

Impact of Salt Pond Restoration on California Gull Displacement and Predation on Breeding Waterbirds

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INTRODUCTION:

The California gull (*Larus californicus*) population in the South San Francisco Bay (hereafter South Bay) has increased from fewer than 200 breeding gulls in 1982 to over 46,800 in 2008 (Strong et al. 2004; San Francisco Bay Bird Observatory, unpublished data). Yet breeding populations of California gulls at other areas, such as Mono Lake, have not increased over the same time period (Wrege et al. 2006). The exponential increase in San Francisco Bay may be closely related to their use of landfills and other anthropogenic sources of food, as there are at least 3 landfills within short flight distance of the main breeding colonies.

The expanding California gull population may negatively affect other ground nesting birds in the

South Bay through harassment (Kakouros 2006), encroachment on nesting sites (Strong et al. 2004), and predation on eggs and chicks (Ackerman et al. 2006a). For example, in 2005 and 2006, we documented that California gulls depredated at least 61% of avocet (*Recurvirostra americana*) and 23% of stilt chicks (*Himantopus mexicanus*, Ackerman et al. 2006a), and 12% of avocet nests (Herring et al., in press). Although these data clearly indicate that California gulls are depredating breeding waterbirds and potentially reducing overall reproductive success, those studies were focused on avocets and stilts because we had large matching funds to study their mercury levels (Ackerman et al. 2007, 2008a,b).

Yet, there are two other species that are common breeders in the South Bay that may be impacted by gulls to a larger degree due to their nesting habits. The federally threatened western snowy plover (*Charadrius alexandrinus nivosus*) and Forster's tern (*Sterna forsteri*) both nest on salt pond islands and pannes, in areas with limited vegetation that is useful for concealment from aerial predators. About 7% of the Pacific Coast population of snowy plovers breed in San Francisco Bay and, in 2007, 43% of the nests found in San Francisco Bay were depredated (Robinson et al. 2007). This estimate of apparent nest success is biased considerably low, because only successful nests are typically found during nest searches (e.g., Mayfield 1961, 1975). Evidence suggests that California gulls may be important nest predators of snowy plovers in the South Bay. In 2009, SFBBO recorded a California Gull depredating a Snowy Plover nest and also documented a California Gull depredated three newly-hatched chicks (Robinson-Nilsen et al. 2009). Evidence also suggests they are important nest predators on breeding snowy plovers at Mono Lake (Page et al. 1983). California gulls may also be negatively affecting breeding Forster's terns. Tern populations have been slowly declining over the past two decades (Strong et al. 2004), coincidentally as California gull populations have increased dramatically (Figure 1). Further, Kakouros (2006) found that more than 90% of all predator intrusions on Forster's tern colonies were by California gulls, and she observed three instances where gulls depredated tern chicks and one time where gulls depredated a tern nest. Moreover, there is anecdotal evidence that an entire tern colony was abandoned in response to gull predation and harassment (Kakouros 2006). Therefore, the impact of gull predation on snowy plovers and Forster's terns should be assessed to more fully document the impact of gulls on breeding waterbirds.

In addition to their impact on breeding waterbirds via predation, there is also concern that California gulls may displace other breeding waterbirds from preferred nesting sites as their population grows. In particular, the California gull colony at Pond A6 was the largest in the San Francisco Bay and is now will be unavailable for nesting California Gulls after the breaching of the A6 levees on 6 December 2010 and the subsequent flooding of the pond for restoration. In 2009, we estimated 25,000 California gulls nesting within the dry pond bed of A6 (Robinson-Nilsen et al. 2009). It is unknown where gulls that occupy A6 will disperse to breed after A6 is restored, but it is likely that many gulls will nest in nearby salt ponds containing suitable island nesting sites that are close to landfills, such as Pond A16 or Pond A23. Additionally, core-use areas of radio-marked California gulls in 2007 and 2008 encompassed the Newby Island and Tri Cities Landfills, as well as several adjacent salt ponds, including A23, where gulls presumably roosted between meals (Ackerman et al. 2009). Therefore, gull movements, and potentially colony relocation sites, may be largely dictated by landfill locations. Unfortunately, Pond A16 currently provides nesting habitat for one of the largest breeding populations of avocets and Forster's terns in San Francisco Bay (Ackerman et al. 2006a) and A23 provides nesting habitat for snowy plovers (Robinson-Nilsen et al. 2009). Thus, understanding where gulls are likely to relocate is also critical to the success of a key restoration project objective of the South Bay Salt Pond (SBSP) Restoration Project to maintain habitat value for nesting waterbirds.

