Pier 400 California Least Tern Nest Surveys and Monitoring

2023 Nesting Season Annual Report

prepared for

City of Los Angeles Harbor Department
Environmental Management Division
425 South Palos Verdes Street
San Pedro, California 90733

prepared by

Rincon Consultants, Inc.
180 North Ashwood Avenue
Ventura, California 93003

and

Wildlife Innovations
11629 Westridge Place
Lakeside, California 92040

Langdon Biological Consulting, LLC
210 Grand Avenue, #102
Long Beach, California 90803

January 2024

RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
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I, Monica Jacinto, certify that the information in this biological report, and its exhibits, fully and accurately represent the field work and findings conducted under my U.S. Fish and Wildlife Service Section 10(a)1(A) recovery permit PER0038601-0 for recovery activities associated with the California least tern.

Monica Jacinto, Senior Biologist

I, Spencer Langdon, certify that the information in this biological report, including any marginal revisions, and its exhibits, fully and accurately represent the field work and findings conducted under my California Department of Fish and Wildlife Memorandum of Understanding SCP-1532 for recovery activities associated with the California least tern.

Spencer Langdon, Wildlife Biologist

Table of Contents

Tables

Figures

Appendices

Executive Summary

This report presents the federally and state endangered California least tern ([CLTE] *Sternula antillarum browni*) survey and monitoring results at the Pier 400 nesting site in the Los Angeles Harbor during the 2023 nesting season.

Before the April 1 start of the nesting season, the City of Los Angeles Harbor Department Construction and Maintenance team prepared the nesting site by grading sand, repairing the chick fence, removing vegetation, and disking the site. Tierra Data, Inc. applied pre and post emergent herbicides to the site. During these pre-season activities, Rincon Consultants, Inc. (Rincon) and Langdon Biological Consulting, LLC (LBC) conducted weekly nesting site visits to document existing site conditions (including observed birds and signs of predators) and to estimate the time of arrival for the CLTE. Wildlife Innovations, the predator management team, conducted weekly site visits and primarily focused on predator surveillance, elegant tern (*Thalasseus elegans*) hazing and deterrence, and preemptive corvid management.

The first CLTE sighting at the nest site was observed on April 26. Upon confirmation of breeding behavior, Rincon initiated focused nest count surveys and monitoring for CLTE on May 18. Focused surveys were conducted under Monica Jacinto's (Rincon) U.S. Fish and Wildlife Section 10(a)1(A) recovery permit (PER0038601-0) and Spencer Langdon's (LBC) CDFW Memorandum of Understanding (SCP-1532) for authorized work with CLTE, along with Rincon biologist's Benson Truong and Nicholas Fager, LBC biologist Nick Liberato, and Wildlife Innovations. The focused surveys took place inside the Central Nesting Site (CNS) between one and two times per week, while weekly site visits were conducted on Fridays outside of the CNS to confirm overall site conditions, CLTE activity, and potential predators. Wildlife Innovations was on-site one to two visits per week, dependent on positive signs of CLTE predators during survey and monitoring efforts.

During the 2023 nesting season, 56 nests and 77 eggs were documented, yielding an average clutch size of 1.4 eggs. The hatch success rate for the 2023 season was zero percent. Of the 77 non-hatched eggs, 52 percent (n=40) were lost due to predation and 48 percent (n=37) were lost to abandonment.

Monitors observed a significant drop in CLTE adult numbers at the CNS in early June through mid-June, which is believed to be a result of persistent nest predation by common raven ([CORA] *Corvus corax*) and possibly exacerbated by undetermined levels of non-project related human disturbance at night around the CNS. With the precipitous decline of CLTE adult activity and nest attendance, the absence of chicks and fledglings detected on-site, and site abandonment in June, it is unlikely that the 2023 nesting season resulted in any fledglings. The 2023 results are similar to those of 2011 and 2017, when the Pier 400 nesting site experienced a drastic decrease in nests and also unlikely resulted in any fledglings.

1 Introduction

Rincon Consultants, Inc. (Rincon), Wildlife Innovations (WI), and Langdon Biological Consulting, LLC (LBC) prepared this annual report for the City of Los Angeles Harbor Department (LAHD) to document the findings of the surveys and monitoring efforts of the Pier 400 California least tern ([CLTE] *Sternula antillarum browni*) colony on Terminal Island within the jurisdiction of the Port of Los Angeles (POLA). This report documents the 2023 pre-season activities, explains the methodology used for CLTE and predator management efforts during the breeding season, evaluates the CLTE survey, monitoring, and predator management results, and provides recommendations for future CLTE monitoring years.

1.1 Project Location and Description

The project site, hereafter referred to as the Central Nesting Site (CNS), is a 15.7-acre area located on Pier 400 within the Port of Los Angeles, approximately 3 miles south of California State Route 47 (Figure 1). The CNS is part of the City of Los Angeles and is within the southern portion of Los Angeles County, California. The central point of the CNS is approximately located at latitude 33.717057° N, longitude -118.248469° W (WGS84). The immediate vicinity of the CNS consists of APM Terminals to the north, the Tern Management Area - West (TMA-W) to the west, and the Pacific Ocean to the east and south (Figure 2).

The CNS is relatively flat, nearly square in shape, contains fine to medium-coarse sand, and is defined by a 0.25-inch (in.) plastic mesh chick fence approximately 3 feet (ft.) high. A wide unpaved perimeter (or access area) runs along the black chick fence's east, south, and west margins, and a small shed is located near the entrance of the CNS for monitors to store equipment and materials used for the CLTE field efforts. The shed may also be used by monitors as a blind to monitor the CNS from a distance. Riprap is located approximately 100 ft. east and south of the CNS. A black 3 ft. high silt fence was placed by LAHD approximately 70 ft. east of the CNS (on the east side of access area) and runs along the riprap to prevent loss of sand from the predominantly westerly winds and to prevent chicks (CLTE or other species) from wandering into riprap should there be a nest outside the CNS. Immediately west of the CNS is the TMA-W, a 10-acre area composed of compact sandy substrate and native and non-native vegetation. The perimeter also has two large "No Fly Zone" signs; one is located southeast of the CNS by the riprap, the second is to the west near the TMA-W.

1.2 Project Purpose

The CLTE is listed as endangered by both the federal Endangered Species Act and California Endangered Species Act (USFWS 1970). In 1984, LAHD entered into a Memorandum of Agreement with the United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and United States Army Corps of Engineers (USACE) to provide 15.7 acres of suitable nesting habitat for CLTE. Nesting of CLTE within the POLA has been documented every year since 1973; however, since 1997, CLTE have only nested within the CNS (Keane Biological Consulting [KBC] 2013, Environmental and GIS Services, LLC [eGIS] 2015, LBC 2021).

California least tern management at the CNS aims to ensure that the nesting site produces the most fledglings possible. Site preparation, monitoring and management, and predator control can increase CLTE nesting success at the Pier 400 nesting site by gathering information on nests and breeding

behavior and by implementing effective predator management with as little disturbance to CLTE as possible. Timely collection of nesting site information allows site managers to adapt site management methods in response to issues that face the colony in any given season (LBC 2021).

1.3 California Least Tern History

The CLTE is one of five subspecies of least tern (USFWS 2009) and is the smallest tern in North America (less the 25 cm when full grown and has 75 cm wingspan). The long, narrow wings and a broad, forked tail identify the CLTE. Its breeding plumage consists of a black-capped head and black-tipped, pale gray wings which contrast with its white body. The CLTE bears a white blaze across its forehead, dark forewings, black-tipped yellow bill, and yellowish feet (USFWS 2020a). The CLTE is a migratory species found along the Pacific Coast of California, from San Francisco southward to Baja California (USFWS 2006). CLTE feed on small fish that they catch near the ocean's surface, shallow wetlands, rivers, and at the margins of ponds and lakes. They nest on open beaches kept free of vegetation by tidal scouring and along intertidal levees, salt flats, bays, lagoons, and sparsely vegetated sandbars along major rivers (USFWS 1985, 2007). Most CLTE begin breeding in their third year and are generally present at nesting areas between mid-April through late August. During the courtship phase, males may perform elaborate aerial displays, offering fish to the female (i.e., the fish flight display), and nesting often starts shortly thereafter. CLTE prefer sand or gravel layered with shell fragments and small pebbles with minimal vegetation for nesting. They may also nest on mud, dredge spoils, and salt panne. Nests are simple scrapes in the sand, gravel, or dirt. Clutch size varies between 1 to 3 eggs with both parents incubating and caring for the young. CLTE can re-nest multiple times in a year during the breeding season if eggs or chicks are lost (USFWS 2007).

