the locations of each seine haul and each location is numbered by the order in which the previous seine hauls were performed so that data for locations could be easily compared. All native fish captured were identified, counted, and released alive back into the estuary. Non-native species were sacrificed.

4.0 Results and Discussion

A total of 18 seine hauls were performed throughout the estuary (Figure 1). Table 1 presents the results of the seine hauls. Native species captured during seining included tidewater goby, partially-armored threespine stickleback (*Gasterosteus aculeatus microcephalus*), California killifish (*Fundulus parvipinnis*), and topsmelt (*Atherinops affinis*). Non-native species captured included mosquitofish

(*Gambusia affinis*), arroyo chub (*Gila orcutti*), Mississippi silverside (*Menidia audens*), carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), and fathead minnow (*Pimephales promelas*).

The tidewater gobies captured were represented by all sizes from small juveniles to large adults and were present throughout the estuary. The stickleback captured were all juveniles or small adults and were present along the berm and in the slough channel (location 16). The killifish captured ranged from a few large adults to many smaller individuals; all were found along the beach berm (Stations 5, 6, and 12). Mosquitofish were abundant at two locations in the southern part of the estuary (Stations 14 and 17). The Mississippi silversides were mostly small juveniles under 3 cm and were found in the southwestern part of the estuary. The only carp captured was a small juvenile under 3 cm, and one small juvenile green sunfish was captured in the slough channel. The arroyo chubs encountered were found along the sand berm and in the slough channel, and one fathead minnow was captured at the Harbor Boulevard Bridge (Station 1).

Table 1 – Results of fish survey in Santa Clara River Estuary, August 29, 2012.

Seine Haul	Area (m ²)	Depth (cm)	Cyprinus carpio common carp	Eucyclogobius newberryi tidewater goby	Fundulus parvipinnis California killifish	Gambusia affinis mosquitofish	Gasterosteus aculeatus microcephalus partially armored threespine stickleback	Gila orcutti arroyo chub	Menidia audens Mississippi silverside	Lepomis cyanellus green sunfish	Pimephales promelas fathead minnow	Atherinops affinis topsmelt	Unidentified small fish	TOTAL
1	8	61		5		1		4			1			11
2	22	61		27			2							29
3	15	61		6										6
4	19	61		3		1								4
5	11	61		2	2									4
6	15	46	1	3	3		2	1						10
7	15	46		3				5						8
8	15	46											1	1
9	8	30		19					3					22
10	11	46		2										2
11	9	30												0
12	15	61		1	p*		2	p*	p*			p*	p*	3
13	11	20		5										5
14	9	46		18		10		6	1					35
15	11	30		2				20	2					24
16	2	76				2	1			1				4
17	15	20		17		11		1						29
18	9	25		26		2		14						42
TOTAL	221	--	1	139	>5	27	8	>51	>6	1	1	p	>1	>239

* p indicates that species was present in seine haul, but was not counted due to large numbers of fish.

Seine hauls at locations 8 and 10 (Figure 1) may not be representative samples. A large mixed flock of birds disturbed the area immediately prior to seining at location 8, and the area seined at location 10 was narrow and close to shore due to the steep underwater slope of the beach berm.

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

Table 2 – Water quality sampling results from Santa Clara River Estuary, August 29, 2012.						
Water Quality Station	Depth	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Salinity (ppt)
OC-1	Surface	24.10	3.71	7.35	2309	1.18
	Bottom	22.40	3.71	7.33	2470	1.27
E-1	Surface	24.20	5.88	8.17	2662	1.38
	Bottom	32.70	2.84	8.08	2671	1.38
R-1	Surface	--	--	--	--	--
	Bottom	19.30	3.51	7.28	2961	1.55
E-2	Surface	24.60	7.25	8.17	2680	1.38
	Bottom	23.50	5.48	8.12	2661	1.38

5.0 Discussion

No tidewater gobies were observed by ABC in the BMI samples.

Tidewater gobies were common and were distributed throughout the estuary but were not as abundant as had been encountered in most previous fall surveys (ENTRIX 2008, 2009, Cardno ENTRIX 2010, Cardno ENTRIX 2011). The relatively lower number of gobies sampled may be reflective of the lower effort (only 18 seine hauls) during the 2012 survey compared to previous years and greater water depth that limited seining to a very narrow band along the shoreline in most locations. In addition, very small tidewater gobies were observed to escape through the mesh when the seine was lifted, so they were not counted. The presence of small juvenile gobies also suggests that spawning had continued until very recently in the estuary.

