

## MEMORANDUM



**To:** Mr. Dan Pfeifer  
City of Ventura  
P.O. Box 99  
Ventura, CA 93002

**From:** Camm C. Swift, Joel Mulder

**Re:** **2010 Survey for Tidewater Goby, *Eucyclogobius newberryi*, in Santa Clara River Estuary.**  
City of Ventura, Ventura County, California

**Date:** October 22, 2010

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### Introduction

As a condition of the City of Ventura's National Pollution Discharge Elimination System (NPDES) discharge permit, the population status of the federally 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 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.

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 and 2010. 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 2010 annual survey, completed on September 17, 2010. The survey was led by Cardno ENTRIX senior biologist Camm Swift, Ph.D. with assistance of ABC biologists Mr. James Mann, Ms. Wendy Willis, Mr. Alan Calvin, and Ms. Brianna Locke in the morning and continued in the afternoon with Mr. Joel Mulder of Cardno ENTRIX. All fish handling was performed under the supervision of Dr. Swift who holds a Section 10(a)1(a) permit (Permit Number TE793644-7) from the U.S. Fish and Wildlife Service for tidewater goby and a current California Scientific Collecting Permit.

Upon reaching the estuary on the morning of September 17, 2010 it was discovered that the estuary sand bar had been breached the previous night and the estuary had emptied into the ocean (Photo 1). Due to the emptying of the estuary and discovery of dead tidewater gobies and steelhead at the beginning of the survey, National Marine Fisheries Service (NMFS) and California Department of Fish and Game (CDFG) biologists Mr. Stan Glowacki and Mr. Tim Hovey, respectively, were contacted by phone. Subsequently, the site was visited in the afternoon by Mr. Chris Dellith, U. S. Fish and Wildlife Service, Ventura Field Office, and Mr. Joshua Crocker, Marine Game Warden, CDFG, San Diego. In addition NMFS enforcement agent Mr. Bill Struble was apprised of the situation by phone. Otherwise the survey proceeded more or less as usual given the greatly reduced area of aquatic habitat.

### Description of the Area

At the time of the survey, the Santa Clara River Estuary had been closed for much of the late summer and fall but had breached during the night before the survey. As a result, the remaining water within the estuary had dropped to very low levels exposing over 95% of the estuary substrate. The water line on the estuary shoreline and vegetation indicated that water depths prior to the breach were up to approximately 1.2 meters (m) at Harbor Boulevard Bridge and approximately 3 to 4 m just inside the beach sand berm at the ocean. Approximately 80% of the estuary had been 1.5 to 2.5 m deep

downstream of Harbor Boulevard Bridge and the estuary had standing water at least 500 m upstream of the bridge.

As a result of the breach, the majority of the estuary was composed of broad, exposed, mud and sand flats (Photo 1). The breach and outflow channel were located at the north end of the berm and the outflow channel ranged from 30 to 50 m wide. The only wetted portions of the estuary were the river channel that meandered southwest along the northern edge of the estuary, the wastewater outflow that ran southwest to join the river channel about 150 m upstream of the breach, and a much smaller channel coming in from the south at approximately the same spot as the wastewater outflow. This southern flow was draining a few shallow, residual, pooled areas in the southern arm of the estuary (Figure 1). Flow was also observed entering the estuary from the marshy area just northwest of McGrath State Beach Campground at two points. It was unclear if those flows would be maintained or whether it was just an outwash of the estuary water that had inundated the marsh area prior to the estuary breach. The slough located in this marshy area was largely dewatered except at its mouth where shallow flow existed. The rest of the small sloughs and wetland near this channel were moist but no standing water was observed. The remaining water within the estuary was generally very turbid as a result of the draining and the concentration of fish, particularly carp, disturbing the water. At the Harbor Boulevard Bridge, the water was somewhat clearer but still turbid from fish activity.