The CLTE was listed as endangered under the federal Endangered Species Act on June 6, 1970, and by the California Endangered Species Act on June 27, 1971, due to a population decline resulting from loss of habitat (USFWS 1970, Keane 2000). The CLTE were historically abundant but declined to about 600 breeding pairs in the United States at the time of listing (USFWS 2009). Reasons for their decline include destruction and disturbance of nest sites, curtailment of foraging areas by coastal development, modification of nest sites by invasive plants, predation, and reduction in food availability due to changes in climate cycles. To increase and protect CLTE populations, intense managerial action was taken to limit disturbance and control predation (USFWS 2009). In 2015, the California CLTE population was estimated at 4,232 to 5,786 pairs (Frost 2015). As a result of a recent population rebound, a motion was set in place to down list the CLTE from endangered to threatened (USFWS 2009). However, since 2008 declines have occurred in both the number of nesting individuals and fledglings produced, therefore no change in status was recommended during the most recent 5-year review (USFWS 2020b). California least tern continues to be a fully protected species under the federal Endangered Species Act and by the California Endangered Species Act.

Figure 1 Regional Location Map

Basemap provided by Esri and its licensors © 2022.

★ Project Location

N

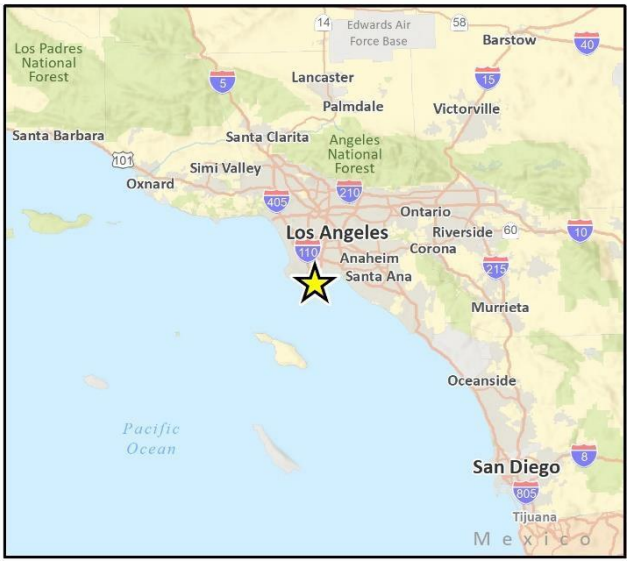


Figure 2 Survey Location Map

Imagery provided by Microsoft Bing and its licensors © 2022.

2 Pre-Season Activities

This section summarizes the site preparation and predator management activities prior to CLTE initiating the 2023 breeding season at the CNS.

2.1 Site Preparation and Site Visits

In efforts to provide the best nesting conditions and productivity for CLTE, a meeting at the CNS took place in January, with representatives from LAHD Environmental Management Division (EMD) and LAHD Construction and Maintenance (C&M), to discuss the next steps required to prepare the CNS and TMA-W. Rincon was provided the information gathered from the January meeting then evaluated the existing conditions at the CNS and TMA-W in early February to determine necessary site preparation activities. It was determined that the 2022 site preparation methods had been effective and would be repeated for the 2023 site preparation.

Pre-season preparation activities were done by LAHD C&M and overseen by Rincon and LBC as they conducted site visits of the CNS weekly between March and April to document preparation activities and site conditions, search for predator signs (e.g., tracks, scat), and determine the approximate arrival date of CLTE. Wildlife Innovations also conducted weekly site visits throughout the month of April to target CLTE predators. Upon the arrival of CLTE, survey and monitoring efforts were modified and are described in the methodology section.

Central Nesting Site Grading and Fence Repair

The LAHD C&M team performed site grading and fence repair activities from March 1 to April 7. Site preparation was initiated by moving sand back into the CNS from the immediate surrounding areas. Historically, high winds in the area have blown the sand from the CNS to the area directly east of the CNS (towards the riprap east of the CNS). The C&M team moved the displaced sand back into the CNS to increase the sand depth and promote suitable nesting conditions for CLTE. Once the movement of the displaced sand was complete, the C&M team removed weeds and disked the CNS in preparation for the herbicide application.

In previous years, the TMA-W had also been disked. However, removal of vegetation at this location has attracted other avian species, including larger tern species, which affected the productivity of CLTE at the CNS (e.g., by elegant terns [ELTE] [*Thalasseus elegans*] trampling CLTE eggs) (LBC 2019). Therefore, to discourage nesting by larger tern species, no vegetation was removed from the TMA-W between 2019-2022. Consistent with this approach, no vegetation removal, sand movement, or disking occurred at the TMA-W in 2023.

The chick fence outlining the perimeter of the CNS had been damaged by weather events. Where there were gaps zip-ties were used to mend openings, areas that had deteriorated were replaced with new sections of chick fencing, and sand was replaced at the base where there were gaps between the fence and the substrate. Additionally, the silt fence placed along the inner side of the riprap located to the east of the chick fence was repaired and replaced where necessary.

Herbicide Application

CLTE typically establish nesting colonies on sandy soils with minimal native plant cover. Plant cover in the CNS and TMA-W consists of both native and non-native plants. In 2023, vegetation throughout

the CNS consisted primarily of telegraph weed (*Heterotheca grandiflora*), mule fat (*Baccharis salicifolia*), saltgrass (*Distichlis spicata*), and coastal heron's bill (*Erodium cicutarium*).

Other non-native plants observed in previous years include sea rocket (*Cakile maritima*), Bermuda grass (*Cynodon dactylon*), horseweed (*Conyza canadensis*), sweet clover (*Melilotus indica*), Russian thistle (*Salsola* ssp.), and coastal sandbur (*Cenchrus incertus*) (LBC 2021). In efforts to control the non-native plant cover throughout the CNS during the CLTE breeding season, and as recommended and approved by CDFW and USFWS, LAHD began applying an Imazapyr-based herbicide containing both pre- and post-emergent components each year since 2012. Following these same guidelines, Tierra Data, Inc., a licensed herbicide applicator, applied an Imazapyr based herbicide to the CNS on April 6, 2023 under the supervision of Rincon and LAHD C&M. The Imazapyr based herbicide was applied according to the product label at the rate of 4 pints per acre, and sufficient water was applied with the chemical to assure proper absorption by the sand. For consistency with previous years, the herbicide application was completed within a few days of the vegetation removal so the herbicide would seal the top of the sand allowing the maximum time for absorption of the chemical into the seed bank and any remaining plant material. This method of applying the herbicide after removing the vegetation has produced the best results to date (LBC 2021). The TMA-W was not treated in 2023.

Grid Marker Establishment and No Aircraft Sign Upgrade

Grid markers were removed from the CNS by Rincon and repainted on April 11, 2023. Rincon then re-set the grid markers to section the CNS into pre-determined zones. These zones help facilitate documenting nesting observations, signs of predators, and site abnormalities during the breeding season. The grid markers were placed at the nodes of a rectangular grid approximately 100 ft. on each side, and the coordinates of each grid marker were recorded. The grid markers were half-round roofing tiles. Aside from the grid markers, one hundred half-round roofing tiles were placed along the west and south perimeters of the CNS chick-fence to provide CLTE chicks shelter or coverage from predators.

The site contains two large "No Aircraft" signs that were upgraded in 2022. One sign is located southeast of the CNS, while the second is to the west. In April 2023, LAHD EMD sent notification letters describing the nature of the restricted flight area over the CNS to 31 nearby airports, military bases, and helicopter and flight schools.

2.2 Predator Management

Upon arrival of CLTE, which are colonial nesters, the accompanying increase in visual, olfactory, and/or audial stimulation on the nesting site may attract a suite of predators that are drawn to investigate the area for foraging opportunities. Once aware of the new availability of prey (e.g., CLTE and their eggs), predators may converge on the site in larger numbers, resulting in substantial nest and/or chick loss which is further exacerbated due to their nesting habits (ground and colonial nesters).

To help mitigate predation on CLTE, WI provided part-time predator management at Pier 400. Predator management field efforts were initiated on April 6. During the pre-nesting season, WI conducted weekly site visits and primarily focused on predator surveillance, pre-emptive corvid management, and ELTE hazing and deterrence. Later efforts included mammal trapping and predation investigation. The frequency of these site visits was adaptive and based on observations by WI and monitors but generally occurred one to two visits per week. The duration of site visits

varied and was dependent upon the objectives of each visit (e.g., number of and/or species of predator targeted and the management methods to be employed) and observational data collected upon arrival.

Predator Surveillance

Direct observations of predators and their signs were digitally recorded by WI while conducting routine surveillance and/or control efforts within the CNS and surrounding areas. Additionally, CLTE monitors reported their predator and track observations to WI. This information was compiled and used to help determine predator diversity, abundance, and behavior within and around the CNS to inform ongoing predator management actions.

