

**U.S. FISH AND WILDLIFE SERVICE  
San Diego National Wildlife Refuge Complex**

**PUBLIC NOTICE**

**Notice of Availability  
of a  
Draft Environmental Assessment**

**2009 Western Gull-billed Tern Population Management Project  
in San Diego Bay**

**NOTICE IS HEREBY GIVEN** that a Draft Environmental Assessment (EA) has been prepared by the U.S. Fish and Wildlife Service, San Diego National Wildlife Refuge Complex and is available for a 30-day public review period. The 30-day public review period begins on April 22, 2009 and ends on May 22, 2009.

**Project Title:** 2009 Western Gull-billed Tern Population Management Project in San Diego Bay (San Diego County, California)

**Lead Agency and Project Proponent:**

U.S. Fish and Wildlife Service  
San Diego National Wildlife Refuge Complex  
6010 Hidden Valley Road, Suite 101, Carlsbad, CA 92011  
Contact: Brian Collins (619) 691-1262 or Andrew Yuen (760) 930-0168

**Project Location:** The project will involve the western gull-billed tern (*Gelochelidon nilotica vanrossemei*) nesting colony on the South San Diego Bay Unit of the San Diego Bay National Wildlife Refuge (San Diego County, California) and addresses California least tern and western snowy plover nesting areas around San Diego Bay, as well as along the San Diego County coastline from the Tijuana Estuary north to Camp Pendleton. One project alternative would also occur within a gull-billed tern nesting colony within the Sonny Bono Salton Sea National Wildlife Refuge.

**Project Description:** The U.S. Fish and Wildlife Service (Service) proposes to conduct an experiment during the 2009 nesting season (May through September) that would involve adding 43 percent of the western gull-billed tern egg clutches within the South San Diego Bay Unit of the San Diego Bay National Wildlife Refuge to limit the overall fledgling productivity of the San Diego Bay colony of western gull-billed terns. The purpose of this experiment is to gather data that will assist the Service in understanding if productivity within the gull-billed tern colony at San Diego Bay can be reduced without causing significant direct impacts to San Diego Bay's breeding population of adult gull-billed terns and to assist the Service in developing future management strategies that could reduce the number of Federally listed endangered California

least tern chicks and Federally listed threatened western snowy plover chicks that are preyed upon by western gull-billed terns, a Service Bird of Conservation Concern and a California Bird Species of Special Concern.

The EA is part of the Service's decision-making process in accordance with the National Environmental Policy Act of 1969. The EA describes the purpose and need for the proposed experiment and future management strategies; potential issues and concerns; alternative actions; and the environmental consequences of each alternative. The EA will determine whether the proposed action will result in a Finding of No Significant Impact or require the need for an environmental impact statement.

**Review and Comment Period:** Comments on the EA must be provided in writing to Andrew Yuen, Project Leader, U.S. Fish and Wildlife Service, San Diego National Wildlife Refuge Complex, 6010 Hidden Valley Road, Suite 101, Carlsbad, California 92011, via email to [Andy\\_Yuen@fws.gov](mailto:Andy_Yuen@fws.gov), or via fax to 760-930-0256 no later than 5:00 PM PST on May 22, 2009. Questions regarding this document or the proposed project can be directed to Brian Collins, Wildlife Biologist, at 619-691-1262.

**Report Availability:** Copies of the EA are available for public review at the following locations:

Tijuana Estuary Visitor Center  
301 Caspian Way  
Imperial Beach, CA 91932

Chula Vista Public Library, Civic Center Branch  
365 F Street  
Chula Vista, CA 91910

The document can also be viewed electronically at the San Diego National Wildlife Complex Website at <http://www.fws.gov/sandiegorefuges/> and click on "What's New" in Site Navigation column.

**Draft  
Environmental Assessment**

**2009 Western Gull-billed Tern (*Gelochelidon nilotica vanrossemi*)  
Population Management Project in San Diego Bay**

**San Diego Bay National Wildlife Refuge, South San Diego Bay Unit  
San Diego County, California**

April 22, 2009

Prepared by  
U.S. Fish and Wildlife Service  
San Diego National Wildlife Refuge Complex  
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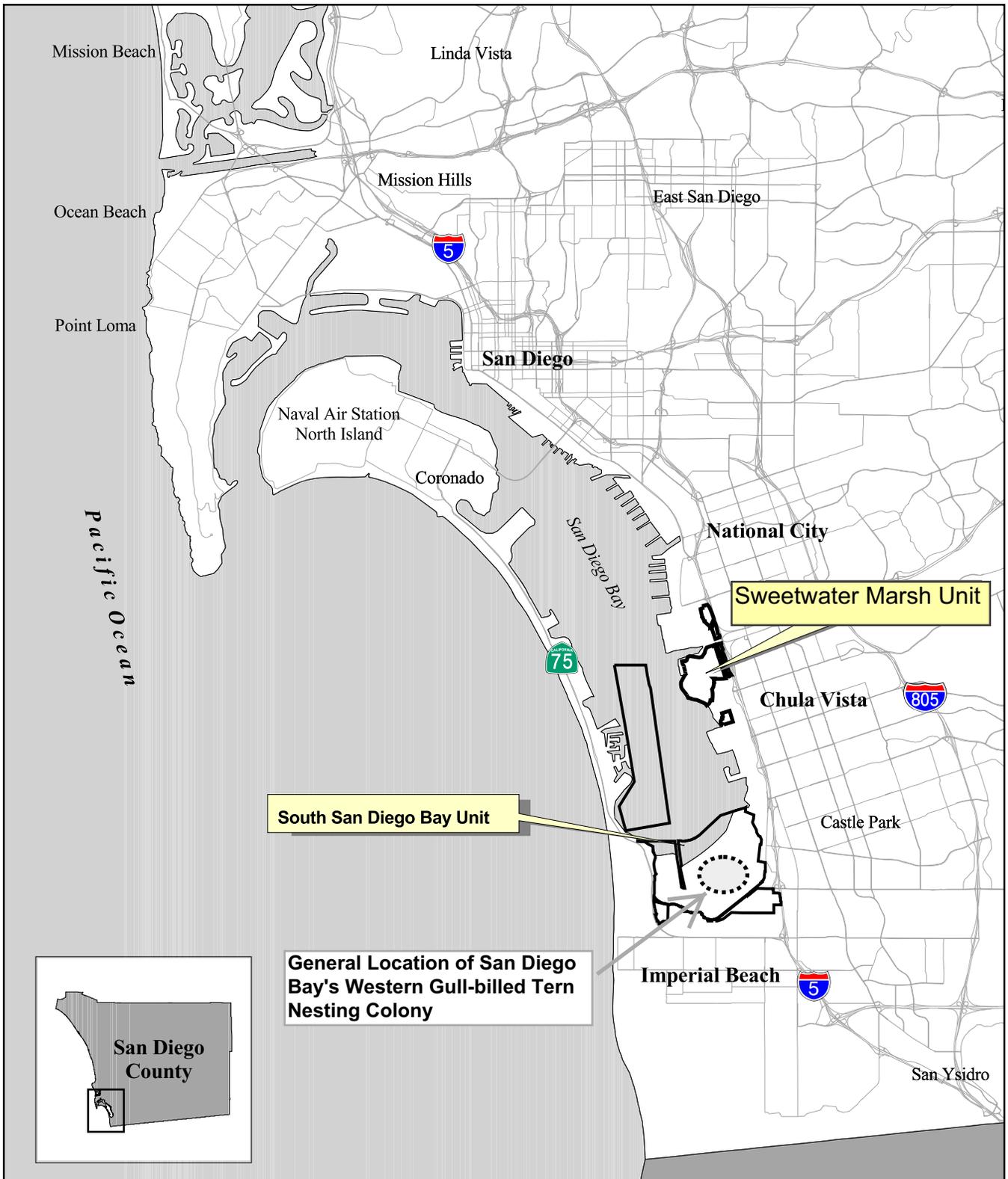
# CHAPTER 1. PURPOSE AND NEED FOR ACTION

## 1.1 Introduction

The U.S. Fish and Wildlife Service (Service) proposes to conduct a pilot study involving western gull-billed tern (*Gelochelidon nilotica vanrossemei*) nesting at the South San Diego Bay Unit of the San Diego Bay National Wildlife Refuge (San Diego County, California) during the 2009 nesting season (Figure 1). The purpose of this study is to determine the individual behavioral and local population level responses of the San Diego Bay population of western gull-billed terns to an experiment that would limit the overall fledgling productivity and energetic needs of the Bay's gull-billed tern colony during the 2009 nesting season. The goals of this study include determining: 1) the behavioral responses of adult gull-billed tern pairs to an egg addling experiment; 2) if egg addling will limit the productivity (the number of young fledged in a given season) of the San Diego Bay gull-billed tern colony; and 3) if limiting the gull-billed tern colony's productivity will lessen the predation pressure from the gull-billed tern colony on the federal endangered California least tern (*Sternula antillarum browni*) and federal threatened western snowy plover (*Charadrius alexandrinus nivosus*) colonies surrounding San Diego Bay (Figure 2). This study will likely lead to further studies in subsequent nesting seasons.

Under this proposal, eggs within 43 percent of the gull-billed tern nests established in the colony at the South San Diego Bay Unit during the 2009 nesting season would be addled (manipulated manually or layered in corn oil to prevent embryo development) or otherwise manipulated by biologists in an experiment to determine if adult gull-billed terns will continue to incubate the addled eggs or abandon the nest and attempt to re-nest (i.e., establish a new nest and lay a new clutch of eggs). If gull-billed tern pairs with addled clutches do not re-nest during the 2009 breeding season, they would not have chicks to feed during the crucial hatching period for the California least tern and western snowy plover. This lack of chicks needing nutrition would then limit the energetic needs of the gull-billed tern colony as a whole, and potentially limit the total number of foraging trips gull-billed terns would need to make, and subsequently, potentially lower the predation of California least tern and western snowy plover chicks by gull-billed terns at colonies surrounding San Diego Bay.

This proposal represents a change in the stated approach to addressing gull-billed tern predation on California least terns and western snowy plovers as presented in the Final Predator Management Plan for the San Diego Bay NWR (*USFWS 2006a*). The Predator Management Plan currently states that the Service has "chosen to refrain from conducting predator control actions on the gull-billed tern. The question of whether or not the Refuge should manage the size of the gull-billed tern colony at the salt works in an effort to reduce the loss of least tern and snowy plover chicks to gull-billed tern predation was raised again during the preparation of this predator management plan. Based on the desire to maintain/enhance the numbers of breeding gull-billed terns in Southern California, it was determined that no lethal control of this species will be considered at this time." The current proposal would involve lethal control (i.e., egg addling) of up to 43 percent of the gull-billed tern clutches of eggs produced in the San Diego Bay colony during the 2009 nesting season. If the experiment indicates that predation of California least tern and western snowy plover chicks by gull-billed terns can be lowered by reducing the overall productivity of the gull-



**Figure 1**  
**Location Map - San Diego Bay, San Diego County, California**



# Gull-billed Tern Status along the San Diego County Coast as of 2008



Don L. Dubaker  
San Diego NWRAC  
15 April 2009

**Camp Pendleton**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

**Batiquitos Lagoon**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

**San Elijo Lagoon**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

**Mission Bay**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

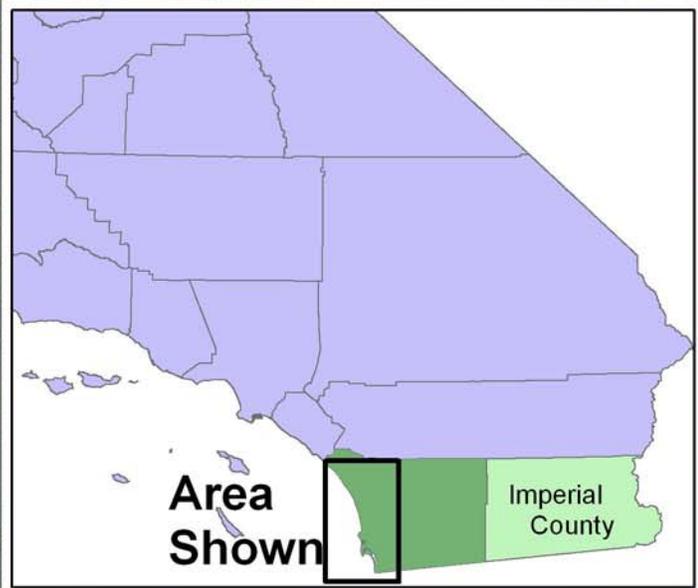
**Naval Base Coronado**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

**Silver Strand State Beach**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

**San Diego Bay National Wildlife Refuge**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern nesting and foraging

**Tijuana Slough NWR & Border Field State Park**  
 - California Least Tern nesting  
 - Western Snowy Plover nesting  
 - Gull-billed Tern foraging

BUENA VISTA LAGOON  
 AGUA HEDIONDA LAGOON  
 BATIQUITOS LAGOON  
 SAN ELIJO LAGOON  
 SAN DIEGUITO LAGOON  
 LOS PENASQUITOS LAGOON



TIJUANA ESTUARY

billed tern nesting colony in San Diego Bay, then the approved Predator Management Plan will be amended to address the control of the gull-billed tern productivity at San Diego Bay as an additional management tool for aiding in the recovery of the federally listed California least tern and western snowy plover. Such an amendment to the Predator Management Plan for the San Diego Bay NWR would require further compliance under the National Environmental Policy Act (NEPA) and additional public review.

This Environmental Assessment (EA), which describes the purpose and need for better understanding of how gull-billed tern population management in San Diego Bay could affect the productivity of California least terns and western snowy plovers, as well as the productivity of the gull-billed tern, is part of the Service's decision-making process in accordance with NEPA. The EA describes the purpose and need for the proposed action; the potential issues and concerns; a range of alternative actions; and the environmental consequences of the proposed action and alternatives. This EA will determine whether the proposed action will result in a Finding of No Significant Impact or require the need for an Environmental Impact Statement.

## **1.2 Purpose and Need**

The purpose of this proposal is to gather data that will help us answer the following questions: 1) can we reduce the loss of California least tern and western snowy plover chicks to predation by gull-billed terns in the vicinity of San Diego Bay by lowering the productivity within the gull-billed tern colony at San Diego Bay; and 2) can productivity within the gull-billed tern colony at San Diego Bay be reduced without causing significant direct impacts to San Diego Bay's breeding population of adult gull-billed terns. The current proposal, which represents the first "experimental" step in the long term management of gull-billed terns in San Diego Bay, is just one of many management approaches that have been and will continue to be evaluated by the Service, California Department of Fish and Game, the Department of Defense, local ornithologists, and others to address the management conflicts surrounding the loss of endangered California least tern and threatened western snowy plover chicks by foraging gull-billed terns, a subspecies identified by the Service as a Bird of Conservation Concern (BCC) (*USFWS 2008*). In accordance with the Fish and Wildlife Conservation Act, birds identified as a BCC represent those species, subspecies, and populations of migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act. It is the Service's goal to implement proactive management and conservation actions to prevent the need for listing. The challenge here is to manage all three species (California least tern, western snowy plover, and gull-billed tern) in a manner that will reverse the current downward trend in the fledgling success of California least terns and western snowy plovers, while also avoiding significant adverse effects to the range-wide population of gull-billed terns over time.

The recovery of the California least tern and western snowy plover requires that sufficient numbers of chicks are successfully fledged to replace individuals lost to the population over time. Predation of least tern and snowy plover chicks by gull-billed terns is increasing and this situation is having an adverse effect on fledgling productivity within the nesting colonies in coastal San Diego County. Gull-billed tern predation is only one of many factors that may

limit the recovery of these two listed species, but it is one of many cumulative limiting factors that we as resource managers and environmental scientists are obligated to address if we are to achieve successful recovery of threatened and endangered species. The goal of this proposal is to increase our understanding of the effects that gull-billed terns are having on least tern and western snowy plover fledgling success in the San Diego Bay area, as well as provide insight into the energetic needs of the gull-billed tern colony at San Diego Bay as a whole. In addition to this proposal, gull-billed tern foraging studies continue to be conducted at several least tern and snowy plover colonies in coastal San Diego County and a range-wide status assessment of the western gull-billed tern, which has been underway for several years, is scheduled to be finalized in 2009.

