ATTACHMENT C: FISH & ESTUARINE BIOLOGY REPORT

MEMORANDUM

To: Robert A. Hamilton
Hamilton Biological, Inc.
316 Monrovia Avenue
Long Beach, CA 90803

From: Camm C. Swift, Ph.D.
Joel Mulder

Re: Results of Fish surveys at Oxford Basin on January 12 and April 27, 2010 and recommendations for restoration potential for fishes and other estuarine and marine life.

Date: August 27, 2010

Introduction

Oxford Basin (Basin) is a storm-water flood control basin connected by tide-gates and a subterranean concrete conduit to Marina del Rey. The Basin is located along Washington Avenue between Oxford Avenue and Palawan Way in the City of Venice, Los Angeles County, California (33°59'6.77"N, 118°27'19.93"W). It is a remnant of the much larger Ballona Wetlands that formerly occupied this area prior to development of the harbor (Swift and Frantz 1981) and which constituted the mouth of the Los Angeles River in the early 1800s. The Los Angeles County Department of Public Works (LADPW) requested a study of the fish population in the Basin from Hamilton Biological in order to provide a basis for the formulation of a restoration plan for the area and to examine the possible alternatives for improvements to the area. ENTRIX, Inc. (ENTRIX) conducted two fish surveys at Oxford Basin (January 12 and April 27, 2010) and performed a review of historical documents on the fishes and other biological aspects of the area. The results of this study are presented here and provide data on the current fish fauna. Also provided is a discussion and analysis of potential restoration actions to benefit and improve the estuarine habitat for fish and other aquatic estuarine species.

Description of the Project Area

Oxford Basin is designed to catch storm and street water runoff from the surrounding urban areas of the City of Venice and Marine del Rey. The main body of the Basin is approximately 465 meters (m) long and 56 m wide at its widest point. The Basin is generally rectangular shaped and runs in a northeast to southwest direction, with one long, narrow arm leading east approximately 120 m to a storm-water inlet (Figures 1 and 2). During the first survey on January 12, 2010, a small amount of street runoff flow was being pumped into the Basin around a construction project taking place at the eastern inlet. On the second survey occurring April 27, 2010, a permanent concrete diversion barrier had been completed at this inlet which collected street runoff and periodically pumped it into the sewer system rather than allowing this flow into the Basin. However, overflow inlets were present to allow high storm flows to pass in the Basin. A second inlet entered the Basin along the northern side via a concrete lined channel with a concrete apron (approximately 8.5 m wide) extending out into the Basin (Figures 1 and 2). Less than an estimated 0.02 cubic meters per second of flow was observed entering the Basin from this inlet on both survey dates. Additionally, two small trickles of street drainage or seepage were observed on the west and east sides of a southward extending point of land on the northern shore, directly across the Basin from the tide gates.

Water depths within the Basin fluctuate with natural tidal fluctuations in Marina del Rey, however, the inflow and outflow to the Basin is controlled by a set of tide-gates at the southwestern corner of the Basin. The elevation of high tide allowed to rise by no more than approximately 1.5 m (4.8 feet) above mean low water (Mike Stephenson, LADPW, January 12, 2010, personal communication). As a result, water depths in the Basin were greatest at or shortly after high tide, with a maximum depth of approximately 2 m in a localized area near the tide-gate. Depths are generally shallower throughout the remainder of the Basin. Approximately one-half of the Basin bottom substrate became exposed at low tide. The tide-gates are reported to be occasionally shut to prevent any tidal fluctuation, such as following low tides before predicted rain storms in order to increase the capacity of the Basin to hold storm runoff.

On January 12, 2010 the salinity at the surface at two sites in the lower Basin ranged between 15-18 parts per thousand (‰), Salinity at the inflow at the east inlet it was 3 ‰. The water temperature ranged from 15-18° Celsius (C) at several locations in the Basin. On April 27, 2010 several salinity measurements throughout the Basin, including at the eastern inlet, ranged from 33 to 34 ‰. Water temperatures were 17-18° C. During both surveys the water was moderately turbid with visibility estimated to approximately 1 m.