Pre-Emptive Corvid Removal

During the pre-nesting portion of the season, both American crow ([AMCR] *Corvus brachyrhynchos*) and CORA were targeted for removal to reduce predator activity on- site prior to and during the CLTE breeding season. As corvids are notorious nest predators of CLTE, reducing their numbers and establishing the area as unsafe for corvid foraging prior to the arrival of CLTE, were important goals in 2023. These management techniques aim to increase CLTE nesting on-site and effectively mitigate predations.

Elegant Tern Deterrence

During the pre-season activities, on April 6, two ELTE were observed by WI within the CNS. WI responded to the activity and utilized hazing techniques to deter ELTE from the CNS and to avoid a situation like in 2022 when ELTE attempted to nest within the CNS (Rincon 2022). Hazing of ELTE was conducted by WI as needed during follow up site visits.

3 Methodology

This section summarizes the surveys at the CNS used to track, map, and monitor CLTE arrival, nesting, and wildlife use and implement adaptive predator management strategies.

3.1 California Least Tern Surveys and Monitoring

Focused nest count surveys and monitoring of CLTE at the CNS were conducted under USFWS Section 10(a)1(A) recovery permit (PER0038601-0) and CDFW Memorandum of Understanding (SCP-1532). Under the recovery permit, Spencer Langdon from LBC was approved as an independent monitor, while Rincon biologist's Benson Truong and Nicholas Fager, and LBC biologist Nick Liberato were approved as supervised monitors. Under the Memorandum of Understanding, Monica Jacinto and Nick Liberato were approved as independent monitors. Before initiating CLTE-focused nest count survey and monitoring efforts, the monitoring team had a kickoff meeting to discuss the survey and monitoring methods, data collection, tablet use, schedules, communication chain, and safety. For all focused nest count surveys conducted in the CNS during the breeding season (i.e., when CLTE were known to be present at the CNS), Ms. Jacinto or Mr. Langdon were present to oversee all activities conducted by supervised monitors. During most of the surveys, both Ms. Jacinto and Mr. Langdon were present.

As previously noted, Rincon or LBC conducted site visits weekly from March to April to determine the approximate arrival of CLTE at the CNS. Once their arrival was confirmed, a monitor continued to conduct site visits twice per week during which they visually scanned the CNS and surrounding areas for CLTE foraging, nesting, and/or roosting locations. Once breeding behavior (e.g., scrapes, copulation, food exchanges) was observed at the CNS in May, the team began focused nest count surveys and monitoring for CLTE which continued through July. Nest count surveys inside the CNS were performed between one and two times per week, with up to five monitors. Additionally, site visits were performed on Fridays, with one monitor to check the overall conditions of the CNS, CLTE activity, and potential predators. Given the visible and audible nature of CLTE during the breeding season, the monitors were often able to monitor the CNS from outside the CNS perimeter when performing site visits on Fridays. During these site visits, the monitors would also record observations of adult terns exhibiting breeding behavior using a combination of 8- 10 x 42 binoculars and a 20-60 x 88-millimeter spotting scope.

Nest counts were performed by monitors walking parallel transects through the CNS to identify and count nests. Monitors typically worked in pairs and were careful to minimize disturbances to CLTE and their nests. When a new nest was identified, nest markers (i.e., two labeled tongue depressors) were placed perpendicular to one another and approximately 1 meter west of a nest to enable viewing the nest number from all directions. An electronic field tablet was used to geospatially map the nest location, and the nest content was recorded on an electronic data form.

Data Collection

Rincon developed an electronic data form and geospatial mapping product to gather and store nest information locally on electronic field tablets, with data also uploaded and archived to Rincon's server. The monitoring team used electronic tablets outfitted specifically for the field to document

survey and monitoring results. Each new nest location was geospatially mapped and displayed on a predeveloped mapping grid overlain on a site-specific aerial photograph uploaded from Rincon servers and housed on individual data tablets. Geospatial documentation of CLTE and other avian species included natural behavior observations and nesting activity and was recorded on the tablets. Field tablets were interfaced with a Geode submeter GPS receiver to record the location and observation qualifiers (species, age, sex, etc.). The electronic data form allowed for data collection during each survey and included tracking the status and contents of each nest throughout the breeding season. Data collected throughout the season was consistent with efforts from previous years to allow cross-year analyses.

After identification, nests were then monitored during subsequent visits to track the nests' progression and determine if the nest successfully hatched (i.e., produced chicks) or failed (i.e., did not produce chicks). All nest markers were removed once a nest was determined to be inactive.

Once hatched, chicks and older fledglings were monitored/counted until they departed the site at the end of the breeding season to determine the overall productivity of the colony.

During all surveys, the behavior of adult CLTE in and adjacent to the CNS were also documented in an electronic data form, as well as human disturbances (e.g., aircraft and watercraft), other nesting birds in the CNS or TMA-W, and predator activity.

Chick Banding

No banding of chicks took place in 2023. As such, chick banding is not discussed in this report.

3.2 Predator Management Techniques

Predator management efforts were conducted under POLA's depredation permit (MB156554-0) from USFWS and WI's Scientific Collecting Permit (S-190860003-20002-001-03) from CDFW. The objectives of the predator management efforts were to mitigate predation pressure on nesting CLTE to help increase their reproductive success. Predator management efforts encompassed digital and physical predator surveillance, deterrence, predation investigation, and corvid, raptor, and mammal control, using a variety of techniques.

For the purposes of this report, one *trap night* was defined as a single trap (also a camera) placed for 24 hours (day or night) that was left available for capturing a targeted animal. Traps that were triggered and closed, had bait stolen but did not capture anything, or captured non-target individuals were classified as “nonactive” and not included in trap nights. Trap success rate was also calculated by dividing the number of captures by the number of trap nights. *Predation rate* was limited to nests and calculated by dividing the number of depredated nests by the total number of active nests found on-site during the nesting season.

3.2.1 Predator Surveillance

Direct and digital observations of predators and their signs were collected by WI while conducting routine surveillance and/or control efforts within the CNS and surrounding areas. Cellular capable trail cameras (Reconyx, Holmen, WI) were also used to better evaluate predator activity and monitor some traps. Additionally, CLTE monitors reported their predator, predation, and track observations to WI. This information was compiled and used to help further evaluate predator threat levels within and around the CNS and to inform ongoing predator management actions.

Trail Camera

Two cellular trail cameras were positioned at the CNS to help monitor predator activity remotely and help inform predator managers while personnel were off-site. Camera trap locations were selected for their field of view of the nesting area or suspected access areas for predators entering and leaving the CNS. They were also used for remote monitoring of corvid traps on a few occasions. As such, it was essential to the function of the cellular camera to select a location on-site that had adequate cellular reception to adequately monitor remotely. The camera was installed with a metal bracket attached to a post hammered into the sand. It was then anchored to the ground with a cable and powered by a solar panel (Reconyx, Holmen, WI, SC10). Camera footage was accessible remotely via the Reconyx Connect cell phone application (Reconyx, Holmen, WI).

Predator Surveys and Investigations

Observations of predators were recorded digitally within the Collector for ArcGIS application (ESRI, Redlands, California) while conducting routine surveillance, setting or checking traps, and while performing other predator control work within and near the CNS. Generally, the amount of time spent at the CNS varied during the season, with more frequent patrols conducted when higher predator activity was observed by either WI or CLTE monitors, predator signs were discovered, or predations were reported by monitors. Due to the site's relatively small size, predator control personnel could monitor the entire colony and conduct predator surveys from multiple locations outside the CNS, especially on the eastern and southern areas of the site.

Predator activity was investigated firsthand by WI when on-site; however, predations and predation events discovered by monitors during in-colony surveys were reported to WI via text or a phone call. Information indicative of the class and/or species of predator being observed in the field, including tracks or signs, was relayed to WI to determine the most likely predator responsible for impacts.

Conclusions drawn from this information were used to continuously inform and adapt the management strategies to ensure the most effective, efficient, and appropriate management methods were being used to mitigate predation of nesting CLTE. As CLTE monitors increased site visit frequency, WI relied on information relayed by monitors regarding observing predators, their signs, and predations to help supplement surveillance data and determine the frequency of site visits by WI.