### **1.3 Decisions to be Made and Authorities**

The Service, like other Federal agencies, must comply with the National Environmental Policy Act. An EA is required under NEPA to evaluate the potential effects of a reasonable range of alternatives that if implemented would meet the purpose and need for the proposed action. The Service will use the EA as the basis for determining whether the proposed action to conduct a one-year gull-billed tern population management experiment in San Diego Bay would constitute a major Federal action significantly affecting the quality of the human environment or would result in a Finding of No Significant Impact. The EA facilitates the involvement of government agencies and the public in the decision making process.

The authorities for the proposed action are the Migratory Bird Treaty Act of 1918, as amended; Endangered Species Act of 1973, as amended; Fish and Wildlife Act of 1956; Fish and Wildlife Coordination Act of 1958; Migratory Bird Conservation Act of 1929; and National Wildlife Refuge Administration Act, as amended (16 U.S.C. 668 dd et seq.).

Project implementation will require the following approvals and/or actions:

U.S. Fish and Wildlife Service – Section 7 Biological Evaluation

U.S. Fish and Wildlife Service – Migratory Bird Permit [39 FR 1178, Jan. 4, 1974, as amended at 50 FR 8638, Mar. 4, 1985; 54 FR 38151, Sept. 14, 1989; 68 FR 61137, Oct. 27, 2003; 72 FR 56928, Oct. 5, 2007]

A programmatic Environmental Impact Statement (EIS) was prepared for the San Diego Bay NWR Comprehensive Conservation Plan (CCP) that addressed the species affected by the current proposal. The EIS was circulated for public review in 2006. A Record of Decision was signed in September 2006. The Final San Diego Bay NWR CCP/EIS (*USFWS 2006a*) is incorporated by reference into this document and is available for review at the Complex Office (760-930-0168), located at 6010 Hidden Valley Rd., Suite 101, Carlsbad, CA, or online at <http://www.fws.gov/sandiegorefuges/new/ccp/ccp.htm>.

### **1.4 Public Scoping and Community Involvement**

The proposal to initiate this one-year management project was a result of a series of meetings and discussions that have been held over the past few years to address the issues associated with gull-billed tern, California least tern, and western snowy plover management conflicts in San Diego Bay. The details of this proposal were worked out during two stakeholder meetings. The first was held on February 6, 2009 to discuss possible options for addressing

the effect of gull-billed terns on California least tern and western snowy plover chicks within the foraging range of the gull-billed tern colony site in San Diego Bay. In attendance were representatives from the San Diego NWR Complex, the Sonny Bono Salton Sea NWR Complex, the Service's Ecological Services and Migratory Bird Programs, the California Department of Fish and Game, and the Department of Defense (US Navy and US Marine Corps). A number of interested ornithologists and consulting biologists were also present. Another meeting was held on March 4, 2009 with a similar group of stakeholders to discuss the potential design of scientific studies to address various aspects of how to measure the effectiveness of the management actions described in this EA.

The Service will solicit comments on the draft EA from other federal, state, and local agencies, non-governmental organizations, and the public during a 30-day comment period. Comments provided during this review period will be considered by the Service when analyzing the proposed action and alternatives, determining the effects to the human environment, and selecting the alternative for implementation.

## **CHAPTER 2. ALTERNATIVES**

### **2.1 Introduction**

This EA evaluates three alternatives including the no action alternative (Alternative A). The action alternatives include Alternative B - Addle Gull-billed Tern Eggs (under this alternative, the experimental design would be implemented by adding the gull-billed tern eggs) and Alternative C – Addle and Cross-Foster Gull-billed Tern Eggs (under this alternative, the experimental design in Alternative B would be implemented but the experiment would be augmented by the removal of a small number of gull-billed tern eggs from San Diego Bay and transporting them to nests at the Salton Sea). Under the no action alternative, no action would be taken to limit the productivity of the gull-billed tern population at the South San Diego Bay Unit. This alternative represents the baseline from which the other “action” alternatives will be evaluated.

### **2.2 Description of Alternatives**

#### **2.2.1 No Action Alternative - Alternative A**

Under the no action alternative, no federal actions to limit either the population productivity (the number of fledglings produced in a given year) or the population size of gull-billed terns in San Diego Bay would be implemented. The no action alternative reflects the status quo condition.

#### **2.2.2 Action Alternatives – Alternatives B and C**

The primary intent of the current proposal is to begin to identify management actions that will reduce the level of predation by gull-billed terns on California least tern and western snowy plover chicks around San Diego Bay, while maintaining a viable breeding colony of gull-billed terns in south San Diego Bay. Specifically, all of the action alternatives evaluated for potential implementation at south San Diego Bay are intended to avoid a long term decline in the overall adult population of gull-billed

terns both in San Diego Bay and range-wide as a result of our actions. Under all of the alternatives, this would occur through the take of eggs rather than the lethal take of adults. Implementation of the preferred alternative would represent the first "experimental" step in the long term management of gull-billed terns in San Diego Bay.

The study design and questions to be addressed through the 2009 Western Gull-billed Tern Population Management Project would be similar for both of the action alternatives. The primary difference between the two alternatives is the way in which the eggs affected as a result of the experiment would be manipulated (i.e., adding eggs in some of the nests at San Diego Bay or implementing a combination of adding some eggs and cross-fostering other eggs by transferring them to receiver nests at the colony at the Salton Sea). Summarized below are the questions to be addressed by the study.

The primary questions to be addressed through this study include:

1. Does the adding of gull-billed tern eggs reduce their hatching rates?
2. Did adding or cross-fostering gull-billed tern eggs during the 2009 nesting season reduce San Diego Bay gull-billed tern nesting productivity in 2009?
3. Will nesting gull-billed terns continue to incubate added and/or artificial eggs beyond the normal incubation period?

The field protocols developed to answer the questions posed above have been designed to produce a data set generated through field work and observations in 2009 that would be subject to statistically valid and defensible scientific analysis. *(A copy of the full scientific study design, including stated null and alternative hypotheses and the proposed statistical interpretation methods to be used to address the data generated, is available upon request [see Section 5.3 for contact information].)*

Secondary questions to be addressed but not statistically evaluated as part of a formal study include:

1. Does a reduced fledgling productivity rate of the overall gull-billed tern colony in San Diego Bay reduce the depredation pressures on California least tern and western snowy plover colonies surrounding San Diego Bay?
2. Is it possible to evaluate and measure reduced depredation pressures on the colonies of these species by gull-billed terns from field observations in the nesting grounds?
3. Can gull-billed tern, California least tern, and western snowy plover populations be effectively managed in close proximity to one another? Is there a perceived balance that may be achieved for the different species within

the bird community in San Diego Bay that will allow land managers to manage for specific population targets for local species coming into conflict over limited resources?

Under all three alternatives, the gull-billed tern colony on the salt pond levees would continue to be monitored throughout the nesting season using normal field survey techniques. In general, this involves observation of likely nesting locations within the salt pond complex on at least a weekly basis from May through July to identify gull-billed tern nesting behavior and likely nest locations. Data collected includes, but is not limited to: the number of nesting pairs; number of nests; number of eggs hatched; number of fledglings; if and how many addled eggs are incubated and for how long; if nests with addled eggs are abandoned; and what percentage, if any, of pairs that abandon a nest with addled eggs re-nest. In addition, various agencies will continue to monitoring the foraging habits of gull-billed terns within the various California least tern and western snowy plover nesting areas surrounding San Diego Bay.

#### **Alternative B – Addle Gull-billed Tern Eggs (Proposed Action)**

Under this alternative, the eggs laid in 43 percent of gull-billed tern nests established along the levees at the South San Diego Bay Unit during the 2009 breeding season would be addled to render them non-viable. (Given the expected colony size in 2009, we predict this number will be approximately 46 eggs.) Egg addling will involve coating the eggs with food-grade corn oil, which is likely to interfere with gas exchange necessary for normal egg development and is intended to preclude hatching of these eggs. Clutches to be addled will be interspersed with non-addled clutches, and all of the eggs within a single clutch will be addled. It is important to this study to intersperse addled nests with non-addled nests to distinguish addling effects from spatial effects on the behavior of gull-billed tern adult pairs individually and as a group.

A sample of non-addled clutches will be selected as a control group to compare to treated clutches. These non-addled nests should fall into one of two general groups: the first group should be located near nests that have been addled; and the second group should be located in an area where none of the gull-billed tern clutches have been addled. The purpose of having two distinct control groups is to distinguish between spatial influence of clutch addling and the addling treatment effect on the behavior of individual pairs and the behavior of groups of pairs within the larger clusters of nests within the colony. This approach may give us an opportunity to analyze behavioral data to answer the following questions: will egg addling cause individual nest abandonment, and if so, will nest abandonment of addled clutches lead to behavioral responses in neighboring pairs with non-addled clutches. Finally, the data may provide insight into how these responses might affect the larger colony.

Subsequent to treatment, all addled clutches and the two distinct control groups of non-addled nests will be observed on a regular basis (e.g., a minimum of one to

two times per week) with the subsequent period of incubation (e.g., days after initiation of incubation and/or post-treatment) recorded. The eventual hatching fate of all treated eggs and control clutches will be documented. Although unlikely, some treated eggs within the addled clutches could hatch (*Blackwell et al. 2000*).

The 43 percent addling goal will initially be applied to first nesting attempts. Based on field observations and subsequent discussion among the gull-billed tern study group members, the 43 percent goal may be applied to second nesting attempts. However, a number of factors will be considered in determining whether or not to addle clutches resulting from second nesting attempts. These include: observations of immediate or near-term abandonment of affected nests following addling; observations of immediate or near-term nest abandonment by gull-billed terns or other breeding avian species near previously addled clutches; observations that addling techniques are ineffective in precluding hatching of gull-billed tern eggs, or practical logistic limitations.

The proposed level of take (43 percent) was selected in an effort to avoid causing a decline of the overall population of gull-billed terns over time due to the activities undertaken for this experiment. This figure is based on data included in the final draft status assessment for the western gull-billed tern (*Kathy Molina, pers. comm.*), which estimates the life span of gull-billed terns to be about 10 years. It appears that gull-billed terns reach reproductive age at 2 years; therefore, an individual gull-billed tern would have the opportunity to attempt to reproduce for approximately 7 years, assuming reproduction rates would decrease towards the end of the bird's life span. Monitoring data collected for the San Diego Bay gull-billed tern colony between 1999 and 2008 indicates that the San Diego Bay colony fledges approximately 0.7 chicks per pair per year. Utilizing the figure of 0.7 fledglings per pair per year, approximately 4.9 fledglings ( $7 \times 0.7$ ) would be produced over the life span of a pair of gull-billed terns and it would take approximately three years for a pair of gull-billed terns to replace themselves (rounding up 2.5 to 3 years for simplicity and based on annual breeding cycle). ( $3$  [the number of years it would take for a pair to replace themselves] divided by  $7$  [years of potential breeding] equals 0.43, or 43 percent.)

The experimental design proposed under this alternative compares the egg viability, adult behavioral responses, and fledgling productivity between the control group of nests (non-addled) and the treatment group (addled nests). This experiment will test the potential for artificially limiting the gull-billed tern population's productivity in San Diego Bay without impacting breeding adult individuals who would have the possibility to reproduce in future years or at other nesting locations.

### **Alternative C – Addle and Cross-Foster Gull-billed Tern Eggs**

Under this alternative, the eggs laid in 43 percent of the gull-billed tern nests (approximately 46 eggs) established along the levees at the South San Diego Bay

Unit during the 2009 breeding season would still be affected, but instead of adding all of the eggs in the treatment clutches, ten eggs (one each from ten different nests proposed for adding) would be removed from the affected nests and relocated to receiver nests at a gull-billed tern colony at Sonny Bono Salton Sea NWR for cross-fostering. The eggs removed for cross-fostering would be replaced with artificial "dummy" eggs and the remaining eggs in the affected clutches at the San Diego Bay site would be added. Eggs removed for cross-fostering would be placed in portable incubators and transported to ten different receiver nests at the Salton Sea in an expanded experiment to determine if eggs transferred to nests at the Salton Sea would be accepted, incubated, hatched, and fledged into the colony at the Sea.

The monitoring and treatment protocols described under Alternative B for the San Diego Bay nesting site would be the same under this Alternative. In addition, monitoring would be conducted at the Salton Sea site to identify potential receiver nests, document the fate of the translocated eggs, and record general observations within the nesting colony at the Salton Sea as a result of adding the eggs to the ten nests. These observations would include whether transported (experimental) eggs had a similar hatching rate to eggs laid within the nest (control) by pairs at the Salton Sea. This would be determined through the marking of eggs. If the opportunity occurs to identify chicks hatched from experimental eggs versus chicks hatched from control eggs within the same clutch, the fledging rates of both groups would be compared and contrasted with chicks hatched from non-manipulated clutches. (Note: this may prove impractical in the field but may be possible with individually identifiable banding of each chick known to be hatched from specific eggs.) This experiment would be highly dependent on adequate observer access at the Salton Sea, the timing of nest initiations at both the San Diego Bay and Salton Sea colonies, and the timing of hatching of particular clutches and the timing of hatching of particular eggs within individual clutches at the Salton Sea.

### **2.3 Alternatives Considered but Eliminated from Detailed Study**

The alternatives development process is designed to allow consideration of the widest possible range of issues and potential management approaches. Over the past few years, the Service and other interested agencies and individuals have discussed a variety of actions that might be implemented in an attempt to reduce the conflicts between gull-billed terns, California least terns, and western snowy plovers. Those actions that were considered but eliminated from detailed study included:

- A. Hazing. A focused hazing program to move foraging gull-billed terns away from California least tern nesting colonies was discussed, however, isolated attempts in the past to discourage gull-billed terns from entering least tern nesting colonies were considered ineffective. In these attempts, the use of firearm launched non-lethal pyrotechnics were deployed to haze gull-billed terns, however, little disruption in the gull-billed terns foraging activities were observed (*Brian Collins, pers. comm.*). Even if this technique had been somewhat effective in moving

gull-billed terns off the least tern nesting colony, with the linear distribution of least tern nesting colonies around San Diego Bay, displaced gull-billed terns could simply fly down the beach or up the bay to nearby nesting colonies or nest clusters.

Hazing also raises concerns related to disturbance of non-target species, including least tern nesting colonies that are intended to be protected. Deployment of the pyrotechnics in proximity to a least tern colony has the potential to cause all adult terns in the area to take flight leaving incubated eggs and brooded chicks unattended and susceptible to predation by gull-billed terns and other predators or may leave them susceptible to thermoregulation problems (overheating) or other impacts (such as burial by blowing sand) due to being exposed to the elements while not under the care of the parent birds.

- B. Lethal Control. Shooting adult gull-billed terns observed in the act of foraging in California least tern colonies during the time of year when small least tern chicks are present in large numbers (approximately early to late June) was also considered; however, the use of lethal removal as a management tool was rejected because the Service has identified the western gull-billed tern as a BCC due to a very low population size and an extremely small breeding range. The breeding range of this subspecies extends from extreme southern California (including only two breeding areas, the Salton Sea and San Diego Bay) south to northwestern Mexico, where approximately 12 nesting colonies have been documented (*Palacios and Mellink 2007, González-Medina and Guevara-Medina 2008*). The most recent estimate of the range-wide population of the western gull-billed tern is between 530 and 810 pairs (*Molina and Erwin 2006*). In 2008, the San Diego Bay population of western gull-billed terns comprised approximately 7.4 percent of the range-wide breeding population of this sub-species. Based on potential future threats to breeding populations both at the Salton Sea (*Shuford and Gardali 2008*) and in Mexico (*Palacios and Mellink 2007*), as well as the need to answer some broader questions regarding individual behavioral and local population level responses to less impactful manipulation of the breeding population at San Diego Bay, the lethal removal of breeding adult gull-billed tern individuals from San Diego Bay was not considered appropriate at this time.
- C. Marking of Adult Gull-billed Terns for Study. Also considered for implementation in 2009 was a study involving the capture, marking, and release of a significant portion of the adult population of gull-billed terns in the nesting colony at San Diego Bay for purposes of determining through observation whether the foraging behavior of individual gull-billed terns has population management implications for the species. Specifically, through the marking of individual gull-billed terns would it be possible to determine if California least tern and western snowy plover predation by gull-billed terns can be attributed to specific individuals that preferentially target these species or are these species targeted more or less uniformly throughout the Bay's nesting gull-billed tern population.