Substrate within the Basin on both survey dates was predominately comprised of firm to soft mud/silt. Some small areas of fine sand existed near the tide gates where the strength of the in-flowing and out-flowing tidal currents presumably prevents deposition of finer substrate. The majority of the Basin banks were steep to gentle earthen slopes densely inundated with pickleweed (*Salicornia sp.*) at the higher, intertidal, edges but the eastern one-third of the northern and southern shores were more shaded and only terrestrial grasses and herbaceous vegetation occupied the shore just above the high tide line. At lower tides, bare, firm to soft mud/silt was exposed between the waters edge and the pickleweed edges. The steeper south side of the Basin and eastern one third or so of the north side had approximately 1-3 m of bottom substrate exposed at low tide. The western two thirds of the north side became much more exposed at low tide, with 5 to 20 m of gently sloping mudflats becoming exposed. Near the tide-gates and the eastern inlet, patches of concrete debris and boulders were present. A few logs were also observed floating in the water. These hard substrates supported barnacles and a small number of mussels existed near and on the tide-gate structures.

During the first survey, no aquatic vegetation was observed in the Basin. On the second survey, filamentous green algae (possibly *Enteromorpha sp.)* were present along 50-80% of the wetted margins at low tide. Approximately 10% of the Basin surface had floating mats of this same algae present.

At high and low tides, very little flow was present in most of the Basin although some surge was observed coming through the mouth of the tide-gates. This caused a slow back and forth flow near the mouth and within about 30 m of either side of the gates, as well as some small wave action against the opposite shore. When the gates were opened with a strong difference in tidal levels between the Oxford Basin and the Basin E of Marina del Rey, stronger flows occurred. During strong incoming flows on April 27, a circular current existed in the western portion of the Basin which caused masses of green algae to float in a broad circular track across the water surface. This current, however, is likely an infrequent event and typically the tidal flow would be much slower over the 4-6 hour duration between high and low tides. These observed currents were with one tide-gate open and possibly even stronger flows can occur under certain circumstances with both tide-gates open.

The Basin is surrounded by elevated roadways, a parking lot, and trees along the roadway edges. Together, these extend upward to 10-15 m above the water level and shield the Basin from wind action. Surrounding high rise buildings and apartments along the northeast border also shelter the area from the wind even more.

Methods

The fish surveys were conducted by visual observation and by beach seining on January 12, 2010 and by visual observation, beach seining, and trapping on April 27, 2010. The seine net utilized measured 5 X 1.8 m with 3 millimeter (mm) mesh. The traps utilized consisted of 4 crayfish traps (Gee's) with 6 mm mesh and 25 minnow traps (Gee's) with 3 mm or 6 mm mesh. The crayfish traps were 70 centimeters (cm) long and 23 cm in diameter with double 5.7 cm openings and the minnow traps were 45 cm long and 23 cm in diameter with double 2.5 cm openings. All traps were baited with cut pieces of fresh mackerel. Traps were set around the perimeter of the Basin on the incoming high tide. Four crayfish traps were placed near the tide gates and the twenty minnow traps distributed around the Basin (Figure 2). The traps fished for 6 to 8 hours after being set in a west to east direction from 06:45 to 08:45 hrs and checked twice, once at approximately 11:30 and again at 14:30 when the traps were removed.

Results

Table 1 presents the results of the surveys. A total of 14 seine hauls around the perimeter of the Basin on January 12, 2010 captured hundreds of mosquitofish, *Gambusia affinis*, and one or two small juvenile shadow gobies, *Quietula y-cauda*, just west of the tide gates. In addition one large longjaw mudsucker, *Gillichthys mirabilis*, was observed in the rocks near the upper end but was not captured. The seining (5 hauls) and trapping on April 27, 2010 captured large numbers of native gobies, such as arrow gobies, *Clevelandia ios*, cheekspot gobies, *Ilypnus gilberti*. Also captured were a small number of native shadow gobies and longjaw mudsuckers. Topsmelt, *Atherinops affinis*, were abundant and hundreds were observed and captured ranging in size from small juveniles to adults (up to about 15 centimeters total length). In addition a few small, juvenile, non-native, yellowfin gobies, *Acanthogobius flavimanus*, were taken. The majority of fish were captured by seining rather than in the traps. Fish were found to be relatively scarce as distance form the tide-gates increased, with the exception of mosquitofish. For this reason, seining during the second survey was focused around the tide-gate. During both surveys, the majority of the Basin was observed from1-10 m from shore and fishes were rarely detected with the exception of the abundant mosquitofish in January.

Table 1 Results of fish surveys occurring on January 12 and April 27, 2010 at Oxford Basin.