3.2.2 Mammalian Predator Management

Mammal trapping efforts utilized only box traps (Tomahawk Live Trap, Hazelhurst, WI, 36" x 12" x 12" Model 609SS and Model CB12DD-36). Trapping was focused on areas of ingress and egress where mammalian predators could be captured while moving in or out of the CNS. Traps were covered with vegetation or plastic covers to provide shelter for captured animals as well as aid in concealing traps from public view. Sand and/or vegetation was used to cover the trap floor; this helped prevent mammalian predators from contacting the wire mesh while also further concealing the trap within the surroundings. Food-based baits and scent lures were used to entice predators to enter traps. Targeted predators captured were euthanized with a .22 caliber rimfire pistol, a method approved by the American Veterinarian Medical Association (2020) as a humane means of euthanasia. Nontarget (i.e., not a CLTE predator) captures were released immediately following a brief inspection for injuries.

3.2.3 Avian Predator Management

Avian predators of CLTE within and around the CNS include raptors and non-raptor species based on observations this season. Both live capture trapping and direct removal via firearm were used to remove threatening avian predators.

Corvids

During the pre-nesting portion of the season, both AMCR and CORA were targeted for removal to reduce their activity on-site prior to and during the CLTE breeding season. As corvids are notorious nest predators of CLTE and their intelligence can make them difficult to control with only part-time predator management, reducing their numbers and establishing the area as unsafe for foraging, prior to the arrival of CLTE, were prioritized by WI in 2023.

Corvids, including AMCR and CORA, were primarily targeted using Corvi-Capture (CC) and Modified Swedish Goshawk (MG) traps designed and constructed by WI. These traps included a chamber designed to hold conspecific individuals as lure-birds to attract targeted individuals. Lure-bird chambers were fitted with perching and partial cover that provided shade. In addition, lure-bird chambers were furnished with food and water dispensers. All traps containing live lure -birds were checked a minimum of once every four hours but were generally monitored constantly. Padded-jaw foothold traps were also used as stand- alone traps or in conjunction with CC or MG traps. Trap locations were selected based on observations of corvid activity and known flight routes in the area. Common Ravens and AMCR that avoided traps were targeted for removal directly via firearms.

Corvid-Capture Traps

The CC traps were constructed primarily of 2020 Aluminum Extrusion and black #36 by 1-3/4" Nylon Netting mesh (Gourock Netting; Bellingham, Washington). Traps consisted of eight small trap chambers surrounding one larger live lure-bird chamber. Each trap chamber had the ability to capture a single individual prior to being reset allowing for the possibility of capturing up to eight birds between trap checks. When a bird landed on the perch to investigate the lure-birds or bait, the perch-trigger collapsed and the door immediately closed above, trapping the bird inside. This trap design is modular, providing versatility and the ability to adjust variables to adapt corvid trapping to specific situations and improve trapping success.

Modified Swedish Goshawk Trap

Like the CC trap, the MG was constructed primarily of 2020 Aluminum Extrusion and black #36 by 1-3/4 in. Nylon Netting mesh (Gourock Netting; Bellingham, Washington). The primary differences between the MG and CC traps are the number of trap chambers and the positioning of the lure-bird chamber in relation to them. The MG trap design included two adjacent trap chambers and one live lure-bird chamber.

Padded-Jaw Foothold Traps

Padded-jaw foothold traps provided an additional management tool for targeting corvids that avoided other trapping techniques and removal methods. Locations for deploying foothold traps were chosen based on the presence of natural "funnel" or narrowed entrances created by topography and/or vegetation. To anchor the traps, weights (2-5 pounds [lbs.]) were attached using a thin-gage bungee cord that absorbed shock and helped to reduce the likelihood of injury to

captured individuals. The weights and traps were lightly buried in sand to conceal them from targeted corvids.

Direct Removal via Firearm

Firearms were used as a last resort to remove corvids that were a threat and were unable to be removed quickly enough through trapping methods. This method was conducted from a vehicle, on foot, or from a fixed position near areas known to be visited by targeted predators. A rifle (.17 caliber rimfire cartridge) or shotgun (12-gauge) was used to remove targeted individuals. The specific method implemented, strategy, and type of firearm used were determined based on the species targeted, behavior of the individual, and various characteristics of the site (i.e., vegetation, topography, etc.) in the area frequented by the predator. When a firearm was to be used on-site, WI first confirmed their team was the only personnel on-site and all requirements and protocols identified in WI's predator control accident prevention and safety plan were followed (WI 2022).

Common Raven Effigies

Common raven effigies, consisting of raven carcasses hung from fence posts or placed on the ground, were deployed to deter ravens that were while WI and monitors were off-site. Effigies were strategically positioned to be highly visible to CORA from ingress flyways to deter individuals before they began foraging within the site.

Raptors

Raptors documented predating, disturbing, or displaying threatening behavior towards CLTE, by WI or monitors, were targeted for non-lethal trap and translocation. Guidelines developed by the CDFW and USFWS for the translocation of raptors, associated with listed species protection programs, were adhered to when establishing justification to begin trapping. Justification and translocation forms were completed and delivered to both regulatory entities upon completion. Captured raptors were banded using an aluminum service band (USGS Bird Banding Laboratory) and a colored auxiliary marker (ACraft Sign and Name Place Co. LTD., Edmonton, AB, Canada) containing an alpha-numeric code visible from a distance using optics. Individuals were translocated and released within locations previously vetted and approved by CDFW and USFWS.

Bal-Chatri

Bal-Chatri (BC) traps target raptors that threatened nesting CLTE. BC traps were constructed and designed in-house by WI to be most effective for targeting raptors of various size and foraging behavior. Consisting of nooses made of fishing line (Chameleon 20 to 30 lbs., Maxima Fishing Line, Hillsboro, Oregon) tied to the outside of a ¼-in. hardware cloth (Everbilt ¼ in. by 24 in. by 25 ft. Galvanized Hardware Cloth, The Home Depot, Atlanta, Georgia) chamber. The chamber was designed to hold lure animals, including live mice or zebra finches (*Taeniopygia castanotis*). The nooses were dispersed evenly around the chamber to snare the talons of a raptor attempting to retrieve the lure animal housed in the chamber. The entire trap would then be anchored to the ground using a weight (2 to 5 lbs.) attached to the lower portion of the chamber by a piece of bungee or shock cord. The cord's purpose was to retain consistent tension on a noose that tightened on a raptor's foot and to absorb shock if a trapped raptor were to attempt to fly away with the trap, thus limiting the possibility of injury to the bird. Variations in BC trap designs included the tensile strength of the fishing line, the size of the nooses, and the size or shape of the chamber itself. Larger nooses and stronger fishing line were used to build traps designed for targeting larger

raptors. When used, these traps were under constant monitoring and surveillance while deployed in order to quickly retrieve all captures and avoid a raptor freeing itself or experiencing undue stress.

Bownet

The bownet trap (Mike's Falconry Supplies; Gresham, Oregon) consists of two opposite spring-loaded doors shaped in semi-circles that make up the sides of one complete circle with a net filling it and a triggering mechanism used to pin the spring-loaded trap together until it is triggered remotely. When deployed, the bownet is staked down to the ground by one side or door. The opposite door is then pinned on top of staked door by the triggering mechanism. The netting is then bunched up with care in order to avoid tangling along the pinned doors. A lure animal such as a mouse or small bird is then placed in the center of the semi-circle wither anchored by a tether or in a small cage similar to the chamber of a BC trap. When the targeted raptor lands to take the lure animal, the trigger is set off remotely and the top door is released. The springs swing the door up and over the raptor pulling the net up, over, and finally down on top of the individual trapping it on the ground. When deployed, the bownet is monitored and under constant surveillance by WI.

Elegant Terns

Hazing efforts were employed to prevent ELTE from nesting in the CNS to reduce the chances of deterring CLTE from nesting or damaging/destroying their eggs. Elegant terns were hazed on foot and by using a high-powered handheld green laser (Xtreme Alternative Defense Systems; Anderson, Indiana) from a stationary position within a vehicle. The laser was used during evening hours just prior to sunset, throughout the night, and early morning hours after sunrise. Outside of those times, the brightness of daylight rendered the laser ineffective, therefore, ELTE were hazed by WI personnel on foot.

3.2.4 Data Management and Analysis

ESRI's Field Maps or Collector for ArcGIS applications (ESRI, Redlands, California), were installed on smart phones and tablets, with customized data input pages designed by WI, and used to record all predator control data while in the field. Examples of data collected include the following: name of predator control personnel, date and time of work being conducted, name of nesting area where work was conducted, type of predator control work (e.g., survey, hunting, trapping), bait used, and species captured. Predation investigations included the collection of the following data: predator control personnel investigating the predation, the date, location of predation, type of predation (e.g., egg/nest, chick, fledgling, adult), number of individuals taken, and predator responsible. This data was later downloaded as spreadsheets (Microsoft Office Excel 2016, Microsoft Corp., Redmond, Washington), and within ArcGIS Pro (ESRI, Redlands, California), for summary, analysis, and mapping.

