

Appendix C

*Draft Predator Management Plan for the
Sonny Bono Salton Sea NWR*

**Draft Predator Management Plan
for the
Sonny Bono Salton Sea National Wildlife Refuge**



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Draft
PREDATOR MANAGEMENT PLAN
Sonny Bono Salton Sea National Wildlife Refuge

1. Overview

Consistent with the purposes of the Sonny Bono Salton Sea National Wildlife Refuge (NWR or Refuge) (i.e., providing a refuge and breeding ground for birds and wild animals [Executive Order 5498], providing a sanctuary for migratory birds [Migratory Bird Treaty Act 16 U.S.C., Section 715d]) and in support of the goals of the National Wildlife Refuge System (Fish and Wildlife Service Manual, Part 601 FW1, NWRS Mission and Goal, and Refuge Purposes), the U. S. Fish and Wildlife Service (Service) will implement, per available funding, predator management on the Sonny Bono Salton Sea NWR. Management will occur in Units 1 and 2 of the Refuge, which are located immediately to the south of the Salton Sea (Figure 1).

Migratory bird species specifically intended to benefit from this action include the gull-billed tern (*Gelochelidon nilotica vanrossemei*) and black skimmer (*Rynchops niger*). Both of these ground-nesting seabird species regularly breed on the Refuge and are especially vulnerable to predation. In recent years, these species have experienced significant declines in breeding success at the Salton Sea due in part to predator related disturbance, as well as actual loss of chicks and eggs to predation. Other species that could experience indirect benefits from this predator management program include the snowy plover (*Charadrius nivosus*), California least tern (*Sternula antillarum browni*), American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), killdeer (*Charadrius vociferus*), and Caspian tern (*Hydroprogne caspia*).

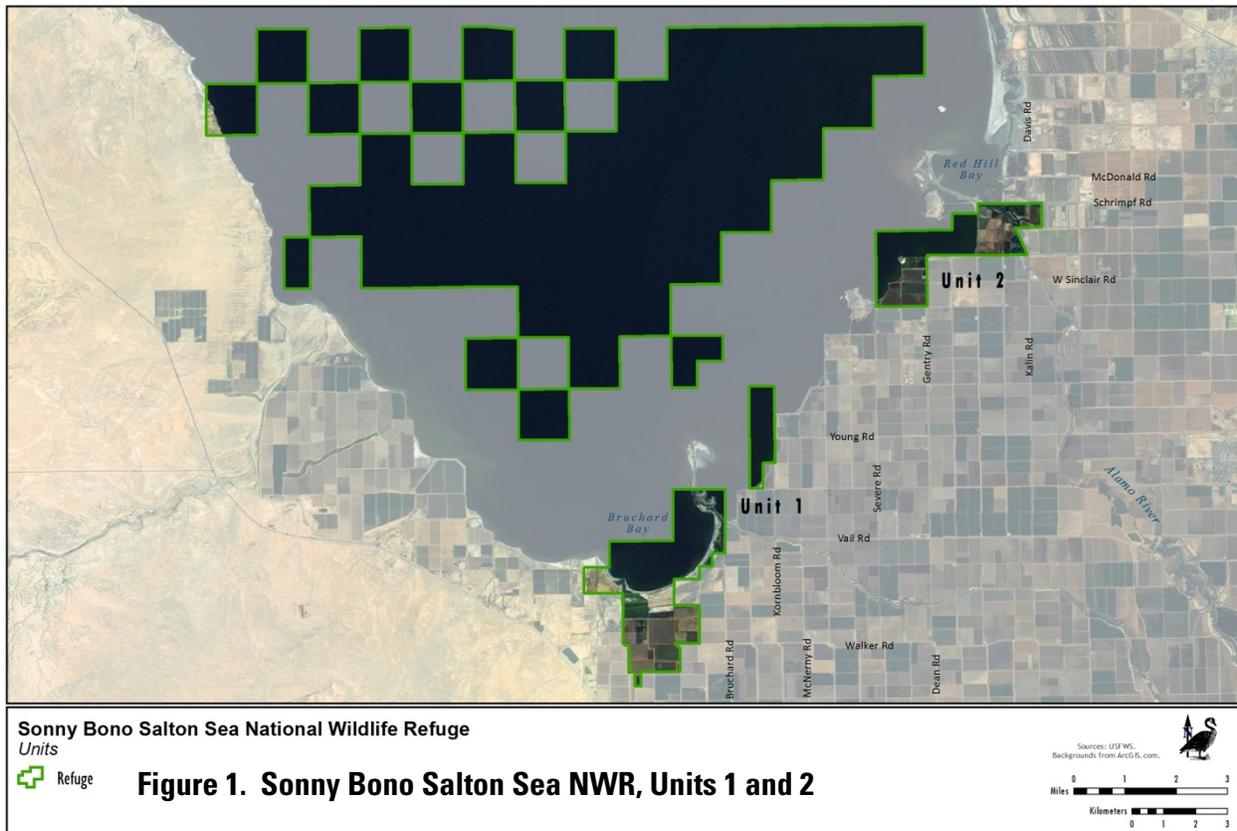
The California least tern, which established three nests at the Salton Sea in 2011 (Marschalek 2012), is federally listed as endangered and three of these species, the gull-billed tern, black skimmer, and snowy plover, are identified by the Service as Birds of Conservation Concern (USFWS 2008) and by the Service's Migratory Bird Program as Birds of Management Concern (USFWS 2011). In addition, the gull-billed tern and snowy plover are included on the Service's Migratory Bird Program's list of focal species (USFWS 2011). Focal species, a subset of the Birds of Management Concern, are those species that the Migratory Bird Program believes need additional investment of resources to address pertinent conservation or management issues.