The southeastern estuary shoreline, from approximately 300 m downstream of Harbor Boulevard and upstream along the river channel, 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 heavily inundated with *Arundo donax* for approximately 170 m. Continuing west, in the vicinity of McGrath Beach State Park, a large flat expanse of low 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 southeastern corner and southern arm of the estuary. The northwestern 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.*, *Arundo donax* and tules. Throughout the estuary, vegetation was restricted to the shorelines and the majority of the water column and benthic substrate were free of vegetation. The beach sand berm was devoid of any vegetation.

Substrate throughout the estuary was primarily (90%) coarse sand. Approximately 5% of the substrate was composed of clay or mud and 5% gravel or cobble. A veneer of soft mud was present on top of sandy substrate throughout much of the lower one third of the estuary and along the beach berm, as well as in the wastewater channel.

## Methods

The estuary was surveyed visually and with a beach seine measuring 3.2 X 1.2 m with 3 millimeter (mm) mesh. Because the estuary was largely dewatered, the small amount of wetted area and shallow depths remaining allowed sampling throughout the estuary and much more visual observation was conducted than in previous surveys. 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. 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, northeast around the estuary's southern perimeter, and then finished back at the 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. With the drastic lowering of the estuary, fish were extremely concentrated and numerous in most seine hauls. To avoid excessive handling stress, the number of fish in each seine haul was estimated so they could be expeditiously released. Voucher specimens of some tidewater gobies mortalities and other fish were kept in ethyl alcohol.

Water quality measurements were taken by ABC at three separate locations (immediately upstream of Harbor Boulevard Bridge and near Seine Hauls 7 and 14, Figure 1) with a YSI water quality meter (Figure 1).

## Results

A total of 28 seine hauls were performed throughout the remaining water in the estuary (Figure 1). Table 1 presents the results of the seine hauls.

**Table 1 – Results of Seine Hauls in Santa Clara River Estuary, September 17, 2010.**

Seine Haul	Area (m <sup>2</sup> )	Depth (m)	Species Captured													TOTAL
			Cyprinus carpio carp	Cottus asper prickly sculpin	Eucyclogobius newberryi tidewater goby	Fundulus parvipinnis California killifish	Gambusia affinis mosquitofish	Gasterosteus aculeatus stickleback	Gila orcutti arroyo chub	Lepomis cyanellus green sunfish	Leptocottus armatus staghorn sculpin	Menidia audens Mississippi silverside	Pimephales promelas fathead minnow	Procambarus clarkii red swamp crayfish	Xenopus laevis African clawed frog	
1 - 2	24	30	20	35	60	0	1	0	5	10	0	0	6	0	0	82
3 - 5	36	40	40	25	55	0	10		10	60	0	5	40	1	0	181
6	8	60	0	0	35	0	0	0	0	0	0	0	0	0	0	35
7	8	60	0	0	90	0	0	0	0	0	0	0	0	2	0	92
8	8	30	0	0	90	0	0	0	0	0	0	0	0	0	0	90
9	8	20	0	0	90	0	0	0	0	0	0	0	0	0	0	90
10	8	30	0	0	300	0	0	0	0	0	0	0	0	2	0	302
11	9	40	0	0	200	0	0	0	0	0	0	0	0	0	0	200
12	9	40	0	0	30	0	0	0	0	0	0	0	0	0	0	30
13	9	70	0	1	120	0	0	0	0	0	0	0	0	4	0	124
14	9	80	0	2	150	0	0	0	0	0	2	0	0	0	1*	155
15 - 18	48	90	0	0	150	1	0	9	0	0	0	10	0	0	0	170
19	12	90	0	0	150	0	0	0	0	0	0	0	0	0	0	150
20	9	40	0	0	50	0	0	0	0	0	0	0	0	1	0	51
21	9	40	0	0	30	0	0	0	0	0	0	0	0	0	12	42
22	9	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	9	50	1	0	15	0	0	0	0	0	0	0	0	0	1	16
24	12	50	0	0	30	0	0	0	0	3	0	0	4	0	1	38
25	12	30	15	0	90	0	20	1	0	20	0	0	15	0	0	146
26	12	20	15	0	30	0	20	0	0	15	0	0	10	0	0	75
27	12	25	1	0	40	0	0	0	0	1	0	0	2	0	0	43
28	16	25	5	0	50	0	0	0	0	5	0	0	25	0	0	80
TOTAL	296		97	63	1855	1	51	10	15	114	2	15	102	10	15	2191

\* = larva

Native species captured during seining included tidewater goby, staghorn sculpin, partially-armored threespine stickleback, and California killifish. Non-native species captured included mosquitofish,

arroyo chub, fathead minnow, Mississippi silverside, carp, prickly sculpin, green sunfish, African clawed frog, and red swamp crayfish.