This action was rejected due to the significant commitment of time and personnel required to capture gull-billed terns. In 2001, an effective remote control trap design and marking technique was developed for the gull-billed tern in a study conducted at San Diego Bay NWR by the United States Department of Agriculture Wildlife Services Branch in coordination with San Diego NWR staff and consulting ornithologists. The results of the 2001 study indicated that it is feasible to capture gull-billed tern adults on a nesting site. Seven adult gull-billed terns were captured from trapping attempts at 17 of 47 nests. The intent of individually marking adult gull-billed terns was to attempt to deduce whether individuals habitually foraged in specific areas for specific prey items. The small sample size yielded data unsuitable for statistical analyses, yet its prime purpose was achieved. A capture method was developed that was effective; however this technique proved to be time intensive and potentially disturbing to a number of ground nesting species at the nesting site in south San Diego Bay. This technique could still be implemented in the future in an effort to answer the question of whether certain individual gull-billed terns targeted California least tern and western snowy plover chicks as prey items preferentially while others do not. However, at present this technique has been determined to be impracticable because of the significant commitment of staff and increased levels of disturbance within the nesting colonies of several sensitive species that would result from the number of adult gull-billed terns within the population that would have to be marked to yield data suitable for statistical analysis.

- D. Capture and Translocation of Adult Gull-billed Terns. We also discussed the potential for capturing and translocating adult birds from the colony at San Diego Bay to a colony at the Salton Sea. The implementation of this potential experimental project in 2009 was considered but rejected at this time for several reasons. One consideration is the difficulty of capturing both members of a breeding pair leading to uncertainties related to pair bonding behavioral implications within and between both colonies in the U.S. Another concern is that the technique that was previously developed for capturing adults for marking or banding requires that they to come to a specific spot on the ground (e.g., the nest). Therefore, eggs could be lost to the effort as it is highly unlikely that a captured pair would accept a translocated nest or that one individual of a pair would be successful in incubating and raising a brood on its own. If one member of a pair was captured and removed, the remaining member of the pair with an established nest is highly likely to abandon that nest in the absence of its mate. Egg incubation, chick brooding and feeding, and other parental protective behaviors are conducted by both members of the pair. We thus would not only be capturing one or both adult birds on a nest with there being some potential effects including physical harm and reduced survivorship for those individuals targeted for capture, transport and release (due to the stresses of being trapped, confined and released in a different location), but this action would also likely cause the loss of eggs already laid in the nest by the pair targeted for capture. Another consideration is that during the 2001 capture efforts, two of the seven adult birds

captured had already been banded at the Salton Sea. This resulted in the observation that at least some of the gull-billed terns found nesting in California travel at some time during their lives between the breeding grounds on the coast and in the desert.

## **CHAPTER 3. AFFECTED ENVIRONMENT**

### **3.1 Introduction**

This section describes those elements of the environment that may be affected by the Western Gull-billed Tern Population Management Project. As such, the description of the affected environment focuses on the nesting habitats in southern California that support gull-billed terns and/or California least tern and western snowy plover; the status of the gull-billed tern, California least tern, and western snowy plover; and the status of the other ground nesting birds that nest in proximity to gull-billed terns on the South San Diego Bay Unit and the Sonny Bono Salton Sea NWR. Other information related to the environment in and around south San Diego Bay is provided in the Final San Diego Bay NWR CCP/EIS (*USFWS 2006a*), which has been incorporated by reference into this document.

### **3.2 Regional and Historic Setting**

San Diego Bay is a natural, nearly enclosed crescent-shaped embayment that originated from alluvial plains of the Otay, Sweetwater, and San Diego Rivers. The bay has a water surface area of approximately 17 square miles at mean lower low water (MLLW) and a total length of approximately 15 miles. Immediately to the north, east, and south of the Bay are the highly urbanized cities of San Diego, National City, Chula Vista, and Imperial Beach (refer to Figure 1). Between the Bay and the ocean to the west are residential and commercial developments in the City of Coronado, as well as several Navy facilities, including Naval Air Station North Island and the Naval Amphibious Base Coronado, and Silver Strand State Beach.

San Diego Bay and adjacent beach areas to the west provide important foraging, roosting, and/or nesting habitat for a wide range of migratory and resident birds. The California least tern, western snowy plover, and gull-billed tern all nesting and forage around the Bay. The least tern and gull-billed tern are primarily summer visitors, while the snowy plover can be observed around the Bay throughout the year. A variety of sites along the southern California coast are intensively managed to protect California least tern and western snowy plover during the breeding season. Some of the agencies responsible for managing one or more of these sites include the U.S. Fish and Wildlife Service, California Department of Fish and Game, U.S. Department of Defense, and various local agencies. Historically, intensive management of these species was not necessary because there were abundant breeding sites available along the coast, including salt marshes, sandy beaches, and barrier islands and human disturbance in these areas was minimal. Today, the vast majority of these habitats have either been lost to urban and recreational development or now experience significant levels of disturbance (*USFWS 2006a*).

Large “colonies” of California least terns could once be found spread along stretches of undisturbed beaches particularly in southern California. In the early 1900s, observations of

at least 1,000 nesting pairs of least terns were reported along a three-mile stretch of the coastline from Pacific Beach to Mission Bay in San Diego County (*Foster 2001, in Unitt 1984*). By the 1930s, the number of least terns in San Diego County was characterized as much less plentiful (*Unitt 1984*). By 1969, the statewide tern population was reported to be approximately 180 pairs (*Patton 2000*).

In the early 1900s, the western snowy plover was described as “an abundant resident of sandy beaches near the surf” (*Unitt 1984*). Historically, this plover nested along San Diego County’s beaches above the high tide line, on salt pans and the drying margins around the County’s coastal lagoons and estuaries, and within coastal dune habitat. Today, plovers still nest on protected beaches in San Diego County, primarily within the boundaries of Camp Pendleton and on Navy lands to the west of San Diego Bay. It also nests on natural coastal habitat protected at the Tijuana Estuary. With the loss of many of the plover’s historic nesting areas, other man-made sites are also now used by the plover for nesting, including dredge-soil sites and salt pond levees (*USFWS 2007*). Western snowy plovers are often be found nesting in association with California least terns (*Powell and Collier 2000*).

There are no records of western gull-billed terns in San Diego County until 1985 (*Unitt 2004*), and currently the only area in which gull-billed terns have been found nesting in San Diego County is on the salt pond levees within the San Diego Bay NWR. Here the gull-billed terns can be found nesting on the unvegetated levee tops with various other species of ground nesting seabirds, including Caspian terns, elegant terns, black skimmers, and others. The only other location in the U.S. in which the western gull-billed tern has been found nesting is at the Salton Sea, where gull-billed terns nest with black skimmers on artificial nesting areas, as well as a few natural isolated habitats (*Molina 2007*). The remaining breeding areas for this subspecies, which are very limited, generally occur in northwestern Mexico (*Molina and Erwin 2006, Palacios and Mellink 2007, González-Medina and Guevara-Medina 2008*). In northwestern Mexico, gull-billed tern nesting areas have been observed in natural areas, as well as in modified habitats, such as empty waste water impoundments and in and around salt evaporation ponds (*Palacios and Mellink 2007*).

All of the California least tern and western snowy plover nesting sites around San Diego Bay (refer to Figure 2) are monitored annually during the nesting season, with some sites having been monitored for more than twenty years. One of the tasks of the monitors is to record incidents and/or evidence of predation within the colonies. As a result, a number of observations have been made over recent years of gull-billed terns preying on California least tern and western snowy plover chicks and eggs. Gull-billed tern take of these two listed species has been documented within the colonies around San Diego Bay, including those at the Tijuana Estuary, as well as further north within the Camp Pendleton colonies, at the northern end of San Diego County.

### **3.3 Physical Environment**

No aspects of the physical environment, including climate, geology, soils, agricultural resources, topography/visual quality, hydrology/water quality, contaminants, or noise, would be affected by this proposal.

### 3.4 Biological Resources

The San Diego Bay National Wildlife Refuge Comprehensive Conservation Plan and Environmental Impact Statement (*USFW 2006a*), as well as the San Diego Bay Integrated Natural Resources Management Plan (*U.S. Navy 2000*) provide extensive information about the biological resources in and around San Diego Bay. This information is incorporated by reference into this document, and information relevant to the current proposal is summarized below. Please see Section 5.3 for information on where you can review these documents.

#### 3.4.1 Regional Context

The coastal and marine habitats within and surrounding San Diego Bay are located within an area referred to as the Southern California Bight, a curve in the southwestern California coastline that extends from Point Conception to just south of the Mexican border. The marine ecosystem and overall biodiversity within the Southern California Bight are influenced by the dramatic change in the angle of the coastline, which creates a significant backwater eddy. This backwater eddy results in the northern flow of equatorial waters along the nearshore and the southern flow of subarctic waters offshore. The biological transition zone that occurs between these warm and cold waters supports approximately 500 marine fish species and more than 5,000 invertebrate species (*Southern California Coastal Water Research Project 1998*).

San Diego Bay also occurs within the Southern California Ecoregion, as designated by the Service. The Southern California Ecoregion is defined by all watersheds (including coastal wetlands and off-shore islands) from Monterey Bay south to the US/Mexico border and east to the Arizona and Nevada state lines. This ecoregion includes distinct coastal and desert components, a rare combination of diverse habitat types, and one of the nation's highest concentrations of threatened and endangered species (*USFWS 1995*). The habitats in San Diego Bay alone support seven federally listed endangered and threatened species, including the California least tern and western snowy plover, and 17 avian species identified by the Service as Birds of Conservation Concern (*USFWS 2008*), including the gull-billed tern and black skimmer (*Rynchops niger niger*). Much of San Diego Bay's remaining natural wetland habitat is protected within the San Diego Bay NWR, situated at the southern end of San Diego Bay.

The Refuge encompasses approximately 2,620 acres of open water, intertidal habitat, and natural and manmade uplands, including two artificial nesting areas: a dredge-spoil area referred to as the D Street Fill, which annually supports a nesting colony of California least terns; and a system of salt pond levees that provide regionally important nesting habitat for seven species of ground nesting seabirds including California least tern, gull-billed tern, Caspian tern (*Sterna caspia*), elegant tern (*Thalasseus elegans*), Forster's tern (*Sterna forsteri*), royal tern (*Thalasseus maximus*), and black skimmer. Western snowy plover also nest on these levees. The Refuge also provides roosting, foraging, and/or nesting opportunities for tens of thousands of migratory birds, as such, the Refuge protects habitats essential to the

migratory birds of the Pacific Flyway. In recognition of the importance of the foraging and nesting habitats protected within south San Diego Bay, and the specific species these habitats support, the south bay has been designated a Western Hemisphere Shorebird Reserve Network Site and the San Diego Bay NWR is recognized as a Globally Important Bird Area by the American Bird Conservancy.

The Salton Sea, the other area within the U.S. where the western gull-billed tern nests, is also a Western Hemisphere Shorebird Reserve Network Site and recognized as an Important Bird Area by the American Bird Conservancy.

### **3.4.2 Habitat and Vegetation**

The coastal habitats within San Diego Bay range from subtidal and intertidal to disturbed uplands and commercial solar salt ponds. These habitats provide a range of foraging opportunities for seabirds, shorebirds, waterfowl, and other waterbirds. Although not considered a natural habitat, the solar salt ponds located at the south end of San Diego Bay provide foraging habitat and the salt pond levees provide relatively isolated nesting and roosting areas for a variety of migratory birds.

To the west of San Diego Bay, western snowy plovers and California least terns nest along some of the extensive beach front referred to as the Silver Strand. Much of this beach front is owned and/or managed by the U.S. Navy or the California Department of Parks and Recreation and includes the ocean beaches of Naval Amphibious Base (NAB) Coronado, Delta beaches, and Silver Strand State Beach. The Tijuana Estuary also provides natural nesting habitat for least terns and snowy plovers, as does Marine Corps Base Camp Pendleton, located at the northwestern most corner of San Diego County. At Camp Pendleton, terns and plovers nest on beaches at the mouths of the Santa Margarita River, North Beach, French, and Aliso Creeks and on the salt flats in the Santa Margarita Estuary (*U.S. Marine Corps 2001*).

Naval Air Station (NAS) North Island and a portion of San Diego International Airport (Lindbergh Field) support least tern nesting within areas consisting primarily of unvegetated, open sandy substrate (*U.S. Navy 2002, Manasjan 2006*). Dredge disposal sites, including D Street Fill, the south end of the Chula Vista Wildlife Reserve, nesting islands in Batiquitos Lagoon, and several areas in and around Mission Bay also support least tern nesting. Snowy plovers previously nested on the D Street Fill and continue to nest at Batiquitos Lagoon.

### **3.4.3 Nesting Seabirds and Western Snowy Plovers**

**Overview.** A number of areas surrounding San Diego Bay (refer to Figure 2) are managed for nesting western snowy plovers and/or California least terns, including the few remaining natural nesting areas on beaches along the Silver Strand to the west of the Bay and the beach and back dunes of the Tijuana Estuary located just south of the Bay. Management also occurs on several man-made sites that provide suitable open sandy substrate to support nesting including NAS North Island; San Diego International Airport, D Street Fill; Chula Vista Wildlife Reserve; and the salt pond levees in the San Diego Bay NWR. All of these areas are actively managed to control

disturbance and predation. Some sites are protected year-round, while other sites, including the sites managed by the U.S. Navy (i.e., NAB Coronado and NAS North Island) are set aside seasonally to protect listed species during the nesting season.

Several of these nesting sites also support other tern species, but only the salt pond site within the San Diego Bay NWR supports western gull-billed tern nesting. The levees around the salt ponds are unique among the other sites around the bay in that they support nesting for both listed species, as well as six additional species of ground nesting seabirds (described below). The extent of species diversity at this site is believed to be related to the availability of exposed or lightly vegetated open ground on the levees, unrestricted visual access from the levees into the surrounding area, the isolated nature of the nesting habitat, and minimal disturbance from humans and mammalian predators.

Little data is available on the early (1900 through 1970) use of the salt pond levees by nesting seabirds. A statewide survey of California least tern nesting areas documented the presence of least tern nests at the salt works between 1968 and 1970 (Craig 1971). Monitoring of avian populations at the salt works was also conducted by Elizabeth Copper in the late 1970s and early 1980s. In 1987, Pacific Southwest Biological Services, Inc. conducted a survey of the birds occurring on portions of the salt works in order to understand the potential effects of proposed alterations to the existing levees. It was not until 1993 that a comprehensive investigation of the avian species in the South Bay was undertaken by the Service (Manning 1993, Stadtlander 1994, Konecny 1995). The Service's Coastal Program initiated these studies to obtain information regarding species diversity, abundance, and habitat use at the salt works. Yearly monitoring of the nesting activities on the salt works has followed this initial effort.

In 1999, when the San Diego Bay NWR was established, active management of the nesting areas within the salt pond complex was initiated by Refuge personnel. This management, which continues today, includes active predator control, intensive population monitoring, nest site enhancement, law enforcement, and other conservation stewardship activities. Many of these management actions are implemented to support the recovery of the listed California least tern and western snowy plover; however, they also provide direct benefits for variety of seabird and shorebird species that nest on the salt pond levees. These species include the gull-billed tern, Caspian tern, elegant tern, Forster's tern, royal tern, black skimmer, black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), the state endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), horned lark (*Eremophila alpestris*), and double-crested cormorant (*Phalacrocorax auritus*).

**Western Gull-billed Tern (*Gelochelidon nilotica vanrossemi*)**. The species, *Gelochelidon nilotica*, is a cosmopolitan species with an estimated global population of 55,000 breeding pairs (Gochfeld and Burger 1996 in Shuford and Gardali 2008). There are five recognized subspecies and possibly two additional subspecies, none of

which are considered very abundant (*Shuford and Gardali 2008*). The subspecies, *G. n. vanrossemi*, was described by Bancroft from a specimen collected by Pemberton at the Salton Sea in Imperial County, California in 1927 (*Molina and Erwin 2006*). This subspecies is described as larger on average than *G. n. aranea*, the subspecies that breeds along the Atlantic and Gulf coasts, with a bill that is longer and deeper than the other subspecies (*Molina and Erwin 2006*). The subspecies was not recognized in 1944 in the The Distribution of the Birds of California (*Grinnell and Miller 1944*), but in 1957, the subspecies was included in the Checklist of North American Birds, 5<sup>th</sup> edition (*American Ornithologists' Union 1957*). Questions continued to be raised about the taxonomic status of western gull-billed tern. As a result, the U.S. Geological Survey (USGS) is currently comparing the eastern and western North American subspecies of gull-billed tern. In support of this effort, samples of gull-billed tern feathers and blood have been taken from the nesting colony in San Diego Bay in past seasons. USGS expects to complete the DNA analysis in fall 2009.