This predator management plan has been developed as a comprehensive and integrated predator management program that includes a range of management actions from nesting habitat enhancements and the creation of new nesting areas at Red Hill Bay to non-lethal (deterrence) and lethal control of individual avian and mammalian predators. The most effective, selective, and humane techniques available to deter or remove individual predators that threaten nesting gull-billed terns and black skimmers will be implemented. Predator management is identified in the draft Sonny Bono Salton Sea NWR Comprehensive Conservation Plan (CCP) (USFWS 2013) as one of several actions to be implemented to achieve Refuge purposes.

2. Purpose

This proposal is intended to support the Refuge purpose of providing a sanctuary and breeding ground for migratory birds, as well as to assist in the achievement of the Refuge's goal of

protecting and maintaining habitat for avian species of conservation concern, including the gull-billed tern and black skimmer. Implementation of this plan could also assist in addressing a regional need to provide successful nesting habitat for the gull-billed tern away from the coast of southern California where this species preys on the young chicks of both the endangered California least tern and threatened western snowy plover (*Charadrius alexandrinus nivosus*).



Colonially ground nesting seabirds such as the gull-billed tern and black skimmer, are particularly vulnerable to predators. Disturbance of colonies by mammalian and avian predators can result in direct mortality of eggs and chicks due to predation and indirect mortality associated with heat stress (Safina and Burger 1983). Gull-billed terns may be especially sensitive to the presence of animals in their nesting colonies, with prolonged disturbance resulting in decreased breeding success (Clapp et al. 1983, Molina 2008a). Mammalian predators that adversely impact bird nesting colonies at the Salton Sea include raccoons (*Procyon lotor*) and coyotes (*Canis latrans*). Other species that reside in the area and could potentially impact colonies include striped skunks (*Mephitis mephitis*) and feral dogs and cats.

Avian predators that adversely impact Salton Sea nesting colonies include peregrine falcons (*Falco peregrinus*), burrowing owls (*Athene cunicularia*), laughing gulls (*Leucophaeus atricilla*), and California gulls (*Larus californicus*). California gulls are a special case because they act as predators as well as competitors for nest sites. Because gull-billed terns consistently mob great horned owls (*Bubo virginianus*), great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), and black-crowned night-herons (*Nycticorax nycticorax*), these species are also suspected to be predators.

Objectives of the Predator Management Plan

- Enhance the suitability and attractiveness of existing nesting habitat to gull-billed terns and black skimmers and provide new nesting opportunities as part of future permanent open water restoration projects proposed along the edge of the receding Salton Sea, to ensure that these smaller-bodied species have access to high quality nesting sites on the Refuge.
- Increase the productivity of gull-billed terns and black skimmers by reducing the loss of eggs and chicks to avian and mammalian predators.
- Maintain and, in some cases, regain the diversity of colonially nesting species that existed on the Refuge in the recent past, and ensure that smaller-bodied species retain colony site areas on Refuge lands.
- Control individual problem predators within the Refuge (problem predators are defined as individual predators that exhibit hunting behavior in seabird nesting areas or that have been identified as actually preying on listed or special concern species).
- Increase the productivity of other ground nesting species such as snowy plovers, killdeers, American avocets, and black-necked stilts that breed on the Refuge and would benefit from predator management.
- Provide indirect benefits to the endangered Yuma clapper rail which nests in marshes located in proximity to nesting seabird areas and are vulnerable to the same mammalian predators that threaten the gull-billed tern and black skimmer.

3. Background and Description of Problem

3.1 Introduction

The quality and extent of wetlands in California are diminished from historic levels (Dahl et al. 1991). The present day Salton Sea, which is *de facto* mitigation for wetland habitat loss in the historical Colorado River-Gulf of California region (Molina and Shuford 2004), represents a regionally important stop-over point for many migratory birds, as well as an important nesting area for various seabirds and shorebirds, including various species of conservation concern.

The Salton Sea supports important source populations of several species of Birds of Conservation Concern (some of which have also been identified as migratory Birds of Management Concern) in the region including the gull-billed tern, black skimmer, and snowy plover. To meet the mandate of the 1988 amendment to the Fish and Wildlife Conservation Act, the Service developed the Birds of Conservation Concern “to identify species, subspecies and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973” (USFWS 2008).

3.2 Species Targeted for Protection

The following are brief summaries of relevant information relating to species populations targeted for protection under this predator management plan.