In addition to those fish encountered during the seining effort, observations of native fishes over most of the estuary included several thousand tidewater goby mortalities on the exposed estuary bottom, a single staghorn sculpin mortality, 1 striped mullet, *Mugil cephalus*, mortality, and 7 rainbow trout/steelhead, *Oncorhynchus mykiss*, mortalities (the rainbow trout/steelhead were dispersed from about 100 m upstream to 400 m downstream of Harbor Boulevard Bridge). Fin clips (for genetic analysis) and scales samples (for age and condition study) were kept as well as the whole fish in frozen condition, as requested by Tim Hovey (DFG), Stan Glowacki (NMFS), and Bill Struble (NMFS). All specimens were photographed soon after discovery (Photos 2-4). The standard (total) lengths of the mortalities were; 310 (365); 257 (300); 260 (300); 273 (322); 262 (307); 227 (267); and 255 (299).

Non-native species observed included several hundred to a few thousand each of fathead minnows and juvenile green sunfish. A few hundred each of prickly sculpin, suckers (not identified but undoubtedly *Catostomus santaanae*, *C. fumeiventris*, and their hybrids), mosquitofish, and one large black bullhead, *Ameiurus melas*, were observed mostly in the upper half of the estuary. Ten to 15 Mississippi silverside mortalities and 3 to 4 staghorn sculpin mortalities were also observed. At least a few hundred live carp were observed in the main river channel from upstream of Harbor Boulevard Bridge to within 100 m of the ocean and increasing numbers of these were observed expiring throughout the day.

The fathead minnows and tidewater gobies captured and observed were represented by all sizes from small juveniles to large adults. The stickleback were all adults and were captured in a backwater pool near the berm breach. The staghorn sculpin were captured in the lower one third of the estuary and were all large juveniles. The single killifish captured was an adult and was found in an isolated pool in the northwest corner of the estuary (Stations 15-18). The mosquitofish were captured primarily in the upper half of the estuary and wastewater channel. The Mississippi silversides were all adults and were captured throughout the estuary and many of these were recently deceased. The green sunfish were also captured throughout the estuary and were overwhelmingly comprised of juveniles less than approximately 70 mm in length.

Approximately one-half of the exposed sand and mud of the estuary was walked and observed. Throughout the majority of this area, tidewater goby, green sunfish, and fathead minnow mortalities were present. Far fewer suckers, prickly sculpin, or carp were stranded. This may be because these species prefer the stream channels where flow was present and were not as broadly distributed over the whole estuary. Most of these latter three species were observed in the river channel at the upper end of the estuary struggling to survive in the low oxygen conditions.

In addition to the survey within the estuary, the outer ocean beach was examined for approximately 800 m north of the berm breach in the early afternoon (approximately 13:00 – 13:30). Along the wrack line, scattered tidewater gobies, juvenile green sunfish, and fathead minnows were observed. It was roughly estimated that all three fish species constituted about 5-10 individuals per meter of beach. Some of the tidewater gobies were alive and were returned to the water but most were mortalities. The green sunfish and fathead minnow were all mortalities likely as a result of their intolerance to salinity. Also observed along the wrack line were 1 adult, carp mortality and 1 adult striped mullet mortality.

Juvenile and adult clawed frogs were abundant and were concentrated in the deeper water just inside the breach to the ocean where they were observed rising to the surface en masse, possibly to feed or to breathe. Hundreds, if not thousands, of them were present. While on the outer beach, at least 20 clawed frogs were observed coming out of the ocean surf where they were being preyed upon by large flocks of Heerman's gulls, *Larus heermanni*. Other beach goers related observing this phenomenon all morning prior to our beach examination. At least 15 clawed frogs were also observed

freshly desiccated on the dune sand, apparently having escaped the gulls but expired trying to traverse the dry sand.