4 Survey, Monitoring, and Predator Management Results

This section summarizes the 2023 results of the survey, monitoring, and predator management efforts and provides further analysis of the data collected in the field.

4.1 California Least Tern Observations

Arrival and Departure

A group of approximately 10 CLTE were first observed flying over the CNS on April 26. Shortly after, CLTE were observed landing in the CNS on May 12. The last day CLTE were detected on-site was June 12, which consisted of two adults heard vocalizing. Follow-up visits were conducted three times per week from June 13 to July 14 then once a week from July 15 to July 26 to confirm the departure of CLTE, and the 2023 nesting season was closed on July 26.

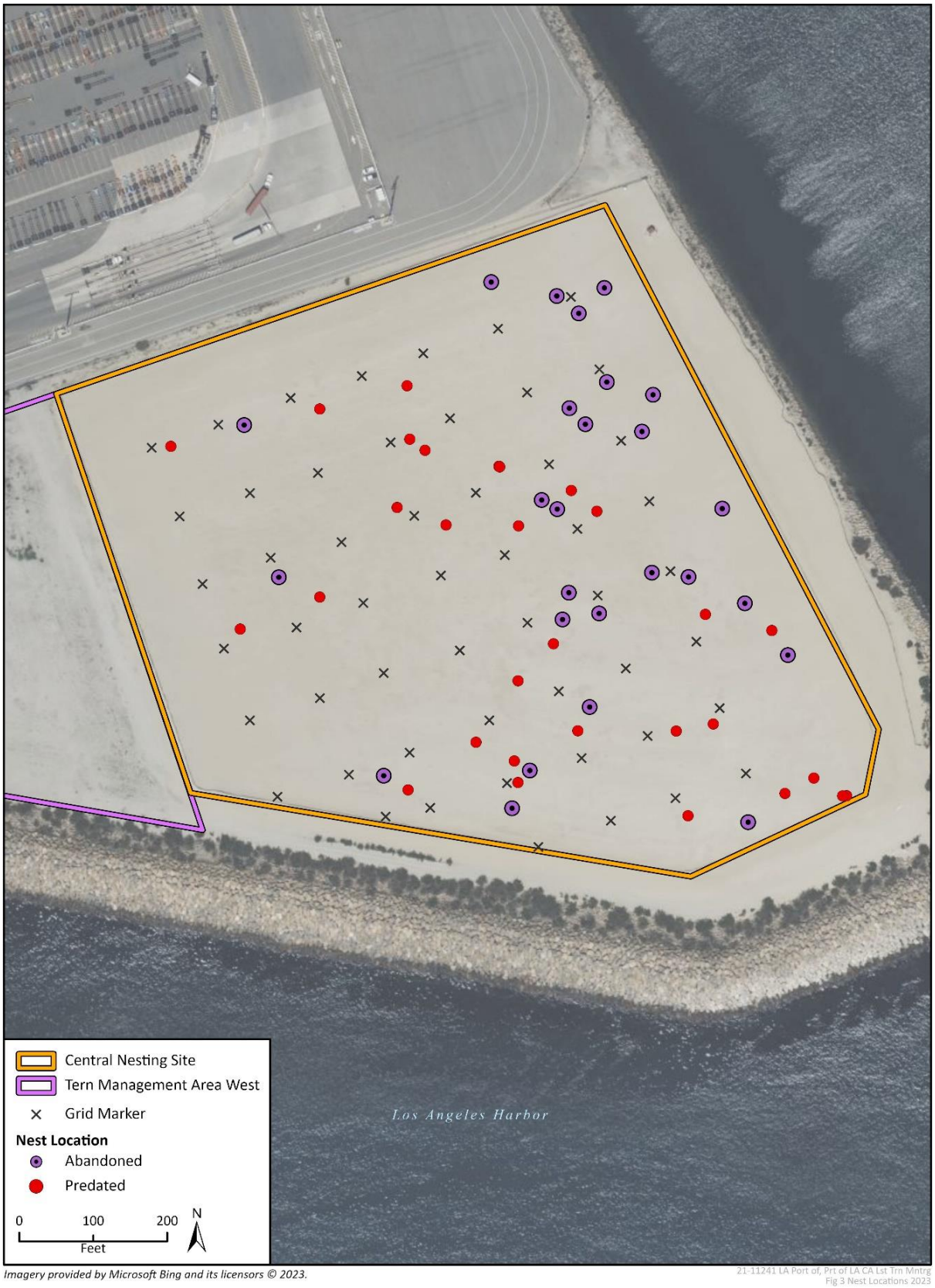
Nest Initiation and Outcomes

Nest count surveys in the CNS were conducted from May 18 through June 21. During the first nest count survey on May 18, several CLTE scrapes were observed throughout the CNS; however, the first nest was not documented until the second nest count survey on May 22. The last of the 56 nests was documented on June 15. Figure 3 displays the location of each nest throughout the CNS and Figure 4 exhibits the nesting chronology in 2023. The status of each nest during each nest count survey and the final nest outcome, Hatch, Predated, or Abandoned, are summarized in Table 1, which defines each classification and indicates the number of nests associated with each classification in 2023.

Table 1 Nest Classification and Outcome

Classification	Definition	Number of Nests
Hatch	Live or deceased chick(s) observed in nest; nest observed vacant during the anticipated hatch date timeframe, no evidence of predation or other failure reasons observed	0
Predated	Evidence of egg predation (e.g., cracked egg shells with yolk, predator prints) observed at the nest prior to anticipated hatch date timeframe	30
Abandoned	Unattended eggs in nest prior to the anticipated hatch date timeframe, no evidence of adult CLTE activity or predation observed	26
Total	**–**	**56**

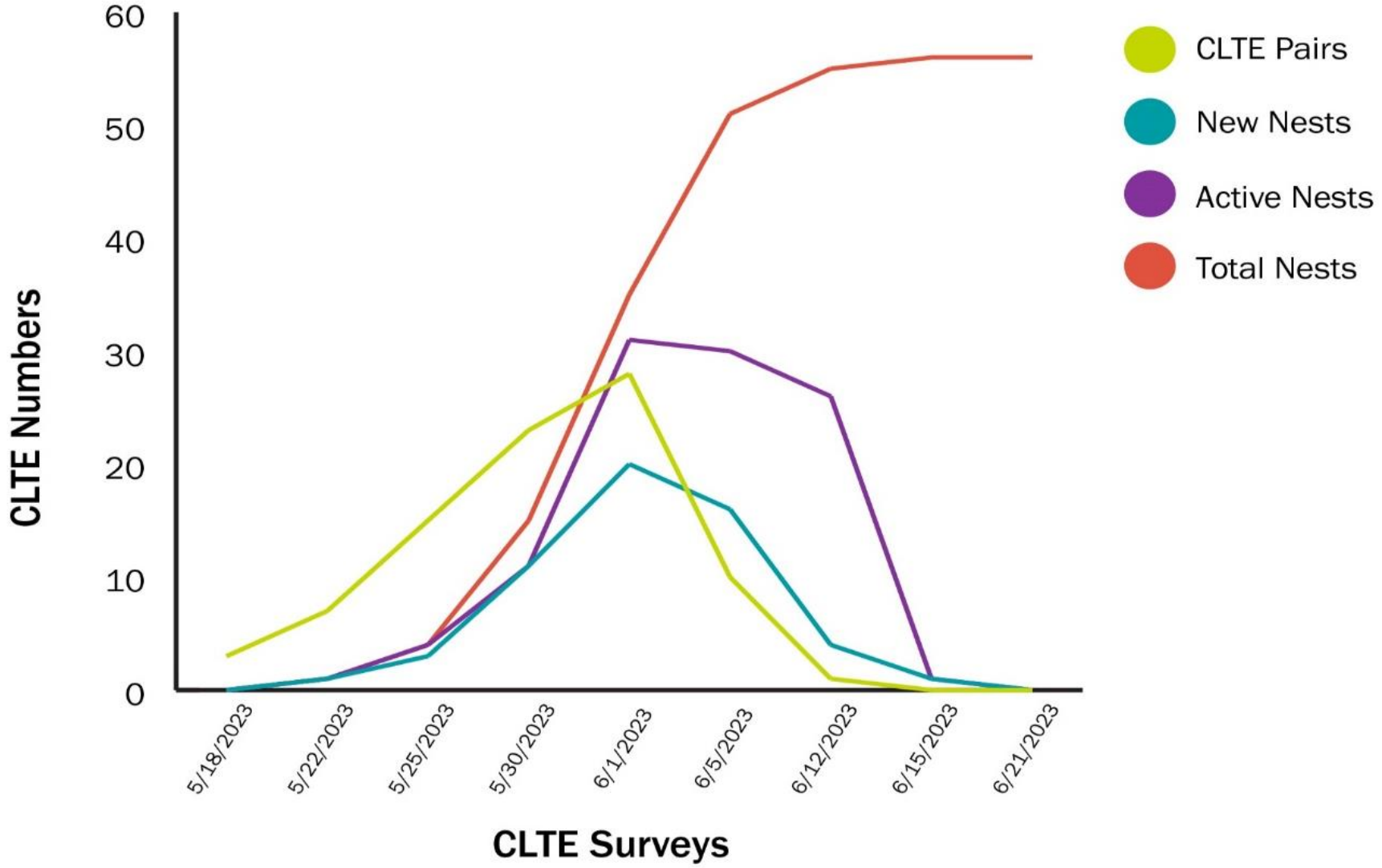
Figure 3 California Least Tern Nest Locations



Imagery provided by Microsoft Bing and its licensors © 2023.