Gull-billed Tern. The western gull-billed tern population is characterized by very small population size and few breeding locations. In California, gull-billed terns breed only at the Salton Sea and in San Diego Bay. In addition to its status as a Bird of Conservation Concern, the gull-billed tern is also a California Bird Species of Special Concern (Shuford and Gardali 2008) and conservation and management of this bird is one of the Service's regional priorities.

Gull-billed terns were one of the first larid species to colonize the Salton Sea after its formation in 1905-1906 (Molina et al. 2010). Pemberton (1927) first documented the presence of gull-billed terns at the south end of the Salton Sea in 1927 when he estimated 500 pairs were nesting on small sandy islets. The breeding population declined to fewer than 200 pairs by 1937. Remsen (1978) summarized the gull-billed tern's continued declines to just 40 to 75 pairs in the 1950s and then to just 17 pairs in 1976.

The 20-year mean (1992-2011, K. Molina, unpubl. data) is 129 pairs (± 40 SD) of gull-billed terns with a range of 65 (in 2002) to 209 (in 2005) pairs in that period. Through 2006, the majority of this nesting activity occurred primarily on Refuge habitats including the nesting islands located in Unit 2's D-Pond (Figure 2). On average, the Salton Sea has accounted for more than 80 percent of the California breeding population.

Beginning in 2007, the number of Caspian terns and California gulls present in D Pond began to increase, with even greater increases experienced in 2009. As a result, the area available for gull-billed terns to nest on the Refuge decreased substantially. In 2010 and 2011, the number of pairs of gull-billed terns breeding at the Salton Sea fell to 87, well below the 20-year mean. Productivity was nil in both years despite multiple nesting attempts.

At San Diego Bay in 2011, approximately 42 to 55 gull-billed terns survived to leave the colony site. In 2012, the estimate was 36 to 39 fledglings from approximately 79 nests. Based on observations of color bands, it appears that a small number of individuals fledged at the Salton Sea have been observed at San Diego Bay in past years; however none were observed in 2011 or 2012. In addition, gull-billed terns from San Diego Bay have been observed at the Salton Sea in past years (pers. comm. R. Patton, 8/20/2012).

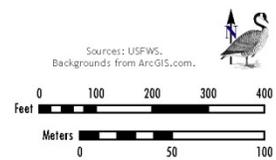
With the loss of suitably isolated nesting habitats within the south end of the Salton Sea to receding water levels (Molina 2004), the productivity within the nesting areas provided within the Refuge's managed permanent open water areas has become even more important for these birds. Two restoration projects are being planned for the southern end of the Salton Sea, one by the U.S. Army Corps of Engineers and the State of California and the other by the Sonny Bono Salton Sea NWR and various partners. Both of these restoration projects will include nesting areas to support the gull-billed tern, black skimmer, and other nesting seabirds.

Black Skimmer. The black skimmer is a highly social colonial waterbird that nests on the bare ground of small islands or isolated sections of impoundment levees (Molina 2008b). The Salton Sea is the only interior nesting location for black skimmers, which first colonized the Salton Sea in 1972 (Molina 2004). By 1988, the annual breeding population at the Salton Sea consisted of up to several hundred pairs. The 20-year mean (1992-2011) is 326 pairs (± 159 SD) with a range of 6 (in 2002) to 622 pairs (in 2005). In 2010 and 2011, the number of pairs that bred at the Salton Sea was well below the 20-year mean with 127 and 209 pairs, respectively.



Sonny Bono Salton Sea National Wildlife Refuge: Unit 2
Nesting Islands

Figure 2. Nesting Islands within D-Pond (Unit 2)



Similar to the gull-billed tern, the black skimmer is also vulnerable to disturbance and predation in nesting colonies. Colony failures due to mammalian predation were recorded at the Salton Sea in 2004 and 2005. In addition, large roosting aggregations of pelicans and cormorants have occasionally contributed to failures of black skimmer colonies at the Salton Sea (Molina 2008b). Predator disturbance can cause repeated up flights of birds, which even for brief periods can potentially subject eggs and young chicks to lethal high temperatures. Such disturbances also increase opportunities for predation by gulls and other opportunistic avian predators, which can have significant impacts on annual nesting success (Molina 2000). In 2010, only some of the late nesting attempts were successful in producing fledglings.

3.3 Species Receiving Indirect Benefits.

A number of other species will receive indirect benefits from this predator management plan. The Salton Sea supports significant populations of breeding and wintering snowy plovers, and the endangered California least tern has in recent years established nests at the Sea. In 1999, a comprehensive survey tallied 221 breeding and 275 wintering snowy plover adults around the perimeter of the Sea (Shuford et al. 2002). The most recent comprehensive breeding survey of snowy plovers conducted around the Sea's perimeter in 2007 yielded 306 adults with 75 of those adults concentrated along the beach at Unit 1 of the Refuge (refer to Figure 1) and adjacent shorelines (K. Molina, unpubl. data).

Nesting by the Federal and State endangered California least tern at the Salton Sea was suspected for many years and was documented near the shore at the south end of the sea in 2011 (McCaskie and Garrett 2012). Least terns have expanded breeding into many interior areas of the State in recent years (Marschalek 2012) and in 2011, three least tern nests were established at the Sea. It is conceivable that this species will continue to establish nesting sites on the Refuge in the future.