Table 2 presents the results of the water quality sampling undertaken by ABC. Water temperatures were slightly cooler upstream where the night time temperatures have more of an effect due to decreased depth and distance from the ocean. Salinity was very low (essentially fresh water) since the estuary had just drained and the incoming freshwater had pushed any saline water out. We observed some minor surge of waves near Water Quality Station 003 during the first half of the day but it was restricted to a small area near the breach. The narrow range of these measurements over widely spaced sites indicate the estuary was well mixed and very similar in temperature and salinity in areas less than about 2 m deep. The deep pool near the ocean may have had saltier water at depth.

**Table 2 – Water Quality Results from Santa Clara River Estuary, September 17, 2007.**

Water Quality Station	Depth (cm)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (µs)	Salinity (ppt)
003	Surface	19.81	4.95	7.60	3371	1.98
004	30	17.23	4.68	7.42	2129	1.30
005	20	17.94	3.3	7.21	3605	2.22

## Discussion

The results of this year’s survey were affected by the fact that the estuary had drained the night before our survey. The estuary had been observed to still be full on the previous afternoon by Mr. James Mann who examined it in anticipation of the water quality work the following day. On the September 14, 2010 Carly Spahr, Cardno ENTRIX., and Jason Wong, City of Ventura, Wastewater Division (Personal communication to Joel Mulder and Camm Swift on September 17, 2010), had each separately observed a trench being dug in the sand berm. Spahr described it in her bird survey report (ENTRIX 2010) as follows:

“While performing the beach strand portion of this survey, the surveyor noted off-road vehicle tracks beginning at the Surfer’s Knoll parking lot continuing down to the mouth of the estuary. The pattern of the tracks appeared to be that of a “joy-rider” rather than harbor patrol or a State Park Lifeguard. The tracks were fairly fresh. The tracks were estimated to be one to two nights old due to the tire tread indentation still present in the sand...At the rivermouth, where the tracks ended, a large trench had been dug from the estuary boundary to the wet sand of the ocean wave slope. This trench was approximately four feet wide, ten feet long, and three feet deep. The trench began at the water’s edge of the estuary and continued to the wet sand of the previous high tide. The surveyor notified the McGrath State Beach Campground kiosk attendant and lifeguards that were on duty of the illegal activity.”

Considerable mortality of both native and exotic fish species occurred during this dewatering of the estuary. Most conspicuous and numerous were the tidewater gobies, fathead minnows, and green sunfish. In addition to stranding, many of the fish (except tidewater gobies) were observed to be

stressed by very low oxygen and were seen gulping or gasping at the surface or at the edge of the water. These fish were very sluggish and did not try to escape when approached, likely as a result of their stressed and weakened condition.

The mortality of seven rainbow trout/steelhead was noted and no live individuals were observed. Mr. Steve Howard, United Water District, related that 64 smolts were transferred by his team from the Freeman Diversion to the estuary in 2010; 34 when the estuary was still open and 30 after it had closed (Personal communication to Camm Swift on September 22, 2010). In addition, some smolts may have passed through the Freeman Diversion during a period of passage flows in the spring. Studies have indicated that smolts released in an open lagoon or estuary typically leave for the ocean in a few days (Kelly 2008). Thus, Mr. Howard suspected that the seven mortalities were some of the smolts transferred after the estuary had closed. The relatively large size and robust condition of these fish (Photos 2-4) indicate they were doing relatively well in or near the estuary and that adequate conditions existed for them in at least part of the local habitat.

In contrast to all the other species of fish observed and captured, the remaining tidewater gobies in what was left of the estuary water appeared in relatively good condition. They were lively and not observed hovering at the surface or near the edges of the existing water, even though they have been observed to do so elsewhere when under low oxygen conditions. Rather, the many tidewater goby mortalities observed appeared to be a result of stranding in the dewatered areas of the estuary. Some of those found dead on the outer ocean beach may have been killed in the churning of the surf or by the higher salinity. While tidewater gobies can tolerate marine salinities, they are more successful in marine environments if given time to acclimate to the higher salinity.