Pemberton's recording of this subspecies at the Salton Sea, in which 500 nests were described, was the first reported occurrence of the western gull-billed tern in the U.S. Pemberton (1927) speculated that based on anecdotal evidence, the colony was probably active since about 1920 (*Shuford and Gardali 2008*). During the 1930s, the number of nests recorded at the Salton Sea declined in response to rising water levels (*Patten et al. 2003*). Despite decreases in numbers, gull-billed tern appear to have continued to nest at the Salton Sea between the 1950s and the 1980s (*Shuford and Gardali 2008*). The lowest number of nesting pairs was recorded in 1976, when only 17 pairs were observed (*Patten et al. 2003*).

Gull-billed terns arrive at the Salton Sea in mid-March and nesting begins in mid-April (*Patten et al. 2003*). Most of these terns leave for southern wintering grounds by September. Nesting areas around the Salton Sea have occurred around the south and lower half of the western edge of the sea and in a small area at the northern end of the sea (*Shuford and Gardali 2008*). Data from observations made at the various Salton Sea colonies between 2005 and 2007 identified seven nesting locations, with all but one located around the south end of the Salton Sea. These nesting locations are not used consistently from year to year (*Molina 2005, 2006, 2007*), however, the site referred to as HQ D pond at Rock Hill on the Sonny Bono Salton Sea NWR (Figure 3), has supported successful gull-billed tern nesting over the past few years (*Molina 2005, 2006, 2007*). In 2005, a peak number of 189 pairs and at least 170 fledglings were observed on a single visit to HQ D Pond and an additional 20 pair of gull-billed terns were observed on a single visit to three other potential nesting sites around the Salton Sea (*Molina 2005*). In 2006, these numbers were 130 pairs and at least 88 fledglings observed on a single visit to HQ D Pond and approximately 50 additional pairs observed at two other potential nesting sites around the Salton Sea (*Molina 2006*). In 2007, 128 pair, 232 nest attempts, and 23 near fledged chicks were observed at the Salton Sea (*Molina 2007*). Various actions to support gull-billed tern nesting productivity have been employed at the Salton Sea by the Service including

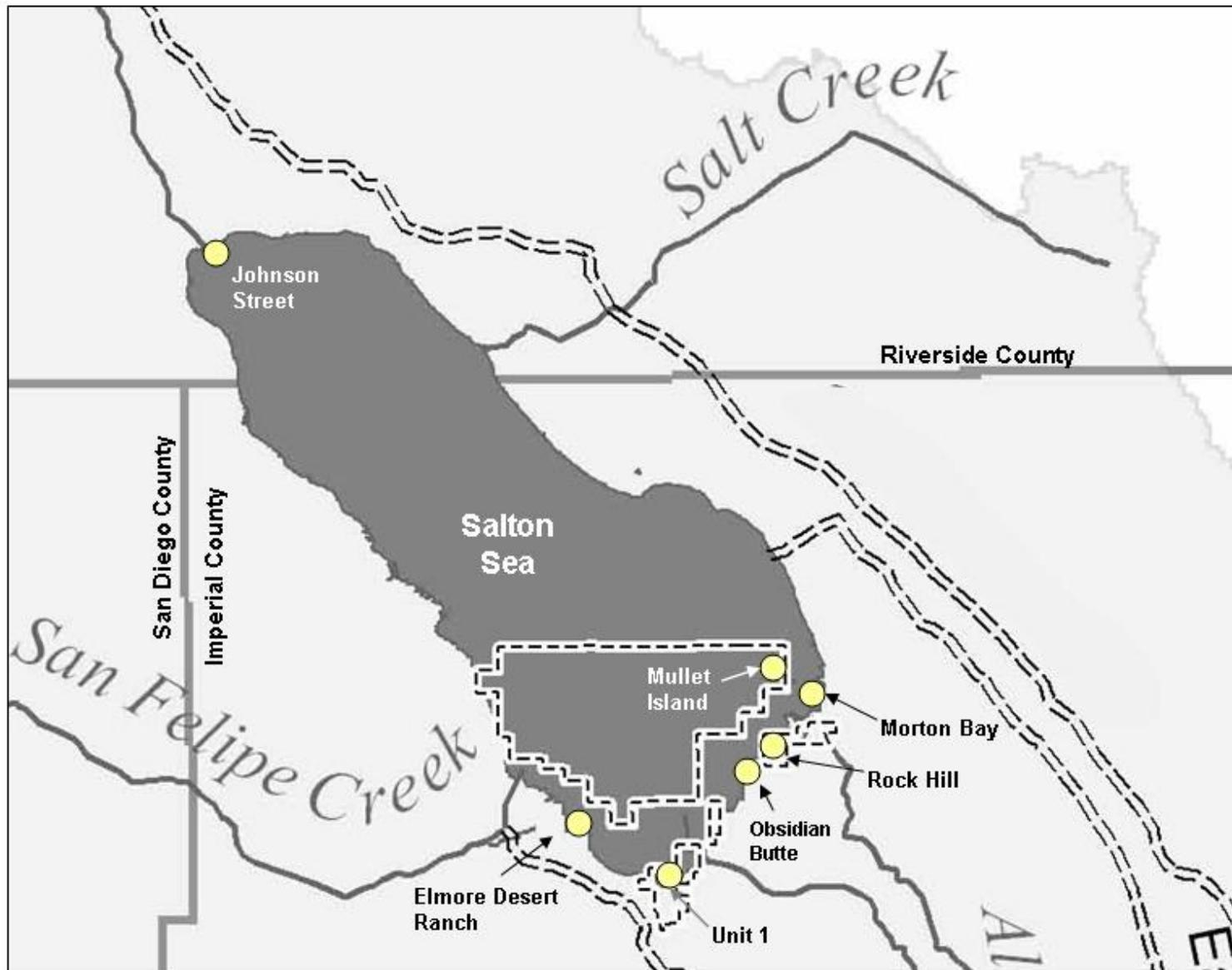


Figure 3 - Location of Sites Recently Occupied by Breeding Gull-billed Terns at the Salton Sea. (Source: Molina 2005, 2006, 2007)

the construction of nesting platforms, the erection of electric fences surrounding nesting sites to reduce mammalian predation, and annually monitoring of the nesting colonies.

The first occurrence of a western gull-billed tern in San Diego Bay was documented in 1985 (*Unitt 2004*) and the first gull-billed tern nest in San Diego County was observed at the salt works in 1987 (*Terp and Pavelka 1999*), and between 1993 and 1998, eight to ten nesting pairs were recorded. In 2003, at least 59 nests were established (*Patton 2004b*) and in 2005, 73 nests were observed (*Patton 2006b*). This tern, which nests in simple lined scrapes on the ground on the salt pond levees, is generally only present during the breeding season (March through July). The locations of nest sites along the levees, which vary from year to year, have been documented since 1999. Data regarding western gull-billed tern nesting at the salt works between 1999 and 2008 is provided in Table 1.

The majority of the western gull-billed tern population nests in northwestern Mexico. Based on surveys conducted in 2003 and 2005 by Palacios and Mellink (*2007*) and an additional survey conducted in 2006 (*González-Medina and Guevara-Medina 2008*) an estimated 12 nesting clusters have been recorded in western Mexico. The range-wide population, including sites in Mexico and the U.S. is estimated to be within the range of approximately between 530 and 810 pairs (Table 2).

The conservation status of the gull-billed tern within the U.S. is currently described by the Service as a Bird of Conservation Concern (*USFWS 2008*) and the State of California has classified the gull-billed tern as a priority 3 Bird Species of Special Concern (*Shuford and Gardali 2008*). The Service identified this tern as a BCC because of declining population trends and threats to breeding birds. At the sub-specific level, the western gull-billed tern is of increased concern due to its very small population size (refer to Table 1), limited distribution (only 14 recorded nesting sites range-wide), suspected population declines, and threats to existing habitat areas in Mexico related to human disturbance and development.

The primary population limiting factor on the gull-billed tern colony at San Diego Bay today is site disturbance and predation by coyotes, northern harriers, and peregrine falcons. Inter-specific competition between gull-billed terns and other species of nesting larids, including Caspian terns and black skimmers, might also be a limiting factor to gull-billed tern fledgling success. This has also been a factor at the Salton Sea site, where nests were lost prior to hatching during the 2007 nesting season due to interference by American white pelicans and California brown pelicans (*Molina 2007*). Potential threats to the population at Salton Sea also include loss of suitably isolated nesting habitat to receding water levels and reduced foraging opportunities both in the Sea as a result of decreasing water quality and on land where the acreage of irrigated farmland, which represents important foraging habitat for the gull-billed tern, is decreasing (*Shuford and Gardali 2008*). Human disturbance by recreationists, researchers, and others could also pose a threat to both of the California colonies.

**Table 1 - Summary of Western Gull-billed Tern Breeding in South San Diego Bay, 1999 – 2008  
(San Diego Bay NWR)**

**Nesting Season**

<b>Observations</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
Date terns first observed	prior to 4/22	prior to 3/28	3/26	4/1	3/27	3/17	3/17	3/27	3/22	3/24
Date terns last seen	8/18	8/2	8/30	9/19	8/21	8/26	8/31	8/9	8/12	8/21
Date of first nest	5/19 (5/4)	5/3 (4/26)	5/4 (4/30)	4/30	4/23	4/21	4/21	4/30	5/2	4/23
Date last nest found	7/14	6/7	6/13	7/24	6/18	6/19	6/29	6/17	6/27	6/25
Date last nest established	7/7?	6/5	6/6?	6/26?	6/17	6/11	6/29	6/17	6/21	6/25
Date of first hatch	5/27	5/17	5/22	5/21	5/27	5/12	5/25	5/20	5/23	5/14
Date of last hatch	7/14	6/28	7/6	6/19	7/9	7/2	7/13	7/12	6/21	7/9
Date of first fledgling	6/30	6/28	7/4	6/19	6/21	6/16	6/15	6/23	6/18	6/7
<b>Estimated number of breeding pairs</b>	11-20	20-27	30	32- 36	32-37	40	43-48	52	54	54
Total number of nests	29	27	47	39	59	49	73	58	62	65
Total number of eggs	54	61	110	83	134	102	129	123	126	130
Clutch Size										
1 egg	10	2	4	8	6	10	25	9	12	9
2 egg	14	16	23	18	31	25	40	33	36	47
3 egg	4	9	20	13	22	14	8	16	14	9
4 egg	1	0	0	0	0	0	0	0	0	0
Average clutch size	1.86	2.26	2.34	2.13	2.27	2.08	1.77	2.12	2.03	2.00
No. of nests hatching young*	9	19-22	25	32	29-32	34-40	48	52	43	45
Total number of eggs hatched	16	40-44	50	68	64-80	77-84	74-77	103	81	87
Estimated number of fledglings	5	19	27-30	22- 32	31-41	30+	32-47	34-38	31-47	31-42
Number of chicks banded	0	31	40	61- 62	48	64	65	80	72	79
Number of adults banded	0	0	7 (2 prev.)	0	0	0	0	0	0	0
Preyed upon:										
Eggs	18	10	8	8	0	7	4	4	11	14
Chicks	10	0	0	4	2	4	1	10	1	8
Fledglings	1	0	0	0	1	0	1	2	0	2

**Table 1 - Summary of Western Gull-billed Tern Breeding in South San Diego, 1999 – 2008  
(continued)**

<b>Observations</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
Adults	0	0	0	0	0	0	1	1	0	0
Other than preyed upon:										
Eggs										
Human Disturbance	0	0	0	0	0	0	0	0	0	0
Failed to hatch (incubated to term)	1	7	5	3	5	6	8	5	7	14
Died hatching	0	0	0	0	0	0	0	0	3	0
Abandoned (pre-term)	7	3	28	4	34	2	25	6	17	8
Damaged	0	0	0	0	4	3	13	5	0	1
Flooded	0	0	0	0	0	0	0	0	0	2
Chicks	0	3	5	5	6	4	3	18	15	5
Fledglings	0	0	0	0	0	0	1	2	0	0
Adults	0	0	0	0	0	0	0	2	(1 NALF IB)	0
Nests*										
No. preyed upon	10	8	8	6	0	5	4	6	10	10
No. failed to hatch	1	6	5	3	5	6	8	5	10	10
No. abandoned (pre-term)	5	2	13	3	17	2	17	4	11	6
No. flooded	0	0	0	0	0	0	0	0	0	1

\* may include more than one category

<b>Table 2 Distribution of Western Gull-billed Tern Breeding Colonies</b>		
<b>Site</b>	<b>Estimated Breeding Pairs</b>	<b>Source</b>
<b>Mexico - Total</b>	341-555	
<b>Colima</b>		
Laguna Cuyutlan (up to 6 sites)	15-55	Palacios & Mellink 2007
<b>Nayarit</b>		
Laguna Las Garzas	120-160	Palacios & Mellink 2007
Estero Teacapan	0-2	Palacios & Mellink 2007
<b>Sinaloa</b>		
Las Tres Tumbas, Laguna El Caimanero	25	Palacios & Mellink 2007
Isla Altamura (=Laricion=La Rision), Bahia Santa Maria	0-1	Friedmann, Griscom, & Moore 1950; Palacios & Mellink 2007
Isla El Rancho, Bahia Santa Maria	1-30	Vega & Gonzalez; Palacios & Mellink 2007
Bahia Ceuta	1	González-Medina and Guevara-Medina 2008
<b>Baja California Sur</b>		
Guerrero Negro saltworks (up to 2 sites)	10-14	Danemann & Carmona 2000; Palacios & Amador; Palacios & Mellink 2007
<b>Baja California</b>		
Isla Montague	30-77	Mellink 2003; Palacios & Mellink 2007
Cerro Prieto	140-191	Molina & Garrett 2001; Palacios & Mellink 2007
<b>U.S. - Total</b>	154-263	
<b>California</b>		
Salton Sea	100-209	Molina 2003; Molina & Erwin 2006
San Diego Bay	54	Patton 2008
<b>Range-wide Total</b>	<b>495-1042</b>	

Over the past five to ten years, gull-billed terns have benefited from the various recovery actions implemented on the San Diego Bay NWR to benefit the least tern and western snowy plover and other species of nesting waterbirds. These actions include protection of existing habitat areas, enhancement of nesting substrate, control of human disturbance, and removal of mammalian and avian predators that forage on the adults, chicks, and eggs of birds that nest on the salt pond levees. The benefits of these actions to the gull-billed tern appear to be reflected in the increase in the number of nesting pairs of this species that has been observed at the salt works over

the past ten years. An estimated 11 to 20 breeding pairs of gull-billed terns were present in 1999 (Patton 2001) and in 2008 approximately 54 breeding pairs were observed at the salt works (Patton pers. comm.).

In south San Diego Bay, the western gull-billed tern is a species of particular concern both for its own status and for its choice of prey, which includes California least tern and western snowy plover chicks and eggs (Patton 2001, 2002, 2004b, 2006, 2008 and Molina and Marschalek 2003). Gull-billed terns are predominately a terrestrial feeder, opportunistically plucking prey from the surface of the ground, the surface of mudflats, beach shore, shallow water, or from among the vegetation (Parnell et al. 1995). Typical prey includes lizards, fish, insects, and the chicks of shorebirds and other tern species. The first documented observation of gull-billed tern predation on a least tern chick occurred in 1988 in Mississippi (Densmore 1990).