3.4 Environmental Dynamism and Habitat Management

Degradation of Salton Sea habitat has occurred due to decline in lake level as result of Colorado River water transfers from the Imperial Valley to coastal cities (Molina et al. 2010). The number of suitable nesting sites has similarly declined (Molina 2004, Molina et al. 2009), with concomitant concentration of avian and mammalian predators. Productivity is influenced by the quality of nesting and foraging habitat, and by predation and other disturbance levels. Historically, terns and skimmers nesting at the Salton Sea did so on small near-shore islets isolated from the mainland.

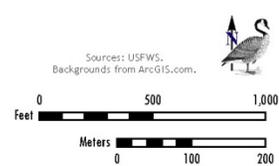
In spring 1995, in response to a rise in the water level within the Salton Sea and the expected inundation of traditional nesting islets, the Refuge maintained the water level in the headquarters' D-Pond (Unit 2) to attract nesting birds to the site. Prior to this time, D-Pond was allowed to draw down and dry after the waterfowl hunt season. Colonies of gull-billed terns and black skimmers were established that season. The five original earthen islands in D-Pond were immediately colonized by the targeted species (Molina 1997), as well as by black-necked stilts and American avocets. Nest success was high for all species in the first year and in subsequent years.

In 2001, water levels in the B4 impoundment of Unit 1 (Figure 3), isolating a single large earthen islet, were similarly maintained after the waterfowl season also to promote nesting habitat for gull-billed terns, skimmers, and shorebirds at an alternate site disjunct from D-Pond. Beginning in 2006, A4 impoundment in Unit 1, which has three small suitable nesting islets and several even smaller nesting areas, was also managed for nesting terns and skimmers. As at D-Pond, colonization was immediate and nesting was successful initially at the B4 and A4 impoundments.



Sonny Bono Salton Sea National Wildlife Refuge: Unit 1
Nesting Islands

Figure 3. Nesting Areas in Impoundments A4 and B4 (Unit 1)



By 2004, incursions by raccoons and coyotes into the tern and skimmer colony of Unit 1 B4 impoundment (and later at A4 impoundment) became increasingly common. These incursions generally caused complete abandonment of the Unit 1 colonies. The last year that gull-billed tern colonies persisted to hatching at B4 was 2003; at A4 it was 2008. Nest depredation by raccoons and coyotes was also noted at D-Pond, especially on islands along the eastern perimeter, causing complete colony failures on these outer islands. The last year that a colony persisted to hatching and fledging at D pond was 2009 when colonies were established on floating structures.

Colonies that established at off-refuge sites such as the near shore islet near Obsidian Butte and the islets in Morton Bay similarly failed due to the depredations of raccoons and coyotes. Despite the annual installation of electric fencing beginning in 2005 at D pond and in 2006 at A4, raccoons continue to leave tracks along the soft shoreline inside the fences at both impoundments. A similar pattern of colonization and initial success followed by heavy predation activity after two or three years of use also characterizes the nesting history of terns and skimmers at the United States Geological Survey (USGS) Saline Habitat Ponds Special Habitat Project (SHP) experimental ponds which were active from 2007 to 2009.

Predation by avian species is less common but does occur at Unit 1 and D-Pond. Since the colonization of D-Pond by California gulls, monitoring methodology has been modified to minimize the disturbance to the nesting islands and platforms. To minimize opportunities for depredation by gulls, the banding of tern and skimmer chicks now occurs on a single visit, if it occurs at all, when most young are of an advanced age. At the Salton Sea when gull-billed tern colonies are small (<30 pairs), they are especially vulnerable to avian predators as they are unable to mount an effective defense to deter the offending individual(s). In small colonies, individual California gulls have been noted to charge and flush terns from their nests to steal exposed eggs (K. Molina, pers. obs.). The predatory actions of these gulls, including both adults and immatures, have been noted to steadily reduce the number of active nests at Unit 1 colonies and eventually cause complete abandonment (K. Molina, pers. obs.). Late in the nesting season and into fall migration, peregrine falcons are known to prey on black skimmer adults and juveniles.

Competitive Exclusion

Perhaps due in part to the successful nesting over many years by gull-billed terns and black skimmers and to an apparently exploding population of tilapia in the Salton Sea during the mid to late 2000s, Caspian terns colonized D-Pond in 2003. Prior to this time, this large-bodied tern sporadically nested at the south end of the Salton Sea with colonies of several hundred to several thousand pairs established off-refuge at Obsidian Butte Island and Mullet Island. The number of Caspian Terns breeding at D-Pond remained comparatively small (<100 pairs) until 2006 when over 500 pairs bred (Table 1). In 2007 >1,000 pairs nested at D-Pond, occupying nearly all of the five original earthen islands.

The number of pairs of gull-billed terns and black skimmers using D-Pond began to decrease in 2007, coinciding with the increased presence of Caspian terns at the Salton Sea. As the numbers of Caspian terns present in D-Pond increased, a substantial proportion of the Refuge's gull-billed tern nesting population, which had previously been successfully nesting at D-Pond, began to establish nests elsewhere on the Refuge (Figure 4). Due to the low number of alternative nesting sites, many gull-billed terns began to establish nests at Unit 1. Unfortunately, the predation of chicks and eggs primarily by mammalian predators has severely limited nesting success at this location. Today, D-Pond continues to support expanding and highly successful breeding populations of Caspian terns and California gulls and relatively few nesting pairs of gull-billed terns or black skimmers.