		January 12, 2010		April 27, 2010		
Common Name	Scientific Name	Seine	Observed	Trap	Seine	Observed
mosquitofish	*Gambusia affinis*	>1000	>10,000	302	2	40
shadow goby	*Quietula y-cauda*	1	2	2	2	0
longjaw mudsucker	*Gillichthys mirabilis*	0	1	24	1	0
arrow goby	*Clevelandia ios*	0	0	0	25	0
cheekspot goby	*Ilypnus gilberti*	0	0	0	25	0
yellowfin goby	*Acanthogobius flavimanus*	0	0	0	7	0
topsmelt	*Atherinops affinis*	0	0	24	>300	150

Discussion

The species captured during the surveys are typical of coastal estuaries of southern California and indicate that Oxford Basin contains habitat that can support estuarine species for at least part of the year. The results of the January survey suggest the Basin supported very few estuarine fish in January. Mosquitofish were present in the tens of thousands while only two or three larval or small juvenile shadow gobies were captured near the tide-gate where they had apparently recently arrived and one large mudsucker was observed. By the April 27, 2010 survey, large numbers of gobies were detected. These were comprised of four native and one non-native species, all of which are typical of coastal estuaries in southern California. In addition, large numbers of topsmelt were present and only a few mosquitofish were captured. Fish were encountered both in seine hauls near the mouth and in traps set around the perimeter of the Basin indicating fish were dispersed throughout the Basin in late April. However, fish were most abundant near the tide gates. It is likely that the difference in fish abundance between the two surveys was due to the changes in freshwater influence and salinity in the Basin. In January, when freshwater input from numerous winter storm events had presumably repeatedly washed out the Basin, salinity in the Basin ranged from almost fresh to approximately half that of seawater. The salinity was considerably higher and at near seawater salinities in April, allowing colonization of the Basin by estuarine species dependent on higher salinity.

Invertebrates were uncommon in January except for “broken-backed shrimp” or *Palaemon macrodatylus*, a non-native species from Asia. This species was very common in January but fewer than 10 were captured in April when they were much les abundant. *P. macrodatylus* is well adapted for brackish or low salinity environments (Kuris et al. 2007). Possibly this species becomes abundant in Oxford Basin during the winter with the increase in freshwater influence that provides lower salinities and decreases the number of predatory fish present as well. California horn shells, *Cerithidia californica*, a typical invertebrate in southern California estuaries, were uncommon with only a few observed during both surveys despite the presence of considerable amounts of green algae, their primary food source, in April. As noted in the description of the area, barnacles were present on hard substrates around most of the Basin while mussels seemed restricted to the area around the tide gates. Other than an abundance of amphipods observed under the intertidal rocks, the only other aquatic invertebrate noted was the bubble shell, *Bulla gouldiana*. Several of these were observed near the mouth of the tide gate among the algae being dislodged by the strong incoming tidal currents and several were also captured by seining. Surprisingly, no crabs were encountered during the surveys. Seining and baited traps frequently take species of marsh crabs when sampling coastal salt marshes and estuaries. These crabs also have long pelagic larval stages which should enable them to colonize the Oxford Basin.

Also of interest are the species not encountered in the Basin during the surveys, but which would be expected to occur in southern California estuarine systems at this time of year. Because these species are typically very abundant following the springtime breeding periods, they are frequently easy to detect and would likely have been encountered if present in the Basin. These species include staghorn sculpin, *Leptocottus armatus*, California killifish, *Fundulus parvipinnis*, diamond turbot, *Pleuronichthys guttatus*, bay anchovy, *Anchoa delicatissima*, deepbody anchovy, *A. compressa*, bay pipefish, *Syngnathus leptorhynchus*, barred pipefish, *S. auliscus*, California halibut, *Paralichthys californicus*, striped mullet, *Mugil cephalus*, and shiner perch, *Cymatogaster aggregata*. A few other species that are less common or are more prevalent in larger estuaries but which might be expected to occur in the Basin include bay blenny, *Hypsoblennius gentilis*, spotted sand bass, *Paralabrax maculofasciatus*, and several species of elasmobranches (sharks and rays). Many of these are species are known to occur in adjacent Marina del Rey. The LADPW personnel present during the surveys related anecdotal observations of “sting rays” in the Oxford Basin in the past. Some of these fish are discussed in further detail below.