Gull-billed terns have been observed foraging along shoreline, dune, mudflat, and marsh edge habitats adjacent to San Diego Bay, including sites managed by the Refuge and the Navy, and within the Tijuana Estuary (Patton 2004b). In 1999, the primary prey of these birds appeared to be side-blotched lizards (*Uta stansburiana*) (Patton 1999), while observations made in 2001 and 2002 indicated that mole crabs (*Emerita analoga* and *Lepidopa californica*) and side-blotched lizards were the predominant prey items (Molina and Marschalek



**Figure 4 - Western gull-billed tern with California least tern chick. (Photo by Matt Sadowski)**

2003 and Patton 2001). The loss of least tern chicks by gull-billed terns has been documented at sites around San Diego Bay since at least 1993, when a predation of least tern chicks by gull-billed terns were documented at Delta Beach North and Delta Beach South and predation was suspected at D Street Fill, Chula Vista Wildlife Reserve, the salt pond levees, and the Tijuana Estuary (Caffrey 1994). Since 2001, gull-billed tern presence and foraging has been documented during annually monitoring at each of the San Diego Bay least tern and western snowy plover sites (Patton 2001, 2003).

A number of gull-billed tern foraging studies have been conducted since 2002 in an effort to better understand the feeding ecology of breeding gull-billed terns. In 2002, focal surveys were conducted of foraging birds in south San Diego Bay. A variety of

food items were identified including, in decreasing order of frequency, mole crabs, small fish, lizards, and small chicks (*Molina and Marschalek 2003*). From the results of these surveys, Molina and Marschalek suggested that predation on least terns and snowy plovers by gull-billed terns is limited to the youngest chicks (hours to less than a week post-hatching) (*Molina and Marschalek 2003*).

During the 2003 nesting season, monitors documented a significant increase in least tern chick predation by gull-billed terns at the salt works and within the Tijuana Estuary (*Patton 2002*). A number of damaged least tern eggs were also attributed to suspected depredation by gull-billed terns. Of the prey observed taken by gull-billed terns at least tern and snowy plover sites adjacent to San Diego Bay and the Tijuana Estuary during the 2003 nesting season, 33 percent were chicks, 30 percent were crabs, 15 percent were lizards, and eight percent could not be identified, seven percent were insects, and seven percent were fish (*Patton 2004b*). These observations differ from the observations made during previous years, and may be attributed to the total number of chicks available in a given season or could relate to differences in the timing and location of data collection (*Patton 2004b*). Based on these observations, at least 37 incidents of least tern and snowy plover chick predation by gull-billed terns were documented in 2003 (*Patton 2004b*).

In 2004, at least 44 least tern and snowy plover chicks were documented as lost to gull-billed tern depredation (*Patton 2006*). In 2008, a total of 137 least tern chicks and six snowy plover chicks were documented lost to gull-billed tern predation in the San Diego Bay area. Biologists monitoring the nesting populations around the bay and at the Tijuana Estuary infer that predation by gull-billed terns on snowy plover and least tern chicks is ongoing when observers are not present, therefore, only a fraction of the predation is being observed. Based on the data, the impacts that gull-billed terns have had on the productivity of nesting sites throughout San Diego Bay and the Tijuana Estuary are not insignificant (*Brian Collins pers. comm.*).

The current situation has raised concerns that the gull-billed tern may be impeding the recovery of California least tern and western snowy plover in San Diego Bay and may have range-wide recovery implications for the California least tern. Various programs within the Service, including the Divisions of Migratory Birds Management, Refuges, and Ecological Services, are currently working together to identify and implement actions that will provide a better understanding of the current situation and its implications to all three species. Actions that are already being implemented include scientifically based monitoring at the salt works of gull-billed tern foraging activities and ongoing population monitoring and nesting site management of all three species throughout the San Diego Bay area. The Service, in cooperation with other agencies and interested stakeholders, is continuing to examine other options for ensuring the conservation of the western gull-billed terns, while also continuing to implement actions that will aid in the recovery of the California least tern and western snowy plover.

**California Least Tern (*Sternula antillarum browni*)**. The endangered California least tern breeds in the United States only along the immediate coast of California from San Francisco Bay south to Baja California, Mexico (USFWS 2006b). Of the approximately 40 known breeding sites in California, eight distinct nesting sites are managed for least terns in and around San Diego Bay.

Unfrequented sandy beaches close to estuaries and coastal embayments had historically served as nesting sites for this species, but by the 1960s, suitable nesting areas were severely reduced due primarily to coastal development and intense human recreational use of beaches. As a result, the tern's numbers diminished from several hundred by 1970, when the species was added to the Federal Endangered Species List. The nesting range in California has apparently always been widely discontinuous, with the majority of birds nesting in southern California from Santa Barbara County south through San Diego County.

Only a few beaches continue to support least tern nesting, including the Tijuana Estuary, NAB Coronado (Delta Beach and Ocean Beach), the Santa Margarita River mouth, Huntington Beach, and Venice Beach. Terns have also recently returned to nest along a portion of beach in Ocean Beach near the mouth of the San Diego River.

The loss of historic undisturbed "natural" breeding sites has forced least terns to adapt to a wide variety of alternatives; however, these alternative sites share several basic ecological requirements. Specifically, alternative sites must be relatively flat, open areas, with a sandy or dried mud substrate; relatively secluded from disturbance and predation; and in proximity to a lagoon or estuary with a dependable food supply (Craig 1971, Swickard 1971, Massey 1974). At present, the majority of the least tern nesting areas in southern California occur on manufactured substrates or fills, some of which were intentionally created to support tern nesting, while others were created for different reasons and inadvertently attracted nesting terns.

The California least tern is migratory, usually arriving in its breeding area in April and departing again in August. Least terns are colonial but do not nest in as dense a concentration as many other tern species. The nest is a simple scrape or depression in the sand, in which one to four eggs are laid, usually two. There is one breeding season, from May through August and only one brood is raised. However, the birds will re-nest if eggs or chicks are lost. Re-nesting often occurs from mid-June to early August, a time when 2-year-old birds also nest for the first time (Massey and Atwood 1981). Parents continue to feed their young even after they are strong fliers.

This tern species is an exclusive fish-eater, typically feeding on topsmelt, northern anchovy, gobies, and jacksmelt (Massey 1974, Atwood and Kelly 1984). Studies on fish dropped at nesting sites suggest that fish size, rather than species, is the essential requirement of suitable prey for the least tern. Feeding is carried out in the calm waters of narrow estuaries or large bays and for a short distance (typically within two miles [three kilometers] of the beach) in the open ocean. The hovering and plunging habits of this species are conspicuous. Adults that are not feeding young tend to go

farther and feed on larger fish. After the eggs have hatched, however, the parents make shorter trips, bringing back smaller fish for their chicks. This need to locate smaller fish appears to result in the increased use of freshwater marsh systems, lagoons, and estuarine areas during the post-breeding dispersal phase, suggesting the importance of such habitats when juveniles are learning to fish.

Around San Diego Bay, there are six areas where least terns nest: Lindbergh Field, NAS North Island, NAB Coronado, D Street Fill (Sweetwater Marsh Unit of San Diego Bay NWR), Chula Vista Wildlife Reserve (Port of San Diego), and the salt pond levees within the South San Diego Bay Unit of San Diego Bay NWR (refer to Figure 2). The nesting sites at the Tijuana Estuary are also located just to the south of San Diego Bay.

Least tern nesting occurred on the salt pond levees in south San Diego Bay for many years before there was any attempt to determine the total nesting population. The first documented count of tern nests occurred in 1968 when 60 pairs were observed nesting on the levees (*Craig 1971*). Over the next two years, the numbers of pairs declined, with only two pairs observed in 1970. Limited surveys of potential nesting sites for California least terns in coastal San Diego County were initiated in 1970 to document nesting locations and the population status for this species. At that time the salt works was identified as one of two nesting sites within San Diego Bay. As indicated in Table 3, California least tern breeding populations at the salt works have ranged from a high of 62 pairs in 1993 to two pairs in 1970, with no known nesting during 1982 and 1983. In 2002, 39 nests were observed, of which only two chicks were estimated to have fledged from the site (*Patton 2004a*) and in 2008, up to 81 chicks from 44 nests were successfully hatched; however, the majority of these chicks were not seen beyond the first three days following hatching (*Patton 2008*). Poor least tern reproductive success at the salt works is partially attributed to high levels of predation of chicks and eggs.

Least terns have been observed nesting at Delta Beach South and the NAB ocean beaches since 1996 (*Navy 2002*). These sites, as well as NAS North Island, are managed by the Navy. California least tern nesting data for the period 1977 to 2008 at the San Diego Bay Navy facilities is provided in Table 4.

Other California least tern nesting sites to the north of San Diego Bay include Mission Bay and Batiquitos Lagoon. Further north at Marine Corps Base Camp Pendleton, California least tern nest on beaches at the mouths of the Santa Margarita River, North Beach, French, and Aliso Creeks and on the salt flats in the Santa Margarita Estuary. To the south, the Tijuana Estuary provides natural nesting areas on the beach and around the mouth of the Tijuana River. Draft results for the statewide population monitoring effort for the 2008 California least tern nesting season are provided in Table 5. In 2008, in total, all sites surrounding San Diego Bay including Tijuana Estuary supported approximately one quarter of the California least tern range-wide population.

**Table 3**  
**Summary of California Least Tern Breeding within the San Diego Bay NWR**  
**and at the Tijuana Estuary in 2008**

Observations	Monitoring Sites		
	D Street Fill (San Diego Bay NWR)	Salt Pond Levees (San Diego Bay NWR)	Tijuana Estuary
Date terns first observed	4/22	4/26	4/26
Date terns last seen	8/13	9/17	9/18
Date of first nest	5/10	5/14	5/15
Date last nest found	7/18	7/23	7/24
Date last nest established	7/16	7/23	7/19
Date of first hatch	6/3	6/7	6/5
Date of last hatch	7/22	7/30	7/10
Date of first fledgling	6/24	6/25	6/26
Estimated number of breeding pairs	133-135	79-80	177-178
Total number of nests	148	102	201
Total number of eggs	262	191	371
Clutch Size			
1 egg	34	15	34
2 egg	114	86	164
3 egg	0	0	3
4 egg	0	1	0
Average clutch size	1.77	1.87	1.85
No. of nests hatching young*	124	44	104
Total number of eggs hatched	223	81	191
Estimated number of fledglings	17-24	6	45-51
Number of chicks banded	129	32	84
Number of adults banded	5	13	2
Uncertain outcome			
Nests*	6	26	30
Eggs	8	47	53
* included in more than one category			

**Table 3**  
**Summary of California Least Tern Breeding within the San Diego Bay NWR**  
**and at the Tijuana Estuary (continued)**

Observations	D Street Fill	South Bay Salt Works	Tijuana Estuary
<b>Documented Mortality</b>			
Preyed upon:			
Eggs**	2	32	62
Chicks	11	7	2
Fledglings	0	0	0
Adults	0	0	0
Other than preyed upon:			
Eggs			
Human Damaged	0	0	1
Failed to hatch (incubated to term)	9	8	11
Died hatching	0	0	1
Abandoned (pre-term)	20	23	25
Flooded	0	0	27
Chicks	12	0	3
Fledglings			
Non-predation mortality	0	0	2
Vehicle strike	0	0	0
Adults	0	0	1
Nests			
Human damaged*	0	0	1
Preyed upon*	2	19	35
Failed to hatch*	6	6	10
Abandoned (pre-term)*	16	15	21
Flooded	0	0	14

\* included in more than one category

\*\* not including previously abandoned eggs that were depredated/scavenged

Through many years of active site management and recovery efforts by a variety of state and federal agencies as well as municipalities and private conservationists, the California least tern's numbers have grown to approximately 7,000 pairs throughout its range, however it is largely dependent for its reproductive success on active nesting site management including site preparation, site protection from human intrusion, and other disturbance sources.

The least tern is vulnerable to a long list of predators, some of which are very abundant in urban environments, such as feral cats and dogs, crows, American kestrels, and other birds of prey. The numbers of least tern chicks and eggs lost during the 2008 nesting season on Refuge lands is presented in Table 3. In San Diego Bay, young least tern chicks also fall prey to adult gull-billed terns which have been successfully nesting on the salt pond levees. To protect least tern nest sites from

**Table 4**  
**Summary of California Least Tern Nesting at San Diego Bay Navy Facilities, 1977-2008**

	Number of Nests by Location						Total Nests	Total Chicks	Estimated Fledglings	Fledgling per nest	% of Chicks Fledged	Clutch Size
	Naval Training Center	North Island MAT	North Island 11	Delta Beach North	Delta Beach South	NAB Ocean						
1977	35	13					48	Na	25		na	na
1978	4	35		4			43	Na	19		na	na
1979	0	75		11			86	Na	64		na	na
1980	0	98		0			98	14	14		100	na
1981	0	61		0			61	20	5		25	na
1982	0	86		0			86	57	26		46	1.78
1983	0	90		0			90	126	110		87	1.90
1984	0	98		0			98	97	41		42	1.84
1985	0	95		20			115	Na	42	0.37	na	1.91
1986	8	34		64			106	117	56	0.53	48	1.95
1987	11	11		30			52	55	15	0.29	27	1.79
1988	1	27		14			42	24	15	0.36	63	1.90
1989	0	32		46			78	89	53	0.68	60	1.86
1990	0	42		67			109	150	78	0.72	52	1.83
1991	0	30		63			93	139	35	0.38	25	1.88
1992	0	52		40	1		93	103	25	0.27	24	1.78
1993	3	53		127	8		191	256	149	0.78	58	1.87
1994	13	51		210	18	1	293	458	183	0.62	40	1.85
1995	6	60		177	1	31	275	436	118	0.43	27	1.83
1996		53		224	21	84	382	618	296	0.77	48	1.86
1997		27		349	25	92	493	822	381	0.77	46	1.87
1998		77		337	81	184	679	1031	495	0.73	48	1.73
1999		102		344	80	278	804	967	87	0.11	9	1.65
2000		134		229	70	330	763	533	150	0.20	28	1.76
2001		113		271	81	463	928	711	175	0.19	25	1.72
2002		83		257	84	401	825	605	63	0.08	10	1.48
2003		172	3	285	216	623	1299	1562	210 (144)	0.16	10	1.74
2004		172	0	263	195	577	1207	1097	42	0.03	4	1.54
2005		134	0	351	215	569	1269	1505	145-170	0.11	10-11	1.63
2006		180	0	223	155	1047	1605	1912	206	0.13	11	1.54
2007		119	4	224	156	782	1285	1785	230	0.18	13	1.71
2008		146	0	295	174	1055	1670	2286	155	0.09	7	1.73

Source: E. Copper

disturbance, ground access is typically controlled by fences or other obstructions. Nest site management involves three essential elements that if implemented may improve least tern reproductive success. These elements include protection from disturbance, management of predators, and surface preparation where weeds or excessive plant growth is a problem.

