

# Technical Memorandum

**Date** November 11, 2011

**To:** Dan Pfeifer  
City of Ventura

**From:** Joel Mulder

**RE:** **2011 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.

Cardno ENTRIX (formerly ENTRIX, Inc.) has 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 2011. 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 2011 annual survey, completed on September 20, 2011.

## 2.0 Description of the Area

At the time of the survey, the estuary had only recently closed to the ocean in late August 2011. Water had re-filled much of the estuary and was higher than what has been encountered in the last few years of surveys (ENTRIX 2008 and 2009, Cardno ENTRIX 2010). 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 200 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 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.

At least 50 percent or more of the estuary was less than 1.5 m deep and an estimated 40 percent of the estuary was less than about 60 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 meters 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 Beach State Park. Depths became gradually shallower proceeding east towards the State Park. A slough inlet existed along the State Park boundary where water extended approximately 60 m inland and was approximately 70-90 cm deep (Seine Hauls 22-23, Figure 1). Much of the area between the slough and Harbor Boulevard Bridge was too deep to wade (more than 100 cm deep). Depths at the south side of Harbor Boulevard Bridge ranged from approximately 30-100 cm, with the deeper areas located around the bridge footings where some scouring had occurred. 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 brown colored, and visibility was limited to approximately 40-50 cm or less.

### 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 TE815144-7) 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 performed in conjunction with a benthic macroinvertebrate (BMI) study performed by ABC. The BMI sampling sites were assessed for tidewater gobies in order to avoid potential impacts to tidewater gobies resulting from the BMI sampling activities. Care was taken not to disturb the substrate where the BMI sampling was to occur. Dr. Thompson visually checked the vicinity of the BMI sample sites for fish prior to the samples being taken, being careful not to disturb the actual sample site. She also checked the samples when they were being screened to make sure no tidewater gobies had been captured in the small dredge. The survey began under Harbor Boulevard Bridge and then

proceeded to the northwest corner of the estuary where it continued southeast along the beach sand berm. After ABC completed their work, Dr. Thompson and Joel Mulder (Cardno ENTRIX) continued the tidewater goby survey southeast along the remainder of the beach sand berm, northeast around the estuary's southern perimeter, and then finished back at Harbor Boulevard Bridge. Figure 1 presents the locations of each seine haul and each location is numbered by the order in which each seine haul was performed. 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 25 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*), and California killifish (*Fundulus parvipinnis*). Non-native species captured included mosquitofish (*Gambusia affinis*), arroyo chub (*Gila orcuttii*), Mississippi silverside (*Menidia audens*), and carp (*Cyprinus carpio*).

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 adults and were present throughout the estuary. The single killifish captured was an adult and was found along the beach berm (Stations 16). Mosquitofish were not abundant and the two captured were under Harbor Boulevard Bridge in a backwater area near a bridge footing. The Mississippi silversides were mostly small juveniles under 3 cm. Similarly, all carp captured were small juveniles under 3 cm. The few arroyo chubs encountered were found only at the Harbor Boulevard Bridge.

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

#### 5.0 Discussion

Tidewater gobies were common and were distributed throughout the estuary but were not as abundant as has been encountered in most previous fall surveys (ENTRIX 2008, 2009, Cardno ENTRIX 2010). Presumably, the goby population was somewhat reduced due to the estuary being open to the ocean throughout the majority of the summer, thereby limiting the amount of rearing and spawning habitat available. The relatively high number of small juvenile gobies also suggests that spawning had only very recently occurred in the estuary.

The other native species captured included only partially armored threespine stickleback and California killifish. Stickleback were found throughout the estuary, while only a single killifish was captured. 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 previous surveys which found them more abundant at the upper end of the estuary near the river inlet. Killifish prefer slow or impounded estuaries and lagoons (Moyle 2002), and may have also been reduced by the open state of the estuary throughout the summer.