Breeding populations of California gulls away from the Great Basin have greatly increased in recent decades, with large colonies established in the San Francisco Bay area (Shuford and Ryan 2000). The gull colonized the Salton Sea, its southernmost nesting location, in 1996 (Molina 2000). By 2007, California gulls colonized D-Pond, usurping the rocky perimeters of the earthen islands that gull-billed terns typically occupied. Like the Caspian tern, nesting gulls similarly expanded to colonize all of the earthen islands as well as the two floating structures of D-Pond.

Year	California Gull	Caspian Tern	Gull-billed Tern	Black Skimmer
2005	0	55	189	453
2006	0	>582	130	240
2007	51	>1,000	39-44a	41
2008	56	>1,600	0	68
2009	58-62	3,000-4,000	97a	185
2010	87 a	2,000-2,500	15 b	127c
2011	133a	2,000-2,200	7b	208c
2012d	~ 130	>1,200	0	0

Source: Molina unpublished reports from 2005-2011.

- a) High proportion of D-Pond breeding gull population and all breeding gull-billed tern established nests on floating "islands" (i.e., raft, jetfloat).
- b) All nesting occurred on newly created earthen islet.
- c) Re-occupation of traditional earthen islet after California gull and Caspian tern nesting ceased.
- d) As of 15 August 2012, K. Molina, preliminary data.

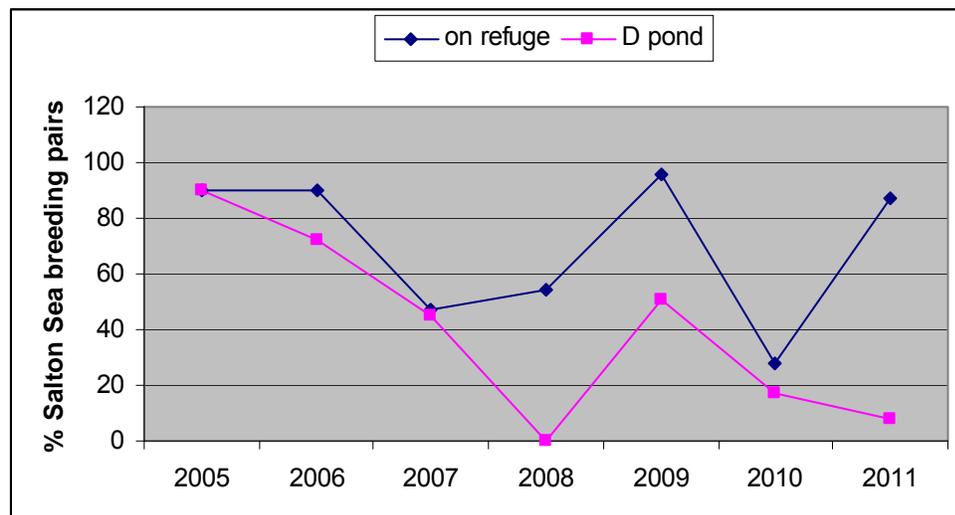


Figure 4. Change in the Number of Breeding Pairs of Gull-billed Terns and Black Skimmers Present in D-Pond (2005-2011)

Gull-billed terns and black skimmers have been observed to fare poorly in territorial contests with Caspian terns and California gulls with the two latter species monopolizing suitable habitat on the nesting islets and structures (K. Molina, pers. obs.).

Since the 2002 Quantification Settlement Agreement, which transferred Colorado River water from the Imperial Valley to coastal cities in southern California, a greater than expected contraction of the Salton Sea has been observed. The loss of several traditional nesting sites near shore occurred as a result of the change in sea level. In a proactive response to both the accelerated recession of the Salton Sea and the population growth of breeding Caspian terns (and later of California gulls), the Refuge began to supplement existing nesting habitat with several artificial nesting habitats in and adjacent to D-Pond.

In 2006, a small floating nesting structure was anchored near existing earth islets in the southern half of the impoundment. At the same time, a stationary platform was installed in the Salton Sea immediately north of D-Pond (Molina et al. 2009). In 2008, a second larger floating structure was added. In 2009 during the renovation of D pond and the rehabilitation of the five existing earthen islets, two additional earthen islets were constructed. Currently, seven earthen islets and two floating structures are available in D-Pond for colonial ground nesting species. Similar enhancements to nesting habitat were made concurrently in Unit 1. In addition to the single large earthen nesting islet in B4 impoundment, maintaining the flooding of the A4 impoundment during the nesting season provides additional nesting opportunities at Unit 1. Caspian terns and California gulls have not colonized Unit 1.