Additionally, there are several species of brackish, freshwater, or anadromous fish that undoubtedly occurred in the Ballona Lagoon and Ballona Wetlands historically but which have been extirpated from the area for at least 70 years or more. These species still occur to the north and south of the area and have special conservation status. The federally endangered tidewater goby, *Eucyclogobius newberryi*, occurs in Malibu and Topanga creeks to the north and in San Diego County to the south and there are historical records for artesian springs in Santa Monica (U. S. Fish and Wildlife Service 2005). The federally endangered southern California steelhead, *Oncorhynchus mykiss*, also still migrates from the ocean into Malibu and Topanga Creeks and was observed in San Mateo Creek in northern San Diego County in 1998-99 (NMFS 2009). After the adult steelhead spawned upstream in freshwater, the juveniles would have used the lagoon as a nursery area for a year or so before the juveniles left for the ocean (Swift et al. 1993; Moyle 2002). Finally the federally endangered unarmored threespine stickleback, *Gasterosteus aculeatus williamsoni*, occurred in the Los Angeles River and presumably occurred in or near the Ballona wetlands. The tidewater goby and stickleback would have been permanent residents of the estuarine area of the wider Ballona Marsh. All of these species rely on relatively stable, low salinity or brackish conditions and such conditions are unlikely to develop for any extended length of time in Oxford Basin, particularly since there appears to be an effort to divert freshwater street runoff into the sewer system, as was observed at the eastern inlet, rather than allowing it to flow into the Basin. Thus it would take exceptional effort to re-establish these species. In addition steelhead and stickleback require relatively cool and well oxygenated water which will also be difficult to maintain in the Oxford Basin under current conditions. If these species are ever to be seriously considered for return to this area, it would probably be best to utilize other areas of Ballona Wetlands where the appropriate habitat conditions can be developed more easily.

Most of the estuarine species detected during the two surveys in Oxford Basin are pelagic mid-water species (such as topsmelt) or have larvae that are pelagic in the water column for a few weeks (such as the goby species encountered). Other species that could be expected in Oxford Basin that produce pelagic larvae include anchovies, staghorn sculpin, diamond turbot, striped mullet, and California halibut. The larvae of these species typically arrive in estuaries in late winter and spring. Because these larvae colonize estuaries by being swept in by water currents, Oxford Basin should have the potential to be colonized by these species.

Fish species that do not have a pelagic larval phase, as well as adult fish of any estuarine species, would only be able to colonize the Basin by swimming in through the subterranean passageway and tide-gate system that connects Oxford Basin to Basin E in Marina del Rey. This connection is at least 100 m long and is unlit. It is unknown if this connection would present a barrier or deterrent to passage of fish into the Basin. As noted above the LADPW workers at the site on January 12 noted observations of “sting rays” in the Basin in the past and several other species known from Marina del Rey (Allen et al. 2006) certainly have the potential to invade. The available composition of fish species available to colonize Oxford Basin is probably largely determined by the community present in Basin E of Marina del Rey. The fauna of Marina del Rey have been studied for over 30 years and is well known to fluctuate considerably due to periodic fish kills in the summer when the lack of circulation and excess nutrients combines to lower oxygen concentrations. These effects are most extreme in the uppermost reaches of the harbor, such as at Oxford Basin or Basin E. (Aquatic BioAssay and Consulting 2009). Thus, the marina may not consistently be a reliable source of fish colonization into Oxford Basin.

One species of fish not encountered in the Basin but which is extremely common in other parts of the Ballona Wetlands and Marina del Rey is the California killifish. California killifish lay large eggs on hard substrates or vegetation and the young hatch out at an advanced stage as small juveniles with little or no pelagic or drifting dispersal phase. Therefore, California killifish may be limited in their ability to colonize Oxford Basin since it does not have a pelagic phase and may not occur close enough for adults to disperse into the Basin. It is possible that the habitat between the nearest known population at Mother’s Beach in the marina may be in inhospitable to killifish thereby limiting their dispersal. The long, dark passage from the tide-gates to Basin E may also deter them. In addition, Basin E has deep water (2 or more meters deep) with vertical concrete walls which may not be conducive to movement of the California killifish. The presence of larger predators in deep-water areas might also prevent significant migration through the marina and Basin E. It is possible that if California killifish were introduced into the Oxford Basin they would succeed in the area since the habitat appears appropriate for them. California killifish typically inhabit gently sloping, sandy, beaches and tidal sloughs. They often inhabit vegetated margins of salt marshes and adjoining shallow marine waters and are tolerant of fresh water (Moyle 2002). They are a prevalent part of the fish fauna of most southern California tidal salt marshes, bays and estuaries and would be a valuable addition to Oxford Basin.