**Table 5  
California Least Tern Statewide Population Monitoring Results for 2008 (Draft)**

2008 Site	Estimated Number of Breeding Pairs		Number of Nests	Estimated Number of Fledglings		Fledgling per Pair Ratio	
	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
<b>Sacramento Area</b>							
Bufferlands	1	1	1	0	0	0.00	0.00
<b>San Francisco Bay Area</b>							
Green Island	16	18	16 to 18	1	2	0.06	0.13
Montezuma Wetlands	35	35	35	11	18	0.31	0.51
Pittsburg Power Plant	10	10	1	0	0	0.00	0.00
Alameda Point	323	324	336	357	507	1.10	1.57
Hayward Regional Shoreline	57	62	62	73	73	1.18	1.28
Eden Landing	2	2	2	0	0	0.00	0.00
<b>San Luis Obispo/Santa Barbara Counties</b>							
Oceano Dunes SVRA	55	55	56	70	70	1.27	1.27
Guadalupe-Mussel Rock	0	0	0	0	0	0.00	0.00
Vandenberg AFB	18	18	18	19	19	1.06	1.06
Coal Oil Point Reserve	1	1	1	0	0	0.00	0.00
<b>Ventura County</b>							
Santa Clara River/McGrath State Beach	89	97	97	77	77	0.79	0.87
Ormond Beach	79	81	81	30	30	0.37	0.38
Hollywood Beach	24	24	24	28	28	1.17	1.17
Pt Mugu- Totals	380	456	506	79	79	0.17	0.21
Ormond Beach East	277	337	362	59	59	0.18	0.21
Holiday Beach	52	66	74	12	12	0.18	0.23
Holiday Beach Salt Panne	13	16	17	4	4	0.25	0.31
Eastern Arm	35	41	53	4	4	0.10	0.11
<b>Los Angeles/Orange Counties</b>							
Venice Beach	460	698	928	296	296	0.42	0.64
LA Harbor	486	515	529	210	210	0.41	0.43
Seal Beach NWR - Anaheim Bay	166	200	206	44	44	0.22	0.27
Bolsa Chica Ecological Reserve	211	217	242	100	150	0.46	0.71
Huntington State Beach	344	411	454	267	267	0.65	0.78
Burris Sand Pit/Buris Basin	4	4	10	2	2	0.50	0.50
Upper Newport Bay Ecological Reserve	22	26	25	20	20	0.77	0.91
<b>San Diego County</b>							
MCB Camp Pendleton- Totals	1604	1604	1665	107	139	0.07	0.09
Red Beach	5	5	5	0	0	0.00	0.00
White Beach	114	114	119	2	3	0.02	0.03
Cockleburrr Beach	1	1	1	0	0	0.00	0.00
Santa Margarita River - North Beach North	432	432	458	17	17	0.04	0.04
Santa Margarita River - North Beach South	987	987	1012	85	116	0.09	0.12
Santa Margarita River - Saltflats	44	44	48	3	3	0.07	0.07
Santa Margarita River - Saltflats Island	21	21	22	0	0	0.00	0.00
Batiquitos Lagoon Ecological Reserve- Totals	598	598	610	123	176	0.21	0.29
W1	35	35	35	24	32	0.69	0.91
W2	397	397	404	73	98	0.18	0.25
E1	165	165	170	25	45	0.15	0.27
E2	0	0	0	0	0	0.00	0.00
E3	1	1	1	1	1	1.00	1.00
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0.00	0.00

**Table 5  
California Least Tern Statewide Population Monitoring Results for 2008 (Draft)  
(continued)**

Mission Bay							
FAA Island	0	0	0	0	0	0.00	0.00
North Fiesta Island	10	10	10	0	0	0.00	0.00
Mariner's Point	12	13	14	0	0	0.00	0.00
Stony Point	0	1	0-1	0	0	0.00	#DIV/0!
San Diego River Mouth	1	1	1	0	0	0.00	0.00
San Diego Bay							
Lindbergh Field & Former Naval Training Center	122	122	139	115	128	0.94	1.05
USN- Totals	1474	1474	1670	155	155	0.11	0.11
NI MAT	139	139	146	25	25	0.18	0.18
Delta Beach North	267	267	295	30	30	0.11	0.11
Delta Beach South	162	162	174	35	35	0.22	0.22
NAB Ocean	906	906	1055	65	65	0.07	0.07
D Street Fill/Sweetwater Marsh NWR	135	135	148	17	24	0.13	0.18
Chula Vista Wildlife Reserve	28	28	33	2	2	0.07	0.07
South San Diego Bay Unit, SDNWR - Saltworks	79	79	102	6	6	0.08	0.08
Tijuana Estuary NERR	177	177	201	45	50	0.25	0.28
<b>Totals:</b>	<b>7023</b>	<b>7497</b>	<b>8223-8226</b>	<b>2254</b>	<b>2572</b>	<b>0.30</b>	<b>0.37</b>

Source: D. Marschalek

In recent years, fledgling productivity for the range-wide population of the California least tern has not tracked its population growth (Figure 5). This condition has led to concerns for the long term recovery of the species due to poor recruitment into the population despite the intensive management efforts taken on its behalf by a variety of resource agencies and conservation biologists.

Presumed or observed causes for these low fledgling productivity rates include poor food supply for chicks due to oceanographic conditions offshore of nesting sites (e.g., lack of upwelling leading to poor fishing conditions), predation pressures at the nesting colony sites, possible disease outbreak events, and other unknown factors.

Gull-billed terns regularly forage and prey on least terns at five sites on San Diego Bay. Those five sites currently account for approximately one quarter (23-25 percent) of all California least tern nests and pairs in the entire population of the species. An additional four sites, including the multiple clusters of nests at Batiquitos Lagoon and the Camp Pendleton sites, have seen irregular visitation by gull-billed terns in recent years, but predation by gull-billed terns has been documented. Those sites account for another 28-31 percent of the current California least tern breeding population. An additional six sites have infrequent but increasing gull-billed tern sightings, bringing the total to 61-65 percent of the entire California least tern population potentially subject to impacts from gull-billed tern predation. Approximately 52 to 56 percent of the current California least tern population currently nests at colony sites with documented gull-billed tern predation.



**Figure 5: California Least Tern Pair Numbers vs. Fledglings 1973-2008**

In 2008 alone, 135 California least tern chicks and six western snowy plover chicks were documented as depredated by gull-billed tern (*Patton pers. comm.*). At the end of the 2008 nesting season, a partial nest search at the gull-billed tern nesting sites in the San Diego Bay NWR yielded 47 California least tern bands and one western snowy plover band from gull-billed tern pellets, undigested castings regurgitated by gull-billed tern individuals, (*Patton 2008*). Each chick band represented a chick that had last been banded between June 3 and June 18, 2008.

In 2008, fledgling productivity in the colonies surrounding San Diego Bay was markedly lower than the range-wide average (see Tables 3, 4, and 5). There are many potential causes of low productivity numbers, however the impacts caused by the local population of gull-billed terns appears to be a significant contributing factor.

**Western Snowy Plover (*Charadrius alexandrinus nivosus*)**. The coastal western snowy plover population is defined as those individuals that nest adjacent to or near tidal waters and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries. The current Pacific coast breeding population extends from Damon Point, Washington, south to Bahia Magdalena, Baja California, Mexico (including both Pacific and Gulf of California coasts) (*USFWS*

2007). Snowy plover nesting currently occurs in only a few locations in southern California including several sites around San Diego Bay.

The breeding season of the western snowy plover extends from March 1 through September 15. Generally, three eggs are laid in a nest, which consists of a shallow depression scraped in sandy or saline substrates. Some nests are lined with plant parts, small pebbles, or shell fragments. Both sexes incubate the eggs for an average of 27 days (Warriner *et al.* 1986). Snowy plovers will re-nest after loss of a clutch or brood. Snowy plover chicks are precocial and leave the nest within hours of hatching in search of food. The tending adult(s) provide danger warnings, thermo-regulation assistance, and guide the chicks to foraging areas, but do not provide food to their chicks. Broods rarely stay in the immediate area of the nest. Young birds are able to fly within approximately 31 days of hatching (Warriner *et al.* 1986). Double brooding and the practice of one female having several mates have been observed. In addition, snowy plover females may abandon a nest before the chicks have fledged in search of another mate, leaving the male to care for the brood. Adults and young forage on invertebrates along intertidal areas, along beaches in wet sand and surf cast kelp, in foredune areas of dry sand above the high tide, on salt pans, and along the edges of salt marshes and salt ponds. The snowy plover is primarily a run and glean type of forager.

Human disturbance, predation, and inclement weather, combined with the loss of nesting habitat to urban development and the encroachment of introduced beachgrass (*Ammophila arenaria*), have led to an overall decline in the breeding and wintering population of the western snowy plover along the Pacific Coast. In southern California, the very large human population and resulting recreation activities have precluded the western snowy plover from breeding on historic beach strand nesting habitat. As a result of these factors, the Pacific coast population of the western snowy plover was federally-listed as threatened in 1993.

In southern California, snowy plovers often nest in association with California least terns, with nesting areas consisting of wide, sparsely vegetated beaches, such as those found at Camp Pendleton, as well as dredge spoil sites, salt pans, and open, unvegetated levees, such as those found at the salt works in south San Diego Bay (Powell and Collier 2000, USFWS 2006). Well used locations include Bolsa Chica (Orange County), Camp Pendleton, Batiquitos Lagoon, NAB Coronado, Silver Strand State Beach, Naval Radio Receiving Facility, and Tijuana Estuary in San Diego County. In 2008, 52 percent of the nests recorded in San Diego County were located on Camp Pendleton, 38 percent occurred to the west of San Diego Bay at NAS North Island, NAB Coronado, Silver Strand State Beach, and Naval Radio Receiving Facility (NRRF), and seven percent were recorded at the Tijuana Estuary. The western snowy plover nests on the salt pond levees in south San Diego Bay only accounted for one percent of the total nests observed in San Diego County in 2008 (Table 6).

**Table 6 - Summary of Monitoring Data for the 2008 Western Snowy Plover Nesting Season  
(San Diego County, California)**

Location	No. of Nests	No. of Eggs	Average Clutch Size	Max # of Active Nests	Date of Maximum	No. of Males	No. of Females	Nests Hatching Young	Chicks Hatched	Estimated Fledglings	Method for determining Fledging #'s	# sick or dead adults or fledglings
Camp Pendleton	148	425	2.87	45	6/2-3	45-55	45-55	109	300	56-59	estimates from observations	1 adult dead - cause unknown
Batiquitos Lagoon - All	6	16	2.67	4	5/8-5/12			5	15	3	estimates from observations	0
Batiquitos Lagoon - W2	2	6		2	5/12			2	6	1	estimates from observations	0
Batiquitos Lagoon - E1	4	10		3	5/8-5/11			3	9	2	estimates from observations	0
North Island Ocean	26	72	2.77	10	4/28-30			20	55	34	estimates from observations; marker on color bands	2 dead adults after breeding season
North Island Airfield	12	33	2.75	4	3/23			1	1	1	observation	
DBN	0	0	0	0								
DBS	0	0	0	0								
NAB Ocean	41	118	2.88	14	5/17-18			40	113	5-7	estimates from observations	1 sick ad to PW-died
NRRF	12	36	3.00	4	3/29-31; 4/7-28; 6/12-15; 7/2			10	29	5	estimates from observations	
Silver Strand State Beach	18	54	3.00	8	6/30			17	49	14-19	estimates from observations	0
D Street	0	0	0	0								
Chula Vista Wildlife Reserve	0	0	0	0								
SD Bay NWR (Salt Pond Levees)	3	9	3.00	2	5/21-6/7	2	2	2	6	1	estimates from observations	0
Tijuana Estuary	20	52	2.60	5	6/13-16; 6/26-7/2; 7/10-15	6	5	12	32	6-10	estimates from observations	0
<b>TOTAL</b>	<b>286</b>	<b>815</b>	<b>2.85</b>	<b>76</b>	<b>4/22</b>			<b>216</b>	<b>600</b>	<b>125-139</b>		

Western snowy plovers were first documented nesting on the levees of the salt ponds in the San Diego Bay NWR in 1978, when 16 nests were observed. The population of snowy plovers in south San Diego Bay has declined substantially since then. In 1993, an estimated seven breeding pairs were present at the salt works. Only one nest was located in 1994, five in 1997, and three in 1998 (*Terp and Pavelka 1999*). In 2008, three nests were identified at the salt works and it was estimated that one fledgling was produced (*Patton 2008*). Snowy plover nesting has also been documented on the D Street Fill in the past; however, plover nesting has not occurred there since 2000, when one nest was identified. Disturbance, predation, and inadequate access to foraging areas are the most likely reasons for this history of low nesting numbers and poor reproductive success.

As with least terns, the list of potential predators of snowy plover eggs and chicks is long. Due to high densities in surrounding urban areas, corvids (crows and ravens), kestrels, and shrikes are likely to be significant threats to plovers. Predation of the snowy plover chicks by gull-billed terns is also well-documented at the salt works and elsewhere around San Diego Bay (*B. Collins, pers. comm.*).

#### **Other Nesting Seabirds.**

The range of seabirds and other bird species that have nested on the salt pond levees at the San Diego Bay NWR, as well as at the Tijuana Slough NWR, between 1999 and 2008 are described in Table 7 along with the number of nests for each species per season.

**Caspian Tern.** Based on the high abundance of Caspian terns during the nesting season and few observations from November through February, Caspian terns are believed to visit San Diego Bay primarily for breeding. Nesting Caspian terns were first recorded at the salt works in 1941 and the salt works is currently the only location in San Diego County where Caspian terns currently nest.

**Royal Tern.** At one time the royal tern was considered the most abundant large tern in California; however, during the 1900s their numbers declined throughout the state (*Unitt 1984*). This tern, which was first discovered nesting at the salt works in 1959, is present in the South Bay in small numbers throughout the year. Since 1959, one or two pairs have occasionally nested in South San Diego Bay. In 2002, two single egg nests were observed (*Patton 2004a*), while 52 nests were observed in 2005 (*Patton 2006b*). Royal tern nests generally have been located among active elegant tern nests. The exception was in 2002, when the two to three nests observed at the site were located among Caspian tern nests. Although royal terns are observed throughout coastal San Diego County, nesting has only been documented at the salt works.

**Elegant Tern.** The elegant tern can be observed in San Diego Bay between March and October. Over the years, surveys have documented the presence of more non-breeding migratory elegant terns than breeding pairs. In 1998, approximately 100 breeding pairs of elegant terns were documented, while about 1,000 non-breeding

**Table 7  
Numbers of Waterbird Nests Recorded at the San Diego Bay and Tijuana Slough National Wildlife Refuges 1999-2008**

Location and Nesting Species	Number of Nests per Species per Season									
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Tijuana Slough NWR/Border Field State Park</b>										
Western Snowy Plover	9	15	12	24	14	18	19	16	11	20
California Least Tern	128	210	313	232	473	520	458	371	291	201
<b>Sweetwater Marsh Unit ( D Street Fill)</b>										
Western Snowy Plover	2	1	0	0	0	0	0	0	0	0
California Least Tern	36	34	32	24	91	111	101	100	130	148
<b>South San Diego Bay Unit (Salt Pond Levees)</b>										
Western Snowy Plover	0	1	3	3	0	2	4	6	5	3
California Least Tern	25	44	45	39	62	49	34	82	97	102
Gull-billed Tern	29	27	47	39	59	49	73	58	62	65
Double-crested Cormorant	80-84	41	39-53	49+	74-77	49	77	70	98	68
Caspian Tern	281-369	500-574	364-450	379	332	313	357	399	400	486
Royal Tern	36	1-2	3	1-3	28-31	38	52	35	109	89
Elegant Tern	3100	86	107-110	37-100	10303-10500	1020	3051-3201	605	5121	6690
Forster's Tern	174-188	325-327	419-438	390+	266	275	415	293	139	158
Black Skimmer	395-410	224-231	419-430	443+	541	496	752	571	435	367

birds were observed in June and over 3,000 in late July. The first documented nesting of this species at the salt works occurred in 1959. The number of breeding pairs at the salt works has fluctuated significantly over the years, with over 800 pair observed in 1981 (*Unitt 1984*), none in 1990 (*Terp and Pavelka 1999*), 511 nests in 1993, and 3,100 nests in 1999 (*Patton 1999*). Only two nesting pairs were observed in 1997 (*Horn and Dahdul 1998*) and as many as 10,500 nests were observed in 2003 (*Patton 2004a*). The salt works is the only successful nesting site for elegant terns in San Diego County.

Forster's Tern. Forster's terns are present in the South Bay throughout the year, but their numbers peak in May and November. This species primarily breeds in the interior of North America with a few colonies located on the Pacific, Atlantic, and Gulf coasts. The first reported nesting at the salt works occurred in 1962 and the colony size has increased substantially since that time. Stadtlander (*1993*) reported 510 Forster's tern nests in 1993, 345 nests were observed in 1994 (*Konecny 1995*), 225 nests were counted in the 1998 surveys (*Terp and Pavelka 1999*), and during the 2005 breeding season, at least 415 nests were observed (*Patton 2006b*). Forster's terns have also been observed nesting in other locations along the coast of San Diego County.

Black Skimmer. Approximately 280 pairs of black skimmers were observed nesting at the salt works during the 1998 investigations. This species is generally present in the South Bay between April and September and in recent years has most often nested on the spit within Pond 23. The first reported nesting of black skimmers at the salt works was a single breeding pair in 1976 (*Stadtlander 1994*). The number of breeding pairs has increased significantly since that time. During the 2005 nesting season, approximately 752 black skimmer nests were observed at the salt works (*Patton 2006b*). Black skimmer nests have also been observed at Batiquitos Lagoon and more recently at Camp Pendleton.

#### **3.4.4. Other Birds Nesting on the Salt Pond Levees**

In addition to providing habitat for nesting seabirds, as described above, the South San Diego Bay Unit also provides suitable nesting habitat for a variety of other bird species. American avocets and black-necked stilts nest on the salt pond levees, where the nests tend to be abundant and distributed throughout the salt pond levees. In May 2002, at least 30 avocet nests and 24 stilt nests were recorded. Some of the other species observed nesting within the salt works in 2004 were killdeer (*Charadrius vociferous vociferous*), horned lark (*Eremophila alpestris*), gadwall (*Anas strepera*), and mallard (*Anas platyrhynchos*).