Gull-billed terns have not nested on D-Pond's initial and most centrally located (i.e. most isolated) earthen islets (Big and Blind) since 2006. This species last used either of the floating structures in 2009; these sites were colonized by California gulls in 2010 and remain occupied by gulls throughout the nesting season. Gull-billed terns immediately colonized the southwest islet; one of the new islets constructed in 2009 and continued to use it until 2011. Black skimmers re-colonized Big Islet in 2010 and 2011 but only late in the season after Caspian terns and California gulls ceased breeding activity there. Like gull-billed terns, skimmers have ceased nesting altogether on the two floating structures. The inability of gull-billed terns and black skimmers to regain a toehold onto the once relatively secure islands at D-Pond continued during the 2012 nesting season (refer to Figure 2).

The declining Sea elevation and the reduction of isolated sandbars, islands, and islets have also resulted in increased competition for loafing space by non-breeding birds. Brown pelicans (*Pelecanus occidentalis*) and American white pelicans (*Pelecanus erythrorhynchos*) destroy the nests of terns and skimmers when vying for loafing space on many of the nesting islets in D-Pond and at Unit 1 (Molina et al. 2010). This is especially problematic when masses of brown pelicans in their post-breeding migration from the Gulf of California arrive at the Salton Sea during the tern and skimmer nesting season.

4. Current Predator Management at the Sonny Bono Salton Sea NWR

Although several actions related to deterrence have been taken at the Refuge to protect nesting seabirds from mammalian predators, there is currently no management plan in place that directly addresses the control of predators on Refuge lands. Actions that are currently being taken include attempting to isolate nesting areas from the mainland, using electrified fencing, and monitoring to document the presence of predators and the effects of predation on the nesting colonies.

Water depths of 18 to 24 inches are maintained in impoundments that include nesting islands in an effort to isolate these islands, but in recent years these levels have proven to be ineffective in discouraging foraging raccoons and coyotes. Mammalian predators have exploited fluctuations in pond depth that periodically expose large amounts of pond bottom and promoted island to island and island to levee connectivity. As a consequence, these predators have now learned that nesting islands contain quality sources of prey (i.e., exposed eggs and chicks) and are easily accessed.

Electric fencing surrounding the entire impoundments of D-Pond and the Unit 1 A-4 impoundment was installed in 2005 and 2006, respectively. However, this fencing has been generally ineffective in excluding mammalian predators at both locations. The tracks of coyotes and raccoons have been consistently observed along the impoundments' inner perimeter and on islands at both sites prior to, and in association with, complete colony failures. Such failures attributed to raccoons and coyotes are now regularly observed at the Unit 1 A4 impoundment and are becoming more regular among the eastern islands in D-Pond. Witnessed foraging by mammalian predators on refuge nesting islands during daylight hours has become more common in recent years. On 12 June 2011, a coyote was observed foraging on islands in A4 (Molina, pers. obs.); similarly, on 11 June 2012, at midday a raccoon was witnessed foraging within D-Pond along its eastern perimeter (Molina, pers. obs.), a mere 50 feet away from two easternmost islands where nests of Caspian terns failed three weeks previously.

5. Management Plan

The predator management plan for the Sonny Bono Salton Sea NWR will be implemented to improve fledgling success for gull-billed terns and black skimmers, by reducing the threat of harassment and predation of adults, chicks, and eggs by mammalian and avian predators. Indirect benefits to Yuma clapper rails and snowy plovers and other nesting shorebirds are also expected to result from the implementation of this plan. A range of management actions, including nesting habitat enhancement and non-lethal and lethal control, will be implemented. As such, the plan represents a comprehensive wildlife damage control program that will integrate and apply practical methods of prevention and control to reduce damage by wildlife while minimizing the harmful effects of the control measures on humans, other species, and the environment. The activities conducted on the Refuge will vary depending upon the specific wildlife damage problem that is occurring. A particular predator problem may be addressed through the implementation of activities related to resource management, physical exclusion, wildlife management, or any combination of these.

For most mammalian predators, removal will be accomplished primarily by hazing or live trapping and secondarily by lethal control. In all cases, the most humane methods available will be used. Efforts will be made to avoid and minimize losses of non-target native wildlife and all uninjured non-target species inadvertently captured will be immediately released near the site of capture or at a suitable location at the discretion of the Refuge Manager.

Direct control methods that may be used on the Refuge include live-capture; the intentional hazing (scaring off) of predatory species, such as California gulls, from nesting areas; and in some cases the lethal removal of problem predators. Lethal removal, which may involve shooting or the use of body grips or gas cartridges, may be used to remove mammalian predators that are identified as known and immediate threats to the target species (i.e., gull-billed terns, black skimmers) within the Refuge. Only licensed and authorized agencies or individuals will implement predator management actions.

Without management of mammalian and avian predators, the Refuge's nesting populations of gull-billed terns and black skimmers could ultimately abandon all of the nesting sites within the Refuge. This is of particular concern with respect to gull-billed terns, which have successfully colonized available nesting areas in south San Diego Bay, where they are known to prey on California least tern and western snowy plover chicks. Providing a successful nesting colony of gull-billed terns at the Sonny Bono Salton Sea NWR could attract some gull-bills that currently nest at San Diego Bay, potentially reducing predation pressures on the listed species that nest at San Diego Bay.

The Service has determined that the following approach to predator management will achieve the goals, objectives, and legal mandates of the Service on the Sonny Bono Salton Sea NWR.