Tidewater gobies were abundant and distributed throughout the remaining estuary water. Presumably, gobies were similarly distributed throughout the estuary prior to the breach based on the stranding observed. The seine hauls captured a wide range of sizes indicating that considerable reproduction had taken place prior to the breach and that the recent large and stable estuary conditions had presented good conditions for reproduction and had provided a large amount of habitat and cover for tidewater gobies. Very small juveniles and larval tidewater gobies were not captured or observed, suggesting that reproduction had slowed going into the fall season. Given the area of the estuary prior to the breach, at least hundreds of thousands of gobies were likely present at the time of this year's survey.

As has been documented in many other coastal lagoons, tidewater gobies were one of the most abundant native species present. The other native species were rarely encountered, namely threespine stickleback, California killifish, striped mullet, and staghorn sculpin, despite the estuary being very accessible to sampling and the fish being concentrated in small areas of water. Previous surveys in the estuary have encountered topsmelt, *Atherinops affinis*, and starry flounder, *Platichthys stellatus*. A few other native estuarine species potentially present but not detected during this survey are diamond turbot, *Hypsopsetta guttulata*, shiner perch, *Cymatogaster aggregata*, yellowfin croaker, *Umbrina roncadora*, arrow goby, *Clevelandia ios*, longjaw mudsucker, *Gillichthys mirabilis*, and California halibut, *Paralichthys californicus*. These six species are usually rare in closed estuarine systems, such as the Santa Clara River Estuary. If present prior to the breach, these species may have been undetected in our survey or may have left the estuary when the berm breached.

As in previous surveys, the flowing stream upstream of the estuary was not examined in the time available. Because the river has very slow flow and appears to lack any vertical barriers, tidewater gobies could occur some distance upstream of the estuary. They are known to occur up to 8 or 9 kilometers upstream of the estuary in the Santa Ynez River (Santa Barbara County) and three or four kilometers upstream in the Santa Margarita River (San Diego County). These systems are similar to the Santa Clara River with sandy, low gradient conditions near the coast. In those systems, no evidence of reproduction in the streams was found. Rather, the river habitat is utilized for feeding and growth by juvenile tidewater gobies.

Non-native species were encountered throughout the estuary. While arroyo chubs and Mississippi silversides were rare, green sunfish and fathead minnows were very abundant. Mosquitofish, suckers, and prickly sculpin were moderately abundant and tended to occur in the upper half to one third of the estuary. 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). Occasional individuals were taken in Pyramid Reservoir, Piru Creek, and Lake Piru but in the last four years they have become common in the lower Santa Clara River and the estuary (ENTRIX 2008, 2009) 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. Topsmelt juveniles provide food for federally and state endangered California least terns, *Sterna antillarum browni*, and it is unknown if Mississippi silversides can fill this role. 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.

## References

- 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.
- ENTRIX, Inc. 2010. September Bird Survey: Santa Clara River Estuary and Wildlife Treatment Ponds. Prepared for the City of Ventura. September 18.
- Moyle, P.B. 2002. Inland fishes of California. University of California Press, Berkeley, CA. 502 pp.
- Kelly, E. 2008. Steelhead Trout Smolt Survival in the Santa Clara and Santa Ynez River Estuaries. Prepared for the California Department of Fish and Game Fisheries Restoration Grant Program. August, 2008.