The California endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) nests in the pickleweed salt marsh vegetation that occurs along the outer levees of the salt ponds and along the edges of the South Bay in remnant patches of salt marsh vegetation.

Double-crested cormorants (*Phalacrocorax auritus*) annually nest within the salt works on a dredging barge anchored in the salt ponds and in a few locations along the salt pond levees. This nesting activity has been noted since the late 1980s. Nesting begins in April and continues through late July. During the 1998 colonial seabird nesting study, 34 cormorant nests were observed on the barge, with over 70 adults and about 42 young were present at the time of observation (*Terp and Pavelka 1999*). A total of 77 cormorant nests were observed at the salt works during the 2005 nesting season (*Patton 2006b*).

### **3.4.5 Other Listed and Sensitive Species**

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the Service to “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973.” The most recent effort to carry out this proactive conservation mandate is the approval of the Service’s report, Birds of Conservation Concern 2008. The overall goal of the report is to accurately identify bird species at each geographic scale that represent Service conservation priorities and draw attention to species in need of conservation action. The bird species identified are primarily derived from prioritization scores from three major bird conservation plans: The Partners in Flight, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan (*Kushlan et al. 2002*). Birds included in the Birds of Conservation Concern 2008 report are deemed priorities for conservation action. These lists are to be consulted in accordance with Executive Order 13186 “Responsibilities of Federal Agencies to Protect Migratory Birds.”

The 2008 report encompasses three distinct geographic scales: the Bird Conservation Regions (BCR) of the United States and Canada, and the cross-border BCRs agreed on with Mexico as part of the North American Bird Conservation Initiative; the USFWS Regions, which each consist of several states in the same geographic area, and the National List, which encompasses the United States, including U.S. island “territories” in the Caribbean and Pacific. Birds of Conservation Concern that occur within the habitats of San Diego Bay (Table 8) are included in the BCR 32 (Coastal California) List, USFWS Region 8 List, and the National List.

### **3.5 Cultural Resources**

The proposal to manage gull-billed terns during the 2009 nesting season would have no affect on the cultural resources present within the project site.

### **3.6 Social and Economic Environment**

No aspects of the social and economic environment, including land use, traffic circulation and parking, recreation, economics and employment, or environmental justice would be affected by this proposal.

**Table 8  
Birds of Conservation Concern Occurring within the South San Diego Bay Unit of  
the San Diego Bay NWR**

Common Name	Scientific Name	Foraging Habitat(s)	Abundance	Included on BCC List		
				BCR 32	Region 8	U.S. <sup>1</sup>
Reddish egret	<i>Egretta rufescens</i>	Wetlands	Rare	No	No	Yes
Peregrine falcon	<i>Falco peregrinus</i>	Uplands, Salt Marsh	Occasional	Yes	Yes	Yes
Lesser Yellowlegs	<i>Tringa flavipes</i>	Intertidal, Salt Ponds	Common	No	No	Yes
Whimbrel	<i>Numenius phaeopus hudsonicus</i>	Intertidal, Salt Ponds	Seasonally Common	Yes	Yes	Yes
Long-billed curlew	<i>Numenius americanus</i>	Intertidal	Common	Yes	Yes	Yes
Marbled godwit	<i>Limosa fedoa fedoa</i>	Intertidal, Salt Ponds	Common	Yes	Yes	Yes
Dunlin	<i>Calidris alpina</i>	Intertidal, Salt Ponds	Seasonally Common	No	No	Yes
Red knot	<i>Calidris canutus</i>	Intertidal, Salt Ponds	Seasonally Common	Yes	Yes	Yes
Short-billed dowitcher	<i>Limnodromus griseus</i>	Intertidal, Salt Ponds	Common	Yes	Yes	Yes
Gull-billed tern	<i>Gelochelidon nilotica vanrossemi</i>	Intertidal, Uplands	Nests at Salt Works	Yes	Yes	Yes
Black skimmer	<i>Rynchops niger niger</i>	Open Water Intertidal	Nests at Salt Works	Yes	Yes	Yes
Burrowing owl	<i>Athene cunicularia hypugaea</i>	Uplands	Historically Present	Yes	Yes	No
Short-eared owl	<i>Asio flammeus</i>	Uplands	Rare	No	No	Yes
Loggerhead shrike	<i>Lanius ludovicianus</i>	Uplands	Uncommon	Yes	Yes	Yes
Horned Lark	<i>Eremophila alpestris</i>	Uplands	Common	No	No	Yes
Common Yellowthroat	<i>Geothlypis trichas</i>	Uplands	Common	Yes	Yes	No
Song Sparrow	<i>Zonotrichia leucophrys</i>	Uplands Transitional	Common	Yes	Yes	No

<sup>1</sup>National List Source: (USFWS 2008)

## CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

### 4.1 Effects to Biological Resources

#### 4.1.1 Alternative A (No Action)

Under the no action alternative, current management practices associated with protecting listed and other ground nesting bird species in San Diego Bay, particularly on the San Diego Bay NWR, would continue. Seabird nesting sites throughout the San Diego Bay area would continue to be managed by the discrete landowners or land management entities responsible for each specific site and the San Diego Bay NWR would be managed in accordance with the approved Comprehensive Conservation Plan for the Refuge (*USFWS 2006*). No actions to limit the gull-billed tern population or nesting productivity of the species would occur.

Under this alternative, depredation of listed species by gull-billed terns would continue to be monitored, but no actions would be taken to intervene. The current rate and magnitude of gull-billed tern depredation impacts to California least tern and western snowy plover chicks and eggs would be expected to continue or possibly increase given no other changes in predator management practices at non-Service managed sites.

#### 4.1.2 Alternative B - Addle Gull-billed Tern Eggs (Proposed Action)

Under this alternative, clutches within 43 percent of gull-billed tern nests established at the south San Diego Unit during the 2009 breeding season would be addled to render them non-viable. A total of 54 pairs of gull-billed terns established nests on the salt pond levees in 2008; therefore, a similar or slightly higher number of pairs would be expected in 2009. If this occurs and if one out of every two first nesting attempts is artificially addled by refuge staff, then approximately 43 percent, or 23 clutches, would be addled. With an average clutch size of two eggs, this would intentionally render approximately 46 eggs infertile. If approximately 7.4 percent of the gull-billed tern breeding population is present in south San Diego Bay in 2009, then approximately 3.2 percent of the range-wide breeding population would be impacted by this action. Fledging rates between 1999 and 2008 for gull-billed tern in San Diego Bay in the absence of egg addling is estimated to be approximately 0.7 fledgling per pair per year. If that is more or less the case in 2009, then it can be assumed that the fledgling to pair ratio would be lowered at the colony in San Diego Bay by approximately 43 percent. Based on the pair numbers in 2008, this would result in the expected net loss of fledgling recruitment to the gull-billed tern population for the 2009 nesting season of approximately 16 fledglings ( $0.7 \times 46 / 2 = 16$ ). This reduction in fledgling success would not constitute a significant adverse affect on the overall population of western gull-billed terns as the percentage of the overall population to be affected would be low (approximately 3.2 percent).

Addling gull-billed tern eggs would result in slight increases in the level of disturbance within the seabird nesting colonies on the salt pond levees over what is currently experienced as a result of routine monitoring activities. This increase in disturbance is not expected to cause adult terns to leave a nest unattended for an extended period of time, nor is this activity expected to adversely affect unaddled gull-billed tern nests or other seabird species nesting in proximity to affected gull-billed tern nests. The proposed experimental design will include two control groups that will provide more detailed information on how gull-billed terns and other nesting seabirds at the salt works will react to the addling experiment. Refuge staff will make every effort to minimize the amount of time spent at any one nest or in any particular nesting area. The time needed to addle individual clutches will be recorded, as will the response of the various species to this activity both during the egg addling process and in the days following this activity.

There is however the potential for nest abandonment, either by individual pairs of gull-billed terns or by the entire colony as a result of these increased levels of disturbance, particularly disturbance associated with egg addling and/or egg removal and replacement with an artificial egg. Complete abandonment of the colony with no renesting during the 2009 season would result in the potential loss of approximately 38 fledglings based on data from the 2008 nesting season. This loss of fledgling success for the 2009 season would not constitute a significant adverse affect on the overall population of western gull-billed terns as the percentage of the overall population to be affected would be still be low (approximately 7.4 percent). Renesting by gull-billed terns has been documented in at least one colony in Mexico (*Palacios and Mellink 2007*), therefore, there is the potential for some pairs of gull-billed terns to renest, which could reduce to some extent the effect of nest abandonment should it occur. No adverse effects to adult gull-billed terns would be expected as a result of implementing this proposal; therefore, no losses to the current adult population would occur.

At this time, it is not known if the effects of this experiment on the overall productivity of California least terns and western snowy plovers during the 2009 nesting season will be detectable or undetectable. The loss of California least tern and western snowy plover chicks as a result of gull-billed tern foraging has been documented over a period of years. Therefore, it is reasonable to assume that by limiting the number of gull-billed tern chicks that have to be fed within the colony, that the energetic needs of the group may be lessened. As a result, fewer California least tern and western snowy plover chicks may be lost to gull-billed tern predation.

#### **4.1.3 Alternative C - Addle and Cross-Foster Gull-billed Tern Eggs**

The effects of this alternative on gull-billed terns and the other species nesting on the levees in south San Diego Bay would be generally same under this alternative. However, the number of potential fledglings lost under this alternative could be less than the 46 assumed lost under Alternative B, if cross-fostering of any of the ten eggs taken from the San Diego Bay nests is successful.

The ten eggs removed from the San Diego Bay site would be transported to a gull-billed tern colony site at the Salton Sea, where they would then be placed in receiver nests. All experimental nests would be monitored for hatching success. The results of this monitoring would then be compared with the monitoring results of the overall nesting population of gull-billed terns at the Salton Sea in an effort to determine the extent to which the transported eggs were successfully hatched and fledged. Potential advantages to this approach would be that the reduction in fledgling productivity at the San Diego Bay colony as a result of removing the eggs could be slightly offset by a minor increase in the fledgling productivity of the Salton Sea colony, if any of the relocated eggs are successfully fledged and the presence of cross-fostered chicks does not lessen the survivability of eggs laid by Salton Sea pairs in the receiver nests. If none of the ten eggs successfully hatch, the impacts to the gull-billed tern population would be the same as those described for Alternative B.

This egg translocation approach presents a series of difficulties related to incubation and transport of eggs and avoiding adverse effects to the affected nesting pairs at the receiver site. The uncertainties associated with this proposal are reflected in the small number of nests proposed to be manipulated at the Salton Sea. Nest phenology (timing) of nests at separate colony sites may not match precisely and the two nesting areas (coastal and desert) are significantly different climatically. In addition, the gull-billed tern colonies at the Salton Sea experience fewer monitoring visits during the nesting season and therefore may be adversely affected by the necessary increases in monitoring that would be required to adequately analyze the results of this experiment. Potential effects related to increased levels of disturbance could include abandonment of receiver nests and/or adjacent gull-billed tern nests and increased energetic needs of broods at Salton Sea given additional eggs, and thus an increase in the potential for within brood competition for limited food resources. Although these effects are not expected to result in significant adverse effects to the nesting colony at Salton Sea, additional monitoring of nesting behaviors, site conditions during nesting, and foraging practices during nesting may be warranted at the site before any egg cross-fostering is attempted.

## **4.2 Cumulative Effects**

Cumulative effects can result from the incremental effects of a project when added to other past, present, and reasonably foreseeable future projects in the area. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. The interrelated effects of separate actions under the alternatives are also considered.

### **4.2.1 Projects Considered in the Cumulative Effects Analysis**

Various actions are occurring or planned that could have an effect on gull-billed terns, California least terns, western snowy plovers, and the other ground nesting birds that nest along the southern California coast and on the Sonny Bono Salton Sea NWR. These actions, which are outlined below, have been considered in this evaluation of cumulative impacts.

### San Diego Bay National Wildlife Refuge Comprehensive Conservation Plan (CCP)

Actions that are implemented in accordance with this Plan include nesting site preparation, monitoring, and predator management to protect listed species. These actions also indirectly protect the other species that nest within the Refuge, including gull-billed terns. The CCP identifies the overarching wildlife, public use, and management needs for the refuge and proposes various actions that could have an affect on ground nesting birds on the salt works, as well as on the recovery of the California least tern and western snowy plover.

### Chula Vista Bayfront Master Plan

The Port and the City of Chula Vista are currently developing plans for the redevelopment of approximately 550 acres of land and water located along the eastern edge of San Diego Bay between the Sweetwater Marsh Unit and the South San Diego Bay Unit. The 550 acres are being considered for the development of a broad range of urban uses, including high- and mid-rise residential development, commercial and office space, hotels, restaurants, major entertainment facilities, public open space, improvements to the existing harbor, and relocation of the existing boat channel in the South Bay. The implementation of this project would increase disturbance in the vicinity of the salt works and has the potential to attract additional mammalian and avian predators to areas adjacent to the current seabird nesting areas on the salt works.

### Integrated Natural Resources Management Plans (INRMP) for San Diego Bay, NAB Coronado, and Marine Corps Base Camp Pendleton

These INRMP include specific management strategies to address the management of habitats and the associated listed species (i.e., California least tern and western snowy plover) that are supported on these military lands. These plans provide direction for the stewardship of these natural resources, while also supporting the ability of the Navy and Marine Corps to meet their missions and continue operations and training activities. The core strategies of the plans address managing habitats, populations, and ecosystem processes; planning and coordinating projects and activities so they are compatible with natural resources; improving information sharing, coordination, and dissemination; and conducting research and long-term monitoring that supports decision-making. Each of these plans address concerns associated with managing listed species in light of documented predation of these species by gull-billed terns.

### Bird Aircraft Strike Hazard (BASH) Program

A small number of gull-billed tern adults have been removed through the Navy's Bird Aircraft Strike Hazard Program. One adult was removed from Naval Outlying Landing Field Imperial Beach airfield (by shooting) on 23 May 2007. Two Gull-billed Terns were removed from Naval Air Station North Island airfield (by shooting) in May 2004 (T. Shepherd, *pers. comm.*).

## **4.2.2 Cumulative Effects Analysis**

Implementation of the 2009 Western Gull-billed Tern Population Management Project in San Diego Bay will have a limited, short term effect on gull-billed tern

productivity at San Diego Bay, with no substantive long term effects to the local or range-wide population. Under either action alternative, the local breeding population of gull-billed terns would be able to sustain itself over time. Therefore, no cumulative effects to the western gull-billed tern are anticipated as a result of this one-year project. No adverse effects to listed species or the other seabird species that nest in San Diego Bay are anticipated as a result of the action alternatives. Under the no action alternative, predation of least tern and snowy plover chicks would be expected to continue at or above the rates documented during the 2008 nesting season.

#### **4.3 Irretrievable and Irreversible Commitment of Resources**

The predicted 3.2 percent reduction in overall productivity of the range-wide population of the western gull-billed tern by adding 43 percent of the clutches laid within the San Diego Bay gull-billed tern colony during the 2009 nesting season could not be reversed or compensated for in subsequent nesting seasons. Therefore, the opportunity to successfully fledge 16 chicks, assuming a fledgling rate of 0.7 per pair, would be lost. The loss would not however constitute a significant adverse effect.

#### **4.4 Short-Term Uses and Long Term Productivity**

The proposal to addle 43 percent of the gull-billed tern eggs within at the San Diego Bay colony during the 2009 nesting season would have a minimal effect on the long-term productivity of the gull-billed tern colony in San Diego Bay. If however adding gull-billed tern eggs does result in an overall reduction in the predation of California least tern and/or western snowy plover chicks during the 2009 nesting season and fledgling rates increase even slightly for one or both species, this would benefit the long term productivity of one or both of these species as additional future breeding adult birds would be produced.

#### **4.5 Unavoidable Adverse Effects**

Approximately 46 gull-billed tern eggs would be addled, resulting in a reduction in fledgling success during the 2009 nesting season. This adverse effect would not constitute a significant adverse affect on the overall population of western gull-billed terns as the percentage of the overall population to be affected would be low (approximately 3.2 percent) and the adult gull-billed terns whose eggs were addled would have future opportunities to nest and produce young over the course of their lifetimes.