21-11241 LA Port of, Prt of LA CA Lst Trn Mntrg
Fig 3 Nest Locations 2023

Figure 4 2023 California Least Tern Nesting Chronology



Clutch Size

The season yielded 56 nests with a total of 77 eggs. The average CLTE clutch size at the nesting site was 1.4 eggs.

Egg and Hatching Outcomes

Along with documenting the status of a nest during each nest count survey, the status of each egg was also documented. The final egg outcome was recorded as one of the following classifications: Hatch, Predated, or Abandoned. Table 2 summarizes the outcome of the 77 eggs documented during the 2023 season.

Table 2 Egg Classification and Outcome

Classification	Number of Eggs
Hatch	0
Predated	40
Abandoned	37
Total	**77**

Out of the 77 eggs documented, no eggs were determined to have been a hatch. Fifty-two percent of eggs documented were determined to have been predated by CORA and the remaining 48 percent of eggs were determined to have been abandoned.

Fledgling Productivity

The number of fledglings to depart a site at the end of the nesting season is the best measure of the productivity of a CLTE colony.

No chicks or fledglings were documented during the 2023 nesting season. Based on the decline of CLTE activity observed in early June and the absence of chicks and fledglings detected on-site, the season is believed to have resulted in a zero percent hatch success rate thus unlikely resulting in any fledglings in 2023.

4.2 Predator Management

Predator management efforts resulted in the removal of 20 predators, including 10 AMCR, seven CORA, one western gull ([WEGU] *Larus occidentalis*), and two striped skunks (*Mephitis mephitis*). Avian predators comprised 90 percent (n=18) of removals, with corvids accounting for 94.4 percent of these. More predators were removed in April (n=12; 60 percent) than in other months. Additionally, five effigies (four CORA and one WEGU) were placed to help deter avian predators from entering the CNS while predator control personnel were not on-site.

Camera Trapping

Two trail cameras were deployed at Pier 400 this season and were positioned in four different locations. A total of 29 wildlife predator detections were made in 105 camera trap nights, a 27.6 percent detection rate. A total of six species of predator were detected in the trail cameras, including striped skunks, feral cats (*Felis catus*), AMCR, CORA, WEGU, and a greater roadrunner

([GRRO] *Geococcyx californianus*). Nine of the predator detections occurred within the CNS and comprised of striped skunks, CORA, and AMCR.

On the night of June 9, two individuals were captured on camera trespassing into the area outside of the CNS and tampering with a decoy nest consisting of tongue depressors and quail eggs. The individuals removed the tongue depressors and quail eggs from the site. Although no other human activity was observed via camera traps, non-project related human footprints were also observed on June 30 entering the area outside of the CNS from the riprap to the east of the CNS.

Striped Skunks

A total of 31 trap nights resulted in the removal of two striped skunks, a trap success rate of 6.5 percent. The first individual was removed on June 11 and the second individual was removed on June 27.

Feral Cats

Minimal evidence (e.g., tracks) of feral cats was observed during the breeding season and was limited to outside of the CNS. Night traps were set to target feral cats; however, no feral cats were captured in 2023.

Racoons

Minimal evidence (e.g., tracks) of raccoons (*Procyon lotor*) was observed during the breeding season and was limited to outside of the CNS. Night traps were set to target racoons; however, no racoons were captured in 2023.

Corvids

A total of 17 corvids were removed, with AMCR comprising 58.8 percent (n=10) of these and CORA accounting for the remaining 41.2 percent (n=7). Of these, trapping attributed to 58.8 percent of removals, with the remaining removed via firearm (41.2 percent). More (80 percent) AMCR were trapped than were removed with a firearm, whereas only 28.6 percent of CORA were trapped. April comprised 70.6 percent (n=12) of the total corvid removals, May comprised 17.6 percent (n=3) of removals, and June comprised 11.8 percent (n=2) or removals.

Raptors

Raptors observed on-site presenting an elevated threat to CLTE this season included peregrine falcons ([PEFA] *Falco peregrinus*), red-tailed hawks ([RTHA] *Buteo jamaicensis*), and a merlin ([MERL] *Falco columbarius*). No owls were observed this season; however, burrowing owl ([BUOW] *Athene cunicularia*) tracks were observed during the first site visit on April 6. Raptor activity was minimal during the nesting season. Merlin and RTHA activity were each only observed once; however, PEFA activity was reported on-site on several occasions throughout the month of May. Two PEFA were regularly observed landing in the CNS, perching on lamp posts, and chasing sea birds over the riprap. Wildlife Innovations surveyed for PEFA, but surveillance was discontinued following the CLTE abandoning the site and no further action was taken against the PEFA. No raptors were captured or translocated in 2023. Additionally, no bownet traps or BC traps were used in 2023.

Elegant Terns

Hazing of ELTE was initiated for two individuals during the first site visit by WI personnel on April 6 and was conducted as needed during each following site visit. ELTE observed landing in the CNS were hazed into flight and off-site by WI either on-foot or by using a handheld laser.

Western Gulls

A single WEGU was removed on May 24 via trapping. The WEGU was frequently observed within the CNS by WI personnel and was captured in a padded-jaw foothold trap. To deter nesting attempts, future CLTE nest predation, and other WEGU from entering the CNS, the individual was euthanized and deployed as an effigy along the western fence of the CNS near where trapping was conducted. No additional WEGU were captured.

4.3 Predations

A total of 30 nests with 40 CLTE egg predations were reported during the 2023 nesting season. Common ravens were responsible for all identified nest predations. The majority (86.7 percent; n=26) of nests were depredated in June, while the remaining predation events occurred in May. All other nests (n=26) were abandoned after the predation event that was discovered on June 12.

5 Discussion

5.1 California Least Tern

Comparing 2023 CLTE activity to previous years may elucidate trends and highlight irregularities useful for informing future management recommendations. These differences are discussed below and include increased rates of nest predation, lack of successful fledgling in 2023, and site abandonment.

Arrival and Departure

California least tern were estimated to have arrived at the Pier 400 site on April 26, 2023. Based on past data reported, the arrival of CLTE on April 26 was typical of previous years. For example, CLTE were first observed over the CNS on April 28 in 2022, April 19 in 2021, April 20 in 2020, and on April 24 in 2019 (LBC 2019; LBC 2020; LBC 2021; Rincon 2022). However, their 2023 departure date of June 15 was sooner than previous years. Based on previous annual reports by LBC, the typical departure date for CLTE at Pier 400 occurs around early to mid-August (LBC 2021). In 2022, an early departure date of July 27 was observed following hunting efforts from a great-horned owl ([GHOW] *Bubo virginianus*) and possibly great blue heron ([GBHE] *Ardea herodias*) and in 2021 the departure date was August 3. The early 2023 CLTE departure date is believed to be the result of persistent nest predation by CORA, which may have been compounded by undetermined levels of human disturbance at night, that led to the rapid reduction of adult CLTE nest attendance, new nests and eggs, and ultimately site abandonment.

The details and effects of nest predation by CORA and human disturbance at night throughout the 2023 nesting season are discussed in further detail below.

In efforts to determine where the CLTE adult pairs that abandoned the Pier 400 nesting site between June 5-15 may have gone, Rincon reached out to two nearby CLTE nesting sites, Huntington Beach and Bolsa Chica. CLTE adult numbers did not peak at Bolsa Chica during the Pier 400 site abandonment timeframe (Bolsa Chica Ecological Reserve 2023). However, the Huntington Beach nesting site experienced a second wave of nests around June 20 which resulted in 33 new nests. Although the timeframe of the Pier 400 site abandonment timeframe may have correlated with the second wave timeframe at Huntington Beach, it is uncertain if the second wave consisted of Pier 400 CLTE or Huntington Beach CLTE first-time nesters/re-nesters as there were no identification indicators on the birds (e.g., banding) (California State Parks 2023, Santa Ana Watershed Association 2023).