**Photo 1 - Drained estuary mud/sand flats with berm breach visible in the background.**



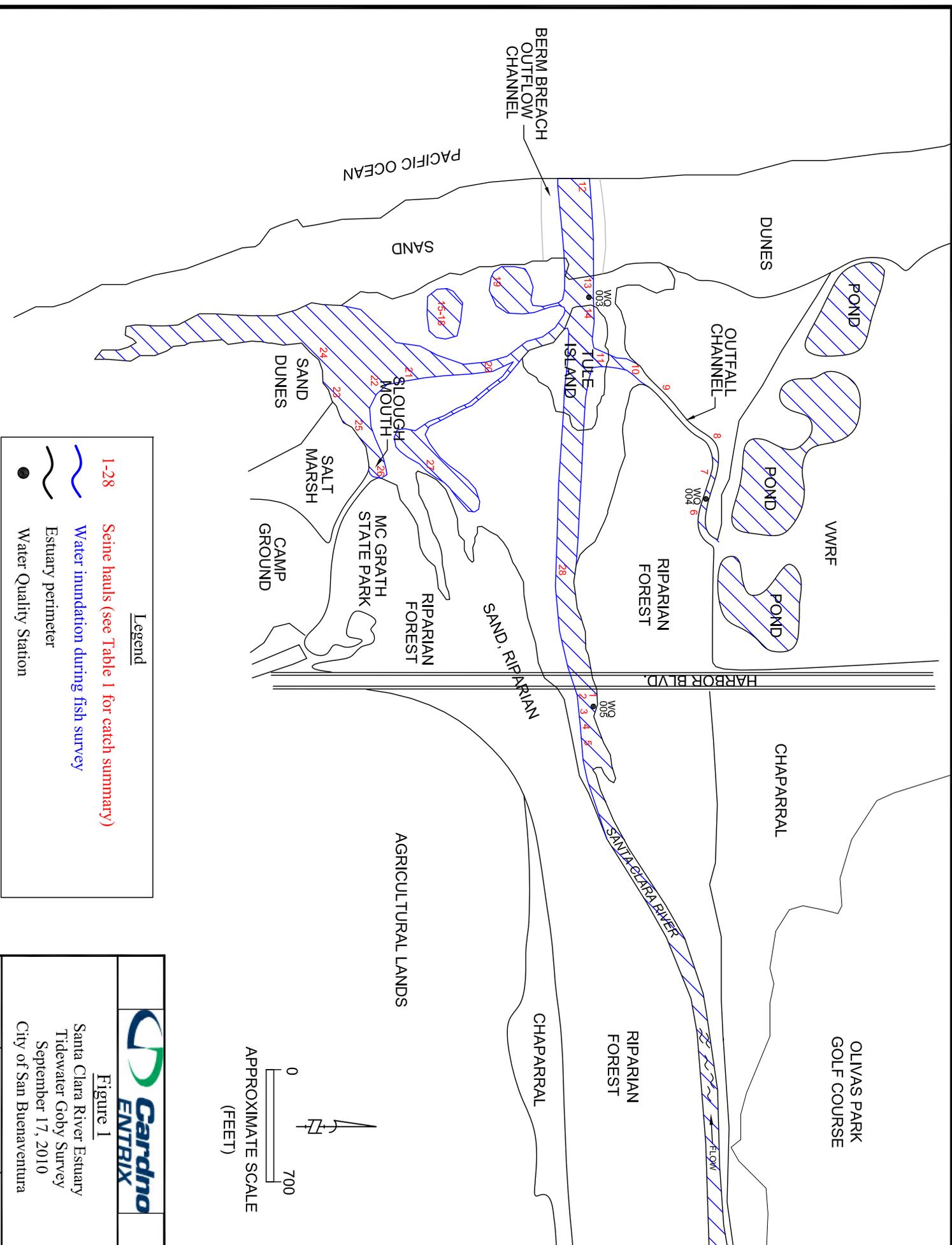
**Photo 2 – Three of the seven steelhead mortalities.**



**Photo 3 - Another three steelhead mortalities.**



**Photo 4 – Single steelhead mortality discovered in the afternoon.**



**Legend**

- 1-28 Seining hauls (see Table 1 for catch summary)
- Water inundation during fish survey
- Estuary perimeter
- Water Quality Station

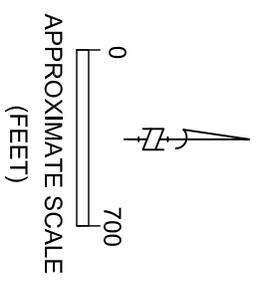


Figure 1

Santa Clara River Estuary  
Tidewater Goby Survey  
September 17, 2010  
City of San Buenaventura