Two other species which lack pelagic life stages, which were not encountered in Oxford Basin, and which are common in other parts of Ballona Wetlands are pipefish and shiner perch. Pipefish reproduce through male brooding of large eggs and the young juveniles are released directly into the habitat without a distinct dispersal stage. However, pipefish are often associated with drifting seaweed and other sea grasses and may disperse via this mechanism. Shiner perch are live bearing and young are born throughout most of the summer. It is uncertain how readily the young or adults would disperse into the Oxford Basin. If water quality conditions were improved in the Basin, artificial introduction of these species may be possible since appropriate habitat is present in the Basin.

The California halibut is an important commercial and sport fish species and is reliant on coastal bays and estuaries as nurseries for the first two or three years of life. Any increase is such habitat would be valuable for this species. Its preferred diet early in life, estuarine gobies, is already common in the Basin as identified in our surveys.

A study conducted by Aquatic BioAssay and Consulting (2009) noted that Basin E and Oxford Basin have some of the highest levels of pollutants and lowest oxygen values in the Marina del Rey area. The study found that the number and diversity of invertebrate species dropped from the mouth of the Marina inland towards the most inland sites such as Oxford Basin. These water quality issues may explain some of the absence of species in Oxford Basin. In addition, the Oxford Basin has only minimal circulation of water with the marina and is therefore more likely to suffer longer spans of poor water conditions that may arise. A good starting point for a restoration effort for fauna would be to improve the water circulation through the Basin, to reduce the level of pollutants, and to increase the dissolved oxygen levels in the Basin water in order to establish the water quality conditions necessary for successful colonization of estuarine aquatic species.

Dissolved oxygen concentration in water is related to water temperature such that the warmer the water the lower the amount of oxygen the water is able to hold in solution. Thus, excessive warming of the water will contribute to lower the availability of oxygen in the water. Other conditions such as the lack of circulation, excessive enrichment of the water, or the overnight lack of photosynthesis by aquatic plants to supply oxygen to the system can result in low dissolved oxygen levels. Excess plant material such as large algal blooms can supply oxygen in the day time but also use up the available oxygen rapidly at night as the plants respire resulting in low oxygen levels for the other organisms. During our surveys, the water was below 20° C which is within the preferred range for most estuarine fish and is cool enough to maintain adequate dissolved oxygen concentrations. Often, areas near the coast stay cooler because the summer fog coverage can insulate coastal marshes and wetlands from the usual summer warming more prevalent farther inland (Swift and Frantz 1981). However, it is possible that the water temperature gets considerably higher in the Basin in the late summer and fall due to the lack of water circulation, relatively shallow depths in the Basin, and as the cooler marine layer is less prevalent. If the water temperature increases beyond the mid-twenties Celsius then temperatures and dissolved oxygen concentrations may become intolerable to many fish species.

Estuarine fish species can generally be divided into two categories relative to oxygen tolerance. Gobies, killifish, and mosquitofish are relatively tolerant of low oxygen conditions and can utilize aerial oxygen and other strategies to survive periods of low oxygen in the water. Other fishes are relatively intolerant of low oxygen conditions and include anchovies, topsmelt, flatfishes (diamond turbot, California halibut), and shiner perch. These fish are unable to tolerate lower oxygen levels for any period of time and are the fish frequently seen during morning fish kills in coastal estuaries. Any attempt to restore habitat conditions that would support these species would have to include provisions for maintenance of relatively high oxygen concentrations (above approximately 4 milligrams per liter). Dissolved oxygen levels in the waters of Basin E and Oxford Basin often fall below this value according to the study by Aquatic BioAssay and Consulting (2009). It is less well known how these fish species are affected by the other pollutants noted by Aquatic BioAssay and Consulting (2009) such as DDT and heavy metals.