- Water levels in the ponds and impoundments within the Refuge that include nesting islands will be maintained at a depth of at least 18 inches where possible throughout the breeding season.
- Pre-nesting season monitoring of site conditions on the nesting islands will be conducted annually, with maintenance of nesting surfaces and perimeters and clearance of vegetation on islands and along the pond and impoundment perimeters conducted as needed prior to the commencement of the nesting season.
- At minimum, weekly monitoring of colony sites will be continued to determine annual occupancy, species composition, abundance, and general colony success.
- The continued use of electric fencing will be evaluated against photographic evidence of predator incursion and disturbance.
- Public signage will continue to be used to enhance education and awareness of significance and vulnerability of nesting habitats.
- Motion-activated cameras will be installed and activated during the nesting season to identify predators and causes of disturbance in nesting colonies.
- In an effort to assist breeding gull-billed terns and skimmers in regaining and retaining nesting space at D-Pond, potential modifications to nest site substrates on selected islands that would discourage competing Caspian terns and California gulls from establishing nesting colonies in these locations will be evaluated.
- The creation of new nesting islands will be incorporated into the design of permanent open water restoration projects (e.g., Red Hill Bay restoration) proposed along the edge of the receding Salton Sea.
- Potential measures to be used in the management of avian predators, particularly gulls, include hazing through the projection of non-toxic paint balls, the use of audio deterrence such as firearms or pyrotechnics, and egg aversion learning techniques.
- The Refuge will work to establish partnerships with other land management agencies (e.g., Imperial Irrigation District, California Department of Fish and Wildlife, Imperial Wildlife Unit - Wister) to increase or enhance seabird nesting habitat around the Salton Sea in an effort to improve nesting success for species of concern.

- The direct control of individual problem mammalian predators will be implemented as necessary to protect gull-billed tern and black skimmer breeding adults, chicks, and eggs.

6. Direct Control of Predators

The direct control of predators on the Refuge will be implemented, per available funding, by U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (APHIS – WS) through an interagency agreement with the Service. Contracts will be issued annually and will include detailed descriptions of approved control methods, disposition procedures for captured predators, and species-specific protocols. Predator management will occur during the nesting season and will be focused on the control of problem coyotes and raccoons, and possibly skunks, as well as feral dogs and cats. Hazing of avian predators, particularly gulls, will also be implemented as deemed necessary by the Refuge Manager.

Various techniques will be employed to implement predator management on the Refuge and all actions will occur in accordance with Federal and State regulations. Hazing, deterrence, and live trapping are the preferred control methods.

Hazing may be used to deter particular predators at the discretion of the Refuge Manager and could include the use of pyrotechnics and other audio and visual stimuli. Deterrence measures for gulls and other egg predators may include the experimentation with egg aversion learning techniques whereby eggs similar in appearance to targeted species are treated with syrup of Ipecac, or methiocarb (www.aphis.usda.gov/wildlife-damage/nwrc/registration/control-produce) and set out to attract egg predators. In the short term, predators are expected to learn to associate the distastefulness of the baited eggs with all eggs thereby reducing egg depredation.

Live trapping may include the use of Havahart baited box traps, Bal-chatri traps (live baited box traps), and scent baited padded leg-hold traps. All traps will be used and inspected in accordance with State Fish and Game Code and Service policy. The use of traps to control mammalian predators will be limited to evening hours and will be checked within two hours of sunrise.

Routine predator monitoring will be conducted in the vicinity of the nesting colonies. Problem predators may be identified through direct observation of predators in the act of hunting or preying on listed species. The presence of predators in the colony can also be established through the identification of tracks in the nesting colony, scat, observations of preyed-upon individuals, eggs, or other material. In many cases these observations can be used to identify, at least to species, the predator impacting the site.

Individual predators that defeat attempts at hazing or live trapping will be removed by lethal means. Lethal removal will focus on individuals of species that are human subsidized, such as raccoons, coyotes, feral dogs and feral cats. When determined necessary, lethal removal of individual problem predators, those focusing foraging activities on the nesting colony, may include shooting, body grip traps, and gas cartridges.

7. Disposition of Captured Animals

All targeted mammalian predators, other than dogs and cats, will be euthanized using approved humane methods. Target and non-target predators that are injured during trapping will be treated on a case-by-case basis. These animals may be euthanized or taken to an approved rehabilitation/veterinary care facility depending on species and extent of injuries.

All non-target wildlife (animals determined not to be a threat to protected species) that is captured unharmed will be immediately released near the capture site or at another suitable location. All domestic or feral dogs and cats, when feasible, will be taken to an approved shelter facility operated by a cooperating local unit of government, humane society, or a veterinary care facility.

8. Monitoring and Reporting

Following the implementation of this predator management plan, effects and results will be monitored and a report will be issued annually describing the range of actions taken to control predation and the numbers and types of predators controlled. In addition, the report will include all documented incidents of predation on target and non-target species, recommendations on how predation might be further reduced, and an evaluation of how the current year's predator management actions relate to the objectives established for this plan.