STUDY OBJECTIVES:

This research builds on our prior gull research findings to directly address the questions raised by the SBSP Restoration Project and the Request for Proposals to better understand how gulls will affect the potential for restoration success. Specifically, are objectives are:

- 1) Determine the impact of gulls on breeding snowy plovers and Forster's terns.
- 2) Color-mark California gulls at A6 to determine potential nesting distributions after restoration of A6.
- 3) Continue our California gull colony surveys to document current population size.

Herein, we provide an update of fiscal expenditures and a summary of recent research findings as they pertain to the objectives of this project.

PROJECT SUMMARY:

Objective 1. Determine the impact of gulls on breeding snowy plovers and Forster's terns.

Snowy Plovers

In order to determine the predators of Snowy Plover nests, SFBBO placed camera systems at nests to continuously record nest activities. We used security cameras placed in camouflaged ammunition boxes, and positioned 10 to 30 m from plover nests. We used a coupled electrical and coaxial cable (up to 300 m in length) to connect the cameras to marine batteries and a DVR unit, which recorded the images collected at the nest. We stored the marine batteries and DVR units in plastic or wood bins placed up to 300 m from the nest. The cameras were equipped with infrared to record images at night and ran continuously. We deployed cameras at 21 Snowy Plover nests in 2010. We recorded two California Gulls, a Gray Fox (*Urocyon cinereoargenteus*) and a Ruddy Turnstone (*Arenaria interpres*) depredating plover nests. In 2010, we upgraded the Snowy Plover nest camera systems by purchasing new DVRs to improve performance. We are currently evaluating our camera systems and making any necessary improvements before the 2011 breeding season begins in March.

Forster's Terns

USGS completed the 2010 field work on tern chick survival. We radio-marked a total of 110 Forster's Tern chicks. This number of radio-marked Tern chicks is far more than the funded 60 radio transmitters. This increase in sample size was necessary due to the high predation rate we observed during the 2010 field season, and we quickly re-designed the study to provide more robust estimates of survival. In 2011, we need to increase our sample size and we plan to purchase 80 radio transmitters, which again is more than the funded 60 radio transmitters.

Of the 110 Tern chicks radio-marked during this study, 51% were confirmed to have died from predation or exposure, 22% fledged, 13% simply went missing, and 14% of transmitters were censored. Because all the Tern chicks we confirmed to have been depredated by Gulls were found in the Gull colony (a distance too great for an unfledged chick to travel), it is likely that many if not all of the missing Tern chicks were actually killed by Gulls and carried away to the Gull colonies. For Tern chicks where the final fates were known, 70% died (40% from predation

and 30% from exposure). For Terns known to have died from predation, California Gulls were the only identified predator of Tern chicks - 94% (29 of 32 predation events) of all confirmed predation events were by California Gulls.

To complement these findings, while looking for Tern chick radio transmitters within the A6 Gull colony, we also found an additional 62 USGS leg bands from depredated Forster's Tern chicks which did not have radio-transmitters attached. Thus, we have confirmed that California Gulls killed at least 91 Forster's Tern chicks from our study colonies in 2010. Obviously, this number is far less than the actual number of Tern chicks depredated by Gulls because finding a 4-mm long leg band within the A6 pond floor is almost like finding a needle in a haystack.

Thus, given the large number of transmitters and bands we located at the A6 Gull colony, there is substantial evidence that predation by Gulls is extremely common on Tern chicks, and we believe that Gulls depredated as much as 50% of all Terns with a radio transmitter (combining radio-marked Tern chicks that were confirmed killed by Gulls with Tern chicks that simply went missing from their colony well before their estimated fledge date).