It appears that the current state of the Oxford Basin is of a system whose habitat and health is compromised by its distance from the ocean mouth and restricted access to Marina del Rey. It has been documented to have relatively poor values of several indicators of aquatic health, most recently by the study of Aquatic BioAssay and Consulting (2009). These factors make the development and sustainability of typical estuarine or bay fish fauna populations difficult. Our study indicates that several typical species can and do colonize and inhabit the area but have difficulty maintaining a year-round population. In addition, several species that would be expected to be present are absent and in some cases the reasons for their absence are not readily apparent. Some uncertainty exists in our sampling results regarding the presence of fish in the Basin throughout the year since our sampling was limited to two visits. More sampling throughout the season could better define the extent of fish population variation in the area. However, the faunal composition of nearby Marina del Rey is well understood and the Oxford Basin aquatic species composition is likely closely tied to conditions in the marina as well. Increasing the diversity and abundance of fish species living in Oxford Basin on a permanent basis will require management of water quality issues and the identification and removal of colonization barriers. Monitoring the fish populations in the Basin as such restoration actions are implemented would be beneficial in assessing the success of these actions as related to creating favorable habitat for estuarine fish.

Recommendations

1. Perform a water quality study to determine conditions present to provide a basis for predicting what fish species can be supported by the system and what changes might be made to accommodate others less likely to be currently supported.

2. Improve water circulation with Marina del Rey in order to improve water quality which is currently compromised both in Oxford Basin and its adjacent water supply, Basin E of Marina del Rey.

3. If water quality is or becomes appropriate, consider introduction of aquatic vegetation like eelgrass, ditch grass, and other species of marine algae to provide habitat for faunal elements more dependent on such vegetation (i.e. pipefishes and shiner perch).

4. Consider introducing some fish species such as California killifish which may currently be prevented from colonizing by inhospitable habitat between current populations in Marina del Rey, Ballona Marsh, and the Oxford Basin.

5. Investigate options for increasing the number of algae eating snails or fish present in the Basin in order to biologically control the proliferation of algae in the summer. If the freshwater conditions present in the winter decimate the populations of such grazers, possibly they could be artificially augmented in the spring from elsewhere in the marsh area. For example, the non-native fish, the sailfin molly, *Poecilia latipinna*, has become established and is common in Ballona Marsh. Stocks of sailfin molly could be transferred to Oxford Basin as a possible way to control algae. Sailfin mollies are a fecund species producing live bearing young and are tolerant of low oxygen conditions such as those found in the Basin. Striped mullet also feed on algae and detritus, reach large size, and could potentially be artificially introduced also. Striped mullet achieve much larger sizes but are more sensitive to oxygen requirements.

6. Investigate options for converting the Basin bottom substrate to more sand and less mud/fine silt. Possibly a layer of sand could be added when or after the system is dredged out periodically. If the fine sediment is determined to be primarily composed of decomposing organic matter, and water quality conditions can be stabilized, an increase in the diversity and abundance of bottom dwelling fish and invertebrate fauna may utilize and thus reduce the thickness of this silt/organic layer.

7. Explore exposing the Basin to more wind which would facilitate mixing and oxygenation of the water which could be effective in a wide shallow system like Oxford Basin, thereby reducing the need for increased water quality in the marina.

As discussed in the report, the long, dark culvert between Oxford Basin and Basin E of the marina likely inhibits dispersal of fish into the Basin. This condition could be improved by replacing some of the paving above the culvert with metal grating or comparable material. However, such a step would not likely improve fish stocks in Oxford Basin due to (1) the need to limit the range of tidal fluctuations in Oxford Basin in order to maintain its flood-protection capacity, and (2) the compromised water quality of Basin E, which limits the fish populations capable of surviving there. Given the inability to change these two items, increasing the amount of light in the culvert probably would not result in significant improvement of fish stocks in Oxford Basin (without simultaneous improvement for fish in these two additional items), and so this measure is not recommended as part of the current plan.

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Photo 1 – Yellowfin goby (top), longjaw mudsucker (bottom left), and arrow goby (middle right)

Photo 2 -Topsmelt

Photo 3 – Western mosquitofish

ENTRIX
Down to Earth. Down to Business.™

Figure 1 – Oxford Basin Survey Area
Fish Survey #1; January 12, 2010
City of Venice, Los Angeles County

100 m

1-9 = Seine Haul Locations ◆ = Trap Location

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Figure 2 – Oxford Basin Survey Area
Fish Survey #2; April 27, 2010
City of Venice, Los Angeles County