Nest Initiation and Outcomes

During the 2023 nesting season, 56 nests and 77 eggs were recorded. In comparison to the 2022 nesting season, during which 189 nests and 339 eggs were recorded, the 2023 nesting season saw lower nest numbers and egg counts than the previous year. Based on the CNS historical nest data, the 2023 nesting season also had fewer nests and eggs than the previous 10 years (Rincon 2022). From 2005 to 2022, an average of 327.1 nests and 545.3 eggs per year was calculated (Appendix A, Table 1).

Prior to the development of the Pier 400 nesting site, nest monitoring data from the Pier 300 from 1973 to 1996 recorded that CLTE in the POLA did not exceed 134 nest initiations per season, and averaged approximately 48 nests (Appendix A, Table 2). After construction of the Pier 400 nesting site in 1996, nest initiations from 1997 to 2005 averaged 600 per season. Following that peak period, nest numbers began to decrease at the rate of about 200 nests per season for 5 years between 2006 and 2010. This decline is aligned with a long-term analysis of statewide CLTE data that indicated the number of nesting pairs and nests declined across the state since 2007 (Lewison and Deutschmann 2014). From 2010 to 2022 at Pier 400, nest numbers averaged around 152 nests per season, excluding 2011 [n=10] and 2017 [n=5] when the site experienced a drastic decrease in nests (131 nests including these years) (Appendix A, Table 1). While the 2023 nest total (n=56) was only approximately one-third the average for the previous 13 years, it did exceed the low nest totals in 2011 and 2017. The CLTE abandonment of the nesting site in 2023 due to CORA predation (and possibly exacerbated by undetermined level of human disturbance at night) occurred in mid-June, a time in the nesting season when new nests still typically occur. Therefore, site abandonment may have contributed to the decrease in nest observations compared to previous years.

Clutch Size

The 2023 season had an average CLTE clutch size of 1.4 eggs. This average clutch size is lower than the previous year (1.8 eggs) and slightly decreased from the Pier 400 10-year average of 1.6 eggs (Rincon 2022; Appendix A, Table 1). Statewide, clutch size has remained constant at an average of 1.5 eggs per nest from 1990 to 2013 (Lewison and Deutschmann 2014).

Egg and Hatching Outcomes

Egg and hatching outcomes from the 2023 nesting season were dissimilar from the previous year. Of the 77 total eggs in 2023, the predation rate was 52 percent and the abandonment rate was 48 percent. In 2022, the predation rate was 7 percent, abandonment rate was 43 percent, and the hatch success was 50 percent. In contrast to previous years, the 2023 nesting season did not result in any hatchlings, as the site was determined to be abandoned on June 21.

Fledgling Productivity

No fledglings were produced at the Pier 400 nesting site in 2023. Persistent predation of nests by CORA, which may have been compounded by undetermined levels of human disturbance at night around the site, is believed to have led to the subsequent CLTE abandonment of the site. Although fledgling productivity at Pier 400 has fluctuated over recent years, 2023 represents the first season without observed fledglings since 2017 (LBC 2021).

Since 2019, no new statewide data from the CDFW has been made available. In 2019, the statewide fledgling percent was 0.145 percent. Considering this statewide data, the 2023 nesting season at the Pier 400 nesting site is considered a low production year in comparison.

5.2 Predator Management

To maximize the effectiveness of the predator management program, predation threats were frequently assessed so that efforts could be adapted to focus on the highest perceived threat to CLTE. In 2023, CORA were the primary focus of control efforts and were ultimately responsible for nest predations on-site. Although tracks of mammalian predators such as feral cats and raccoons were observed near the CNS, there was no evidence that these species entered the CNS. As such,

the threat of these species to CLTE were considered low. However, surveillance efforts did indicate striped skunks entering the CNS and resulted in removal of the striped skunk. Predation events only occurred when predator management personnel and monitors were offsite. As such, these events and the associated predation activities likely contributed to the abandonment of the CNS by adult CLTE.

5.2.1 Mammalian Predator Management

Three species of mammalian predators were detected at Pier 400 this season, including striped skunks, feral cats, and raccoons. Although these species are known nest predators of CLTE (Manley 2016), no predations were suspected from them this season. Skunk tracks and detections via trail camera were discovered on a few occasions within the CNS; however, no raccoons or cats were detected within the CNS.

Free-roaming domestic cats have been listed among the 100 detrimental non-native invasive species in the world and are estimated to be at least partially responsible for the extinction of 14% of native bird, mammal, and reptile species worldwide (Deak et al. 2019; Loss et al. 2013). Feral cats are a threat to CLTE at all life stages (adults, fledglings, chicks, and eggs); therefore, cats are generally targeted for removal upon detection in order to prevent predations. Though predations by feral cats were not documented on-site this season, other nesting sites around Southern California have experienced detrimental predations by feral cats in the past; therefore, the presence of cats on-site is a serious cause for concern. One feral cat or free-roaming domestic cat was directly observed in the TMA-W on June 14, and cat tracks were detected on-site but outside of the CNS via track surveys, during site visits, and on one occasion, by remote trap camera footage. Activity was never observed for consecutive nights. Due to this inconsistency, the opportunity for trap exposure during trapping efforts was limited. Although WI discovered the remains of a cat feeding station (i.e., plastic food containers with food) on the Pier 400 perimeter during the 2022 nesting season, they were not observed in 2023 nor were new feeding stations discovered this year. Supplemental feeding stations have a major influence on numbers, home range, and behavior of cats in an area (Tennent and Downs 2008). Cat tracks were never detected within the CNS despite cat tracks being observed throughout the season outside of the CNS; therefore, avian predators were considered the highest threat to CLTE and were the focus of predator control efforts.

On two occasions, raccoon tracks were detected outside the eastern edge of the CNS. As these racoons were considered a low threat to CLTE and a potential competitor for feral cats, WI did not invest any efforts into trying to remove them. No predations were suspected from raccoons this season nor were any raccoons captured or removed. For future years, it will be important to continuously reevaluate the threat of this species, as their potential to depredate CLTE nests and chicks will increase substantially if they are discovered entering the CNS during peak nesting season.

Skunks were the only mammalian predator discovered to have entered the CNS. As skunks have been documented as a significant predator to CLTE nests (Manley 2016), WI focused trapping efforts to target them, which led to the removal of both individuals. Although they are primarily a concern for nests with eggs, WI considers them a threat to young chicks as well.

5.2.2 Avian Predator Management

During the 2023 nesting season, the primary threat to CLTE were avian predators, specifically CORA. Although the number of CORA removals increased from the previous season, it was determined that one to two individuals were responsible for the majority of nest predations that ultimately

contributed to the abandonment of the site and nests by CLTE during 2023. Similar to previous years, the management of CORA was challenging this season due to the presence of an "educated" individual that was hesitant to visit the site while WI was present. Additionally, refill rates for other CORA were quick after the removal of others. In contrast, AMCR were able to be managed effectively and were not suspected of being responsible for any predations.

American Crows

American crows are primary predators of nesting CLTE on sites throughout Southern California (Manley and Johnson 2019, Brinkman and Garcelon 2016, Liebezeit and George 2002). American crows will predate CLTE eggs, chicks, and fledglings, and populations of AMCR may be growing in Southern California as they are synanthropic species that thrive around human development and urbanization (Johnston 2001, Marzluff et al. 2001). Effective removal of AMCR early in the nesting season is essential to providing a safe nesting habitat for CLTE; therefore, predator management efforts to target AMCR residing in and around the Pier 400 nesting site were initiated early in the season prior to CLTE arrival on-site on April 12. Resident AMCR were primarily targeted for removal outside of the CNS, in the TMA-W, by utilizing innovative traps designed specifically for capturing corvids. Individual AMCR were observed on-site to become wary of trapping efforts, or "trap shy", making them more challenging to remove. To comprehensively reduce the local AMCR population, and ultimately the threat of predation from these birds in the nesting area, trap shy individuals were targeted directly using a firearm. These removal efforts substantially reduced AMCR activity within and around the CNS for the remainder of the season. No predations by AMCR were reported on-site this year; however, AMCR will continue to be a threat to CLTE at Pier 400 in upcoming seasons and will require regular management during the pre-nesting season.

Common Ravens

Common ravens have been documented to have significant impacts on nesting CLTE throughout California, and due to their large territories and intelligence, they are a challenge to manage (Burrell and Colwell 2012; Frost 2015; Liebezeit and George 2002; Manley and Garcelon 2014; Smith and Murphy 1973; Wooten et al. 2016, 2017, 2018). Many threatened and endangered species are vulnerable to predation by CORA, including CLTE (Liebezeit and George 2002). In the United States, CORA populations grew an estimated 2.87 percent annually for the last half-century and by 3.46 percent annually within the last decade (Sauer et al. 2017). With rapid population growth expected to continue, CORA will likely become an increasing threat to CLTE.