This is a much higher rate of Forster's Tern chick mortality caused by California Gulls than we had anticipated. These data suggest that Gulls can exhibit significant pressure on waterbird reproduction, especially within waterbird colonies that are in close proximity to breeding Gulls.

Objective 2. Color-mark California gulls at A6 to determine potential nesting distributions after restoration of A6.

USGS and SFBBO banded a total of 569 California Gull chicks of which 504 birds also received a color band with a unique numeric code.

In 2010, SFBBO staff and volunteers re-sighted 467 individual banded California Gulls, including those banded in 2010 and in previous years. Most of these birds were chicks re-sighted at the A6 colony, however 28 gulls were seen at other locations in the South Bay. Most of the gulls observed outside the A6 colony were seen in the Coyote Hills colony. We also observed a

banded gull at Eden Landing Ecological Reserve in Hayward.

Additionally, recreational birders reported five banded California Gulls outside the Bay Area during the non-breeding season. These included a gull that was banded as a chick this year which was seen on Ten Mile Beach, Mendocino County (Robinson-Nilsen and Demers 2010).

In 2011, we will expand our banded gull re-sighting surveys in 2011 in response to the A6 pond breach.

Objective 3. Continue our California gull colony surveys to document current population size.

SFBBO and USGS conducted walk-through surveys at California Gull colonies at ponds A1, A5, A6, A9/A10, Coyote Hills, and Mowry. We also surveyed a newly establish colony in the Coyote Hills complex. We documented the South Bay California Gull population to be approximately 46,104 nesting birds. Additionally, we continue to survey the Newby Island Landfill twice each month to record gull use of the area.

INTERIM MANAGEMENT RECOMMENDATIONS:

- Additional research on gull reproductive ecology (chick survival and nest success) is needed to understand the most effective ways to manage the expanding Gull population.
- Initiate longer-term tracking of Gull movements across seasons to understand if the San Francisco Bay California Gull population is increasing due to local reproductive success or to immigration from other colonies in the West.
- Plan for Gull management actions in 2011 field season. For example, if Gulls displace other nesting waterbirds, some management action such as hazing may be warranted.

COMPLIANCE WITH TERMS AND CONDITIONS IN GRANT:

- At this time, no extenuating circumstances exist, and we have not adjusted our research in any way that would substantially affect the final products to be delivered in 2012.

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EXPENSE REPORT:

Summary of current expenditures on project and use of RLF funds:

USGS – Spending Report

Task	Original Budget (Total)	Expenses to Date (12/31/2010)	Remaining Funds
Plover Nest Predation Study	\$798	\$399	\$399
Tern Chick Predation Study	\$126,640	\$30,765	\$95,875
Gull Color Marking	\$8,191	\$8,191	\$0.00
Gull Colony Surveys	\$3,958	\$1,979	\$1,979
Report Writing and Presentations	\$10,939	\$2,898	\$8,041
Operating Expenses	\$85,877	\$70,529	\$15,348
Total	\$236,403	\$114,761	\$121,642

SFBBO – Year 1

Task	Original Budget (Year 1)	Expenses to Date	Remaining Funds	Notes
Plover Nest Predation Study	\$5,808.90	\$5,963.35	(\$154.45)	
Tern Chick Predation Study	\$1,345.30	\$1,263.03	\$82.27	
Gull Color Marking	\$3,012.68	\$3,002.10	\$10.58	
Gull Colony Surveys	\$2,038.16	\$2,191.41	(\$153.25)	
Report Writing and Presentations	\$1,758.20	\$1,676.33	\$81.87	
Expenses	\$4,500	\$5,835.57	(\$1,335.57)	MH approved the release of funds budgeted in FY11 in FY10 (per 7/15/10 email).
Overhead	\$327.42	\$327.42	\$0.00	
Total	\$18,790.66	\$20,259.20	(\$1,468.54)	