The other native species captured included only partially armored threespine stickleback, California killifish, and topsmelt. Stickleback were found in low numbers at several locations in the estuary. Similar

to the previous year's survey, stickleback are found throughout the Santa Clara River and seem to have been utilizing much of the estuary at the time of the survey, in contrast to earlier surveys which found them more abundant at the upper end of the estuary near the river inlet. Killifish were found at three locations along the western edge of the estuary. A seine haul at location 12 captured between 100 and 200 small fish, a mixture of killifish, topsmelt, silversides, and arroyo chubs that were not individually counted. Killifish prefer slow or impounded estuaries and lagoons (Moyle 2002), and may have increased in abundance due to the duration of lagoon closure, since the spring in 2012. Notably absent were native sculpins, specifically staghorn sculpin (*Leptocottus armatus*) and prickly sculpin (*Cottus asper*), which have been captured in previous surveys (ENTRIX 2008, 2009, Cardno ENTRIX 2010).

Non-native species were common, representing roughly half of the fish captured. Carp, fathead minnow, and green sunfish were only represented by one individual each, less than in most previous years (ENTRIX 2008, 2009, Cardno ENTRIX 2010). The most abundant non-native species captured were Mississippi silversides, arroyo chubs, and mosquitofish. The increase in arroyo chubs and mosquito fish compared to the previous year (Cardno ENTRIX 2011) may be attributable to the closed state of the estuary over many months that resulted in habitat throughout the estuary being less brackish (salinity ranging from 1.18 to 1.55 compared to 1.35 to 1.70 in 2011) and more stagnant, possibly favoring these species. Mosquitofish were mostly found at locations in the estuary away from the sand berm, likely due to the presence of vegetative cover. Arroyo chub were captured throughout much of the estuary, compared to only at the Harbor Boulevard Bridge in the previous survey (Cardno ENTRIX 2011). Arroyo chubs are native to the Los Angeles Basin and are considered introduced in the Santa Clara River watershed (Moyle 2002).

Mississippi silverside juveniles were fairly abundant and, judging by their size, were likely the result of successful reproduction after the estuary had closed. 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, 2009, Cardno ENTRIX 2010, Cardno ENTRIX 2011) as well as at a few other coastal estuarine sites in southern California. Mississippi silversides are ecologically similar to topsmelt and the interactions between the two species are not well understood. Mississippi silversides feed to some extent on the larvae of other fishes, and they may potentially impact native species like tidewater gobies, topsmelt, and others. Notably absent were crayfish (*Procambarus clarkii*) and African clawed frogs (*Xenopus laevis*), species which have often been captured during previous surveys (ENTRIX 2008, 2009, Cardno ENTRIX 2010).