Non-native species were less common than in previous surveys, with the exception of numerous juvenile carp and Mississippi silversides. Again, the change in non-native fish numbers is likely attributable to the open state of the estuary over many months that resulted in habitat throughout the estuary being more

riverine as the Santa Clara River flow was confined to a narrow channel and exited the estuary straight to the ocean. While this may have scoured away many non-native fish better adapted to slower or pooled habitat, it seems to have favored carp reproduction. Notably absent were green sunfish (*Lepomis cyanellus*), crayfish (*Procambarus clarkii*), and African clawed frogs (*Xenopus laevis*), species which have often been captured during previous surveys (ENTRIX 2008, 2009, Cardno ENTRIX 2010). Arroyo chub were captured only at the Harbor Boulevard Bridge. It is unknown if some habitat condition in that area is favorable to this species. 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) 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.

Water quality results indicated that the estuary was essentially freshwater throughout, as expected due to the recent closure and filling with river water. 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 WQ 003 than other stations, likely a result of its location in the wastewater outlet area. DO was high at the Harbor Boulevard and wastewater outflow locations and lower along the sand berm (WQ004). The former two locations have inflowing water while the sand berm location was essentially ponded due to the berm closure. Many birds were present at and adjacent to WQ004, and decomposition of their feces in the water could have reduced DO. .

## 6.0 References

- 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.

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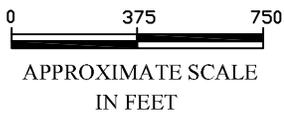
# Tables

November 11, 2011  
 2011 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary.

Table 1 – Results of fish survey in Santa Clara River Estuary, September 20, 2011.										
Seine Haul	Area (m <sup>2</sup> )	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	TOTAL
1	9	75	5	6	--	--	1	1	--	13
2	6	75	3	7	--	--	1	2	--	13
3	5	60	2	7	--	--	1	--	--	10
4	20	60	--	5	--	--	--	--	--	5
5	30	75	--	8	--	--	--	--	--	8
6	22	60	--	27	--	--	--	--	--	27
7	19	46	--	29	--	--	--	--	--	29
8	15	75	--	13	--	--	2	--	--	15
9	19	30	--	2	--	--	--	--	--	2
10	19	46	1	7	--	--	1	--	--	9
11	15	46	--	7	--	--	2	--	1	10
12	15	61	1	8	--	--	1	--	--	10
13	15	46	1	2	--	--	--	--	1	4
14	19	46	1	9	--	--	--	--	2	12
15	22	61	--	1	--	--	5	--	2	8
16	22	30	12	27	2	--	2	--	38	81
17	22	30	--	11	--	--	1	--	4	16
18	19	30	--	4	--	--	--	--	2	6
19	19	61	--	--	--	--	--	--	2	2
20	3	75	--	2	--	--	--	--	3	5
21	17	75	--	--	--	--	--	--	4	4
22	5	91	1	3	--	--	--	--	--	4
23	2	91	--	2	--	--	--	--	--	2
24	11	75	--	4	--	2	--	--	16	22
25	30	61	--	53	--	--	--	--	--	53
<b>TOTAL</b>	<b>400</b>	<b>--</b>	<b>27</b>	<b>244</b>	<b>2</b>	<b>2</b>	<b>17</b>	<b>3</b>	<b>75</b>	<b>370</b>

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Table 2 – Water quality sampling results from Santa Clara River Estuary, September 20, 2011.						
Water Quality Station	Depth (cm)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µs)	Salinity (ppt)
003	Surface	19.60	12.98	9.51	32.41	1.70
	Bottom	19.58	12.75	9.42	32.41	1.70
004	Surface	19.37	6.28	8.22	26.89	1.35
	Bottom	19.64	8.62	8.97	29.58	1.54
005	Surface	19.95	15.23	8.87	31.27	1.63
	Bottom	20.00	13.50	8.33	30.63	1.60



LEGEND

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



TIDEWATER GOBY SURVEY SANTA CLARA RIVER ESTUARY SEPTEMBER, 2011 CITY OF VENTURA			
Drawn By: CMO	PROJECT No. 30254090.00	FIGURE No. 1	DATE 9/11