9. Cooperators

This plan will be implemented in cooperation with the following agencies and organizations, as appropriate:

- Fish and Wildlife Service, Palm Springs Ecological Services Field Office
- Fish and Wildlife Service, Division of Migratory Birds and Habitat Programs, Region 8
- California Department of Fish and Wildlife
- U.S. Department of Agriculture, Animal Plant Health Inspection Service -Wildlife Services
- Imperial County Department of Animal Control

10. Restoration to Benefit Targeted Species

Predator management is just one of the strategies that will be implemented to achieve the management goal of protecting and improving the productivity of nesting gull-billed terns and black skimmers on the Refuge. Another strategy described in detail in the Sonny Bono Salton Sea NWR CCP is the creation of new nesting islands within future open water restoration areas within Units 1 and 2.

11. Alternatives Considered

In addition to the predator management plan presented above, various alternatives for addressing predation of colonially breeding and/or ground nesting species on the Refuge were considered. These included:

- Non-lethal Control Only
- Indirect Control Only (include management activities that may reduce predation (or competition) without non-lethal or lethal removal of predators)
- No Predator/Competitor Management

11.1 Proposed Plan

The predator management plan combines direct actions to minimize predation along with indirect actions to reduce disturbance and improve habitat quality. The Refuge believes this more comprehensive proposal represents the most effective and humane alternative.

11.2 Non-lethal Control Only

Management of predators by non-lethal control only is usually ineffective in the long term resulting in significant breeding failures over many breeding seasons. Predators that have learned to forage successfully at colony sites often become trap wary and difficult, if not impossible, to catch.

11.3 Indirect Control Only

Under this alternative, measures such as hazing or electric barriers are employed, which are intended to reduce levels of predation/competition without the removal of the predator/competitor. The Refuge has operated under this alternative for many years and gull-billed terns and skimmers have continued to decline to the point where few pairs now attempt to occupy Refuge sites. It is likely that an Indirect Control Only alternative would result in continued low (or zero) nesting success of gull-billed terns and skimmers. If tilapia populations remain high, it is also likely that the expanding and successful populations of Caspian terns and California gulls will continue to occupy most or all of the suitable colony sites to the exclusion of gull-billed terns and black skimmers. A management strategy that excludes any form of predator or nest-site competitor management would place the viability of key stewardship species at the Refuge (i.e., those listed, of special concern, or otherwise of conservation concern) at risk; such a result would be inconsistent with the management goals of the Refuge.

11.4 No Predator/Competitor Management

Under this alternative, no actions would be taken on the Refuge for the specific purpose of controlling predators or nest-site competitors. Mammalian predators and avian predators and competitors would not be harassed or specifically deterred from entering nesting colonies and surrounding areas. Based on existing data on colony site occupation and nesting success for ground-nesting waterbirds in the Refuge area, it is likely that a “No Predator/Competitor Management” alternative would result in continued low (or zero) nesting success of smaller colonial species such as the gull-billed tern and black skimmer at most or all colony sites in most years. If tilapia populations remain high, it is also likely that the growing and successful breeding populations of Caspian terns will continue to occupy most or all of the suitable colony sites to the exclusion of gull-billed terns and black skimmers. Predation on Yuma clapper rails, ground-nesting shorebirds (e.g., stilts, avocets, snowy plovers, killdeer) will also likely increase above present levels. A management strategy that excludes any form of predator or nest-site competitor management would place the viability of key stewardship species at the Refuge at risk and would be inconsistent with the management goals of the Refuge.

12. Justification

The implementation of this predator management plan will result in temporary localized reductions in populations of some mammalian predators around the Refuge. The lethal removal of a few native mammalian predators (e.g., coyote, raccoon) is likely to occur annually on the Refuge; however the numbers of individuals taken will be low, and should diminish after the first few years. Lethal removal will generally only be implemented after other non-lethal methods for removal and relocation have proved to be unsuccessful. Impacts to gulls from hazing and egg aversion learning would be minimal and clutch oiling or removal would only be implemented if monitoring indicates that it is needed on specific islands to protect gull-billed tern and black skimmer nesting areas.

The Birds of Conservation Concern and other bird species of management concern present on the Refuge were once more widely distributed throughout southern California and the sizes of the various populations throughout the region were much larger. The loss of wetland habitat,

displacement of nesting areas on the coast due to human development and within the Salton Sea due to receding water levels, increases in Caspian tern numbers due to displacement from other areas, and increases in the number of gull present in the area due to increases in the Sea's tilapia populations have all contributed to significant declines in the productivity of nesting gull-bird terns and black skimmers on the Refuge. The bird conservation plans prepared to address declines in the populations of seabirds, shorebirds and waterbirds (Kushlan et al. 2002, Page et al. 2003, and USFWS 2005), all include predator control in the list of recovery and/or conservation actions to be implemented to maintain or restore productivity of species with declining populations. However, predator control will only be effective in conjunction with a larger overall management plan for the Refuge. The CCP for this Refuge also includes habitat restoration proposals that include provisions for additional nesting habitat to support nesting seabirds. Through this combination of efforts, the productivity of the Refuge's breeding gull-billed tern and black skimmer populations are expected to improve as these various actions are implemented.

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