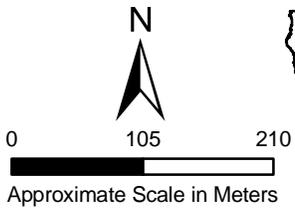
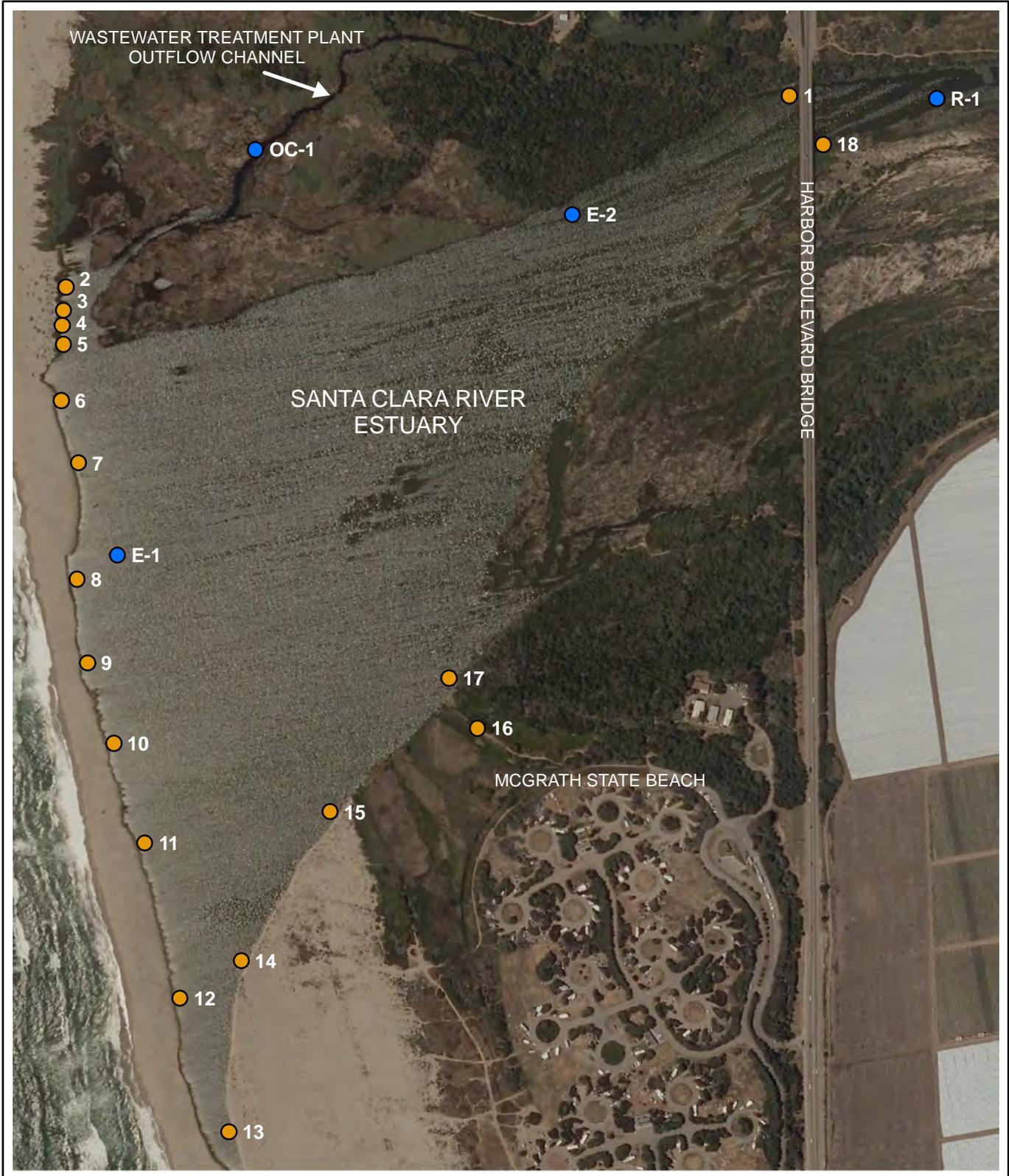
Several small, unidentified fish with what appeared to be highly deformed backbones were collected at two locations.

Water quality results (Table 2) indicated that the estuary was essentially freshwater throughout, as expected due to the high water levels that come from freshwater input. Temperatures were relatively uniform throughout and from surface to bottom indicating the water was well mixed throughout the estuary body. Conductivity was relatively uniform throughout. pH was lower at OC-1 and R-1 than other stations, likely a result of its location in the wastewater outlet area and upstream of Harbor Boulevard Bridge, respectively. DO was substantially lower than in 2011 at all stations and decreased from surface to bottom at stations E-1 and E-2. DO was fairly constant surface to bottom at OC-1 (wastewater outflow)

with a similar value at R-1 (upstream of Harbor Boulevard Bridge). The latter two locations have inflowing water while the sand berm location (E-1) and E-2 were essentially ponded due to the berm closure. Many birds were present at and adjacent to E-1, and decomposition of their feces in the water could have reduced DO.

6.0 References

- Cardno ENTRIX. 2011. 2011 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary. City of Ventura, Ventura County, California. November 11.
- Cardno ENTRIX. 2010. 2010 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary. City of Ventura, Ventura County, California. October 22.
- ENTRIX, Inc. 2008. Results of Survey for Tidewater Gobies, *Eucyclogobius newberryi*, in the Santa Clara River Lagoon with Aquatic Bioassay, Inc. on October 14, 2008 for City of Ventura NPDES Assessment. November 21.
- ENTRIX, Inc. 2009. 2009 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary. City of Ventura, Ventura County, California. November 19.
- Moyle, P.B. 2002. Inland fishes of California. University of California Press, Berkeley, CA. 502 pp.



Legend

- TIDEWATER GOBY SURVEY LOCATIONS (SEINE HAUL LOCATION NUMBER)
- WATER QUALITY SAMPLING LOCATIONS (STATION NUMBER)

Aerial Imagery:
National Agriculture Imagery Program 2010



**TIDEWATER GOBY SURVEY
SANTA CLARA RIVER ESTUARY**

AUGUST 29, 2012
CITY OF VENTURA