## **CHAPTER 5. CONSULTATION/COORDINATION WITH OTHERS**

### **5.1 Agency Coordination and Public Involvement**

As described in Section 1.4, a series of meetings and discussions have taken place over the past few years involving the resource agencies and other affected agencies, including the California Department of Fish and Game, U.S. Navy, U.S. Marine Corps, and Service representatives from Refuges, Ecological Services, Coastal Program, and Migratory Birds. Non-agency scientists and consulting biologists were also invited to participate in discussions about this and other potential actions that might reduce the conflicts among the three species and/or lessen the effects of predation on California least terns and western snowy plovers. Additional input is being sought through the distribution of this EA. Appendix A provides a

list of those agencies, organizations, and individuals who were notified of the availability of this document.

## **5.2 Other Federal Laws, Regulations, and Executive Orders**

In undertaking the proposed action, the Service would comply with the following Federal laws executive orders, and legislative acts: Endangered Species Act of 1973, as amended; Fish and Wildlife Conservation Act of 1980; Responsibilities of Federal Agencies To Protect Migratory Birds (Executive Order 13186); Migratory Bird Treaty Act of 1918, as amended; Refuge Recreation Act, as amended; National Wildlife Refuge System Administration Act of 1966, as amended; Management and General Public Use of the National Wildlife Refuge System (Executive Order 12996).

## **5.3 Distribution and Availability**

This document will be available for public comment for a period of 30 calendar days. All comments must be provided to Andrew Yuen, Project Leader, U.S. Fish and Wildlife Service, San Diego National Wildlife Refuge Complex, 6010 Hidden Valley Road, Suite 101, Carlsbad, California 92011, via email to [Andy\\_Yuen@fws.gov](mailto:Andy_Yuen@fws.gov), or via fax to 760-930-0256 no later than 5:00 PM on May 22, 2009. Questions regarding this document or the proposed project can be directed to Brian Collins, Wildlife Biologist, via phone at (619) 691-1262 or via email at [Brian\\_Collins@fws.gov](mailto:Brian_Collins@fws.gov).

To obtain information on where you can review any documents incorporated by reference into this EA, or to obtain a copy of the full scientific study design for the 2009 Western Gull-billed Tern (*Gelochelidon nilotica vanrossemei*) Population Management Project, please contact Brian Collins at the number provided above, or visit the Refuge website at <http://www.fws.gov/sandiegorefuges/>, under Site Navigation click on "What's New."

The EA or notice of the EA has been sent to local, state, and federal agencies, organizations, community groups, and individuals listed in Appendix A. Additional copies of this document are available at the address provided above, and is posted for electronic viewing at the following website:

San Diego National Wildlife Complex Website, go to:  
<http://www.fws.gov/sandiegorefuges/>, under Site Navigation click on "What's New."

## **CHAPTER 6. PLANNING TEAM, AUTHORS, ACKNOWLEDGEMENTS**

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## 6.3 Acknowledgements

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## CHAPTER 7. REFERENCES CITED

- American Ornithologists' Union. 1957. Check-list of North American Birds, 5th ed. American Ornithologists' Union, Baltimore, Maryland.
- Atwood, J.L. and P.R. Kelly. 1984. Fish dropped on breeding colonies as indicators of least tern food habits. *Wilson Bulletin* 96:34-47.
- Barbour, M.G. and J. Major (eds.). 1988. *Terrestrial Vegetation of California*. Second edition. California Native Plant Society, Sacramento, California.
- Blackwell, B.F., T.W. Seamans, D.A. Helon, and R.A. Dolbeer. 2000. Early Loss of Herring Gull Clutches after Egg-Oiling. *Wildlife Society Bulletin* 28(1):70-75.
- Caffrey C. 1994. California least tern breeding survey, 1993 season. California Department of Fish and Game, Wildlife Management Division, Nongame Bird and Mammal Section, Report 94-07, Sacramento, CA.
- Clapp, R.B. and P.A. Buckley. 1984. Status and conservation of seabirds in the southeastern United States. In J.P. Croxall, P.G.H. Evans, and R.W. Schreiber, eds. *Status and conservation of the world's seabirds*. Tech Publ. No. 2., Internl. Council Bird Preserv., Cambridge, UK.
- Craig, A.M. 1971. Survey of California least tern nesting sites. California Department of Fish and Game, Special Wildlife Investigation, Project W-54-R-4, Final Report, Job II-5.1.
- Danemann, G. D. and R. Carmona. 2000. Breeding birds of Guerrero Negro saltworks, Baja California Sur, Mexico. *Western Birds* 31:195-199.

Densmore, R. J. 1990. Gull-billed tern predation on a least tern chick. *Wilson Bulletin* 102(1):180-181.

Friedmann, H., L. Griscom and R. T. Moore. 1950. Distributional check-list of the birds of Mexico. part Isla Pacific Coast Avifauna 29:1-202.

González-Medina, E. and M. Guevara-Medina. 2008. A New Breeding Site for the Gull-billed Tern (*Gelochelidon nilotica*) in Central Sinaloa, Northwestern Mexico. *Huitzil* 9(1):-7.

Grinnell, J. and A. H. Miller. 1944. The distribution of the birds of California. Berkeley, CA: Pacific Coast Avifauna, No. 27.

Horn, M. H. and W. M Dahdul. 1998. Prey Resource Base of the Tern and Skimmer Colony at the Western Salt Works, South San Diego Bay, During the 1997 Breeding Season. Final Report on Grant #3 14-48-0001-95586 from the U.S. Fish and Wildlife Service, Ecological Services, Carlsbad Field Office, Carlsbad, California.

James, R. and D. Stadtlander. 1991. A survey of the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) in California, 1991. A report of the California Department of Fish and Game, Nongame Bird and Mammal Section Report 91-05.

Konecny, J. 1995. A summary of colonial seabirds and the western snowy plover nesting at Western Salt, south San Diego Bay, California, during 1994. Report for the U.S. Fish and Wildlife Service, Coastal Ecosystem Program. Carlsbad Field Office, Carlsbad, California.

Manasjan, Paul. "San Diego International Airport: Tracking Our Environmental Footprint." San Diego County Regional Airport Authority. 1 Aug. 2006.  
<http://www.ciwmb.ca.gov/Part2000/Events/06Conf/Presentation/Day1/Keynote.pdf>

Manning, J. 1993. Seabird and waterfowl censusing at San Diego Bay, California. Progress report prepared by U.S. Fish and Wildlife Bay Service, Bay and Estuary Program. Carlsbad Field Office, Carlsbad, California.

Massey, B.W. 1974. Breeding biology of the California least tern. *Proc. Linnaean Soc.* 72:1-24.

Massey, B.W. and J.L. Atwood. 1981. Second-wave nesting of the California least tern: age composition and reproductive success. *Auk* 98:596-605.

McCaskie, G., S. Liston, and W. Rapley. 1974. First Nesting of Black Skimmer in California. *Condor* 76(3):337-338.

Mellink, E. 2003. Effect of the 1997-1998 El Niño and 1998-1999 La Niña events on breeding waterbirds and sea lions in the Upper Gulf of California, México. *Geofísica Internacional* 42:539-546.

Molina, K.C. 2005. The breeding of terns and skimmers at the Salton Sea, 2005. Contract # 101815M484, report to Sonny Bono Salton Sea NWR, 906 W. Sinclair Rd., Calipatria, CA 92233.

Molina, K.C. 2005. The breeding of terns and skimmers at the Salton Sea, 2005. Contract # 101815M484, report to Sonny Bono Salton Sea NWR, 906 W. Sinclair Rd., Calipatria, CA 92233.

Molina, K.C. 2006. The breeding of terns and skimmers at the Salton Sea, 2006. Contract # 801815M035, report to Sonny Bono Salton Sea NWR, 906 W. Sinclair Rd., Calipatria, CA 92233.

Molina, K.C. 2007. The breeding of terns and skimmers at the Salton Sea, 2007. Contract # 801817M234, report to Sonny Bono Salton Sea NWR, 906 W. Sinclair Rd., Calipatria, CA 92233.

Molina, K. and R. M. Erwin. 2006. The Distribution and Conservation Status of the Gull-billed Tern (*Gelochelidon nilotica*) in North America. *Waterbirds* 29(3):271-295.

Molina, K. and K. L. Garrett. 2001. The breeding birds of the Cerro Prieto geothermal ponds, Mexicali Valley, Baja California. Pages 23-28 in *Birds of Baja California: Status, Distribution, and Taxonomy* (R. A. Erickson and S.N.G. Howell, Eds.) Monographs in Field Ornithology 3, American Birding Association, Colorado Springs, CO.

Molina, K. C. and D. A. Marschalek. 2003. Foraging behavior and diet of breeding western gull-billed terns (*Sterna nilotica vanrossemei*) in San Diego Bay, California. California Department of Fish and Game, Habitat Conservation Planning Branch, Species Conservation and Recovery Program Report, 2003-01. Sacramento, CA.

Palacios, E. and E. Mellink. 2007. The Colonies of VanRossem's Gull-billed Tern (*vanrossemei*) in Mexico. *Waterbirds* 30(2):214-222.

Parnell, J.F., R. M. Erwin, and K.C. Molina. 1995. Gull-billed Tern (*Sterna nilotica*). *In* *The Birds of North America*, No. 140 (A. Poole and F. Gills, eds.) The Birds of North America, Inc., Philadelphia, PA.

Patten, M.A., G. McCaskie, and P. Unitt. 2003. *Birds of the Salton Sea Status, Biogeography and Ecology*. University of California Press, Berkeley and Los Angeles, California.

Patton, Robert. 1999. *The Status of the California Least Terns and Breeding Waterbirds at South San Diego Bay National Wildlife Refuge in 2000*.

Patton, Robert. 2001. *The Status of Western Gull-billed Terns at South San Diego Bay National Wildlife Refuge in 2001*.

Patton, Robert. 2002. California Least Tern Breeding Survey 2000 Season. Final Report to the State of California Department of Fish and Game.

Patton, Robert. 2003. The status of western gull-billed terns at South San Diego Bay National Wildlife Refuge in 2003.

Patton, Robert. 2004a. The Status of Western Snowy Plovers, California Least Terns, and Breeding Waterbirds at South San Diego Bay National Wildlife Refuge in 2002.

Patton, Robert. 2004b. The Status of Western Gull-billed Terns at South San Diego Bay National Wildlife Refuge in 2003.

Patton, Robert. 2006a. The Status of Western Gull-billed Terns at South San Diego Bay National Wildlife Refuge in 2004. Prepared for the U.S. Fish and Wildlife Service, San Diego National Wildlife Refuge Complex.

Patton, Robert. 2006b. Foraging by Western Gull-billed Terns at Tijuana Slough National Wildlife Refuge and Border Field State Park in 2006. Prepared for the U.S. Fish and Wildlife Service, San Diego National Wildlife Refuge Complex.

Patton, Robert. 2008. California Least Tern and Western Snowy Plover Site Summaries, 2008. San Diego National Wildlife Refuge and Border Field State Park Sites.

Pemberton, J. R. 1927. The American Gull-billed Tern Breeding in California. *The Condor* 29(6):253-258.

Powell, A.N. and C.L. Collier. 1998. Reproductive success of Belding's savannah sparrows in a highly fragmented landscape. *Auk* 115(2): 508-513.

Powell, A.N. and C.L. Collier. 2000. Habitat use and reproductive success of western snowy plovers at new nesting areas created for California least terns. *Journal of Wildlife Management* 64(1):24-33. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/birds/wsplover/index.htm> (Version 16May2000).

Shurford, W.D. and Gardali, T. editors. 2008. PDF of Gull-billed Tern account from: California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. *Studies on Western Birds Western Field Ornithologist*, Camarillo, California, and California Department of Fish and Game, Sacramento.

Stadtlander, D. and J. Konecny. 1994. Avifauna of South San Diego Bay: The Western Salt Works 1993-1994. U.S. Fish and Wildlife Service, Coastal Ecosystems Program, Carlsbad, CA.

Swickard, D. 1971. The status of the California least tern at Camp Pendleton, 1971. Rept. National Resources Office, Marine Corps Base, Camp Pendleton, Oceanside, California.

Terp, J. M. and M. Pavelka. 1999. Summary of Colonial Seabird Nesting at Western Salt Company 1998 Season. U.S. Fish and Wildlife Service, Coastal Program, Carlsbad, CA.

U.S. Department of the Navy, Southwest Division (USDoN, SWDIV). 2000. San Diego Bay Integrated Natural Resources Management Plan, and San Diego Unified Port District. September 2000. San Diego, CA. Prepared by Tierra Data Systems, Escondido, CA.

U.S. Department of the Navy, Southwest Division (USDoN, SWDIV). 2002. Naval Base Coronado Integrated Natural Resources Management Plan, and San Diego Unified Port District.

U.S. Fish and Wildlife Service. 1995. Draft Conceptual Management Approach Document for Southern California (September, 1995).

U.S. Fish and Wildlife Service. 2006a. San Diego Bay National Wildlife Refuge Sweetwater Marsh and South San Diego Bay Units Final Comprehensive Conservation Plan/Environmental Impact Statement.

U.S. Fish and Wildlife Service. 2006b. California Least Tern (*Sternula antillarum browni*) 5-Year Review Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, California.

U.S. Fish and Wildlife Service. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). Sacramento, California.

U.S. Geological Survey (USGS). 2006. Bird Checklists of the United States, Salton Sea National Wildlife Refuge. Northern Prairie Wildlife Research Center. (<http://www.npwrc.usgs.gov/resource/birds/chekbird/r1/salton.htm>)

U.S. Marine Corps. 2001. Integrated Natural Resources Management Plan Marine Corps Base and Marine Corps Air Station Camp Pendleton, CA.

Unitt, Philip. 1984. The Birds of San Diego County. San Diego Society of Natural History.

Unitt, Philip. 2004. San Diego County Bird Atlas. San Diego National History Museum. San Diego, California.

Warriner, J.S., J.C. Warriner, G.W. Page, and L.E. Stenzel. 1986. Mating system and reproductive success of a small population of polygamous snowy plovers. Wilson Bulletin 98(1):15-37.

Zembal, R. and S.M. Hoffman. 2002. A Survey of the Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*) in California, 2001.

## Appendix A

### **Distribution List**

The draft EA was provided to the following agencies, organizations, and interested parties for review and comment:

### **Local Libraries**

Chula Vista Public Library  
Imperial Beach Public Library  
Coronado Public Library

### **U.S. Congress**

Honorable Barbara Boxer, U.S. Senate  
Honorable Dianne Feinstein, U.S. Senate  
Congresswoman Susan Davis, District 53  
Congressman Bob Filner, District 51

### **California State Legislature**

Senate, Denise Ducheny, District 40  
Assembly, Mary Salas, District 79

### **County Government**

MSCP, Tom Oberbauer

### **Federal Agencies**

U.S. Fish and Wildlife Service, Ecological Services  
U.S. Fish and Wildlife Service, Migratory Birds  
U.S. Navy, Southwest Division  
U.S. Marine Corps, Camp Pendleton

### **California State Agencies**

California Coastal Commission, Federal Consistency  
Department of Fish and Game  
Resources Agency  
State Lands Commission  
State Parks

### **Other Agencies**

Unified Port of San Diego

### **Organizations**

Animal Protection Institute  
California Audubon  
Center of Conservation Strategies

Center for Biodiversity  
Chula Vista Nature Center  
Defenders of Wildlife  
Endangered Habitats League  
Environmental Health Coalition  
Friends of San Diego NWRs  
Human Society of the United States  
National Wildlife Federation  
National Audubon Society  
PETA  
Point Reyes Bird Observatory  
San Diego Audubon Society  
San Diego Natural History Museum  
Sierra Club San Diego Chapter  
SWIA  
TRNERR  
WHSRN Manomet Center  
Wild Coast  
Wilderness Society  
Wildlife Management Institute

**Media**

San Diego Union-Tribune  
Star News

Copies of the draft EA were also made available for review at the following location:

Tijuana Estuary Visitor Center  
301 Caspian Way  
Imperial Beach, CA 91932

San Diego NWR Complex  
6010 Hidden Valley Road, Suite 101  
Carlsbad, CA 92011