For these reasons, WI focused the majority of their control efforts to target CORA at Pier 400, prior to and following the arrival of CLTE. To comprehensively reduce the local CORA population, and ultimately the threat of predation from these birds in the nesting area, trap-shy individuals were targeted directly using a firearm. Although, WI was able to remove the majority of CORA that showed up at Pier 400, one pair showed signs of being extremely wary, and were suspected of being "educated" from previous years. Neither CORA would enter WI traps originally, but control personnel were eventually able to capture one of the pair using a combination of these traps and padded legholds. This bird was captured without the mate present and immediately removed from the trap. Later, a modified set was placed to target the remaining individual. However, prior to the CORA investigating the trap set, a WEGU was captured while the CORA was present. This was suspected to have exacerbated the wariness of this individual for the remainder of the season, as WI never observed this bird land on-site following this trapping event, but CORA tracks and camera

footage showed that at least one bird would enter the site in between WI and monitor visits. It is suspected that this individual was responsible for the first predation event that occurred on May 30.

Shortly after, another CORA pair showed up to the site. This pair was hazed by monitoring personnel while predator control staff was off-site. As there were schedule gaps between when WI and monitors were on site, the site was left unoccupied portions of each day which led to the predation of at least 17 nests, some of which were captured on cellular cameras. The 17-nest predation was documented on June 5 during the nest count survey. In response to this predation event, monitors were present at the site in the mornings and evenings to prevent further CORA predation then WI arrived on site and removed the suspected pair. It is suspected that the predation caused by this pair was a contributing factor for the abandonment of the remaining nests at Pier 400. As corvids are intelligent and tend to increase their hunting effort in an area once successful, it is important to minimize any gaps in site presence by predator control and/or monitors during CLTE nesting efforts when CORA are active nearby or on-site. Failure to do so is likely to result in predation events.

Raptor Management

Raptors observed on-site presenting an elevated threat to CLTE this season included PEFA, RTHA, and MERL. The MERL detection reported on April 13 was the only observation of the species documented all season. Likewise, one RTHA was observed on May 30 and no other observations of this species was recorded within the Pier 400 area this season. Peregrine falcon activity was reported on-site on several occasions throughout the month of May. Two PEFA were regularly observed landing in the CNS, perching on lamp posts, and chasing sea birds over the riprap. On May 11, a PEFA was observed consuming prey that was suspected to be a CLTE while perching on a lamp post just north of the TMA-W. The lamp post was in a fenced-off area north of Pier 400, and WI staff were unable to look for remains under the pole. Wildlife Innovations continued to survey for PEFA, since they presented an elevated threat to CLTE, but surveillance was discontinued following the CLTE abandoning the site. No owls were observed this season; however, BUOW tracks were observed during the first site visit on April 6. A trail camera was placed in this location following the discovery of these tracks, but no detections of BUOW were recorded. Although, the predation threat from raptors did not require trapping efforts to occur in 2023, the POLA Migratory Bird Treaty Act depredation permit only included American kestrel ([AMKE] *Falco sparverius*) and BUOW. Wildlife Innovations assisted POLA in the preparation of their depredation permit amendment that was submitted in early 2023 and included additional potential predators, but it was not issued during the breeding season and is still pending. It will be important to have this permit for future seasons to allow for the management of additional predators, should it become necessary.

Great Horned Owls

Great horned owls are documented predators of CLTE in southern California (Keane 1999; Zimmerman 2008; Frost 2015, 2017). No GHOW or their signs were observed during the 2023 nesting season.

American Kestrels

With a diet often consisting of insects, small rodents, and birds, AMKE have been documented as a high predation threat to nesting CLTE within Southern California (Toland 1987, Sin 2021). American kestrel did not present an elevated threat to CLTE this season (e.g., not observed within the CNS) and therefore were not targeted.

Great Blue Heron

Great blue heron have been documented to target and depredate CLTE and western snowy plover chicks (*Charadrius nivosus nivosus*) on-sites within California (Manley and Johnson 2019). Great blue heron did not present an elevated threat to CLTE this season (e.g., not observed within the CNS) and therefore were not targeted.

5.3 Non-Predator Impacts and Management

During the 2023 nesting season, non-predators that were observed on site included ELTE and humans. Elegant terns pose a significant threat to CLTE nesting, as ELTE occupy similar nesting habits to that of CLTE. Humans may impact CLTE by preventing adult CLTE from attending to their nests. During the nesting season, ELTE were deterred from the site; however, human activity could not be directly addressed as activity occurred while no project-related personnel were on site.

5.3.1 Elegant Terns

During the 2023 nesting season, hazing techniques were successfully implemented to deter a group of ELTE making scrapes in the CNS. Although ELTE have primarily nested on Isla Rasa in Mexico in previous years (Velarde et al. 2015), their breeding range has expanded northward into sites across Southern California, including Pier 400 (Burness et al. 1999). When occupying sites with CLTE, ELTE can lead to negative impacts on CLTE nesting by overtaking all available nesting areas or by trampling nests. This was observed at Pier 400 during the 2019 nesting season, where ELTE nesting was documented in the CNS and resulted in the trampling of CLTE eggs (LBC 2019).

5.3.2 Human Disturbance

On the night of June 9, camera traps placed by WI captured two individuals trespassing into the CNS and removing a decoy nest containing quail eggs. Based on the camera footage and footprints on site, it was determined that the trespassers accessed the site by walking along the riprap to the east of the CNS and around the chain-link fence separating the Pier 400 nesting site from APM Terminals. Although no other human activity was observed via camera traps, non-project related human footprints were also observed on June 30, after site abandonment, entering the area outside of the CNS from the same path as the June 9 incident. No other non-project related human disturbance was observed during the 2023 nesting season; however, it is possible that other disturbances may have taken place undetected. Human disturbance could not be directly addressed during the nesting season as activity occurred while no project-related personnel were on site and the site was soon abandoned by CLTE.

Humans may impact CLTE by crushing their eggs and/or chicks and preventing adult CLTE from attending to their nests (e.g., preventing them from feeding their chicks and protecting them from predators). Individuals trespassing the site at night can, for example, scare off adult CLTE incubating their nests which can lead to exposing eggs to cold temperatures for long periods of time and/or exposing the eggs to night predators. Although CORA are considered the leading factor for site abandonment in 2023, it is possible that undetected human disturbance may have taken place at Pier 400 and if that activity was persistent for consecutive nights, it may have also contributed to site abandonment.

For future nesting years, coordination with the Port Police should continue to take place to deal with trespassers and provide additional surveillance of the site, if possible, to prevent further trespassing of individuals.

6 Recommendations

The following recommendations for the 2024 nesting season are provided in the interest of ensuring the best conditions for CLTE productivity.

6.1 Central Nesting Site Grading

Re-grade the CNS as necessary to redistribute sand buildup along the perimeter fence. In 2010, LBC measured sand depths at more than 100 locations within the CNS and estimated an average sand depth of 7.6 in. In 2011, approximately 20,000 cubic yards of new sand was imported to the nesting site resulting in a 10 to 12 in. depth over the entire nesting surface. In the following years, sand has been lost every season from wind blowing sand into the ocean. In the last four years, silt fence placement along the east end of the buffer zone has helped to reduce sand loss. It is recommended the POLA identify sand replacement opportunities for the site in the near future.

6.2 Chain-Link and Chick Fence Maintenance

Examine and repair, as necessary, the chain-link fence separating the Pier 400 nesting site from APM Terminals, including the chain-link fence extending into the water to prevent humans from gaining access to the CNS, and the fence around the curbed area leading to the CNS main gate which was first placed by C&M in 2022.

It is recommended that the plastic chick fence be replaced by a well-designed and properly constructed chain-link fence with entrance doors for surveyors to help prevent unwanted mammals from gaining access to the CNS and help support predator management efforts. The chick-fence should be at minimum 72 in. above ground, to help exclude most mesocarnivores, and buried at least 12 in. below ground and extend horizontally away from the CNS to deter burrowing animals. With a 72 in. fence, it is also recommended to add solid mesh on the northern side of the chick fence to shield predator management efforts from the public in the surrounding areas. If a 72 in. chick fence is not feasible for the entire CNS, a fence consisting of a 72 in. side on the north and 36 in. sides on the east, west, and south is recommended.

6.3 Grid Markers

The LAHD to continue providing roof tiles for use as grid markers and chick shelters. Roof tiles to continue being placed throughout the CNS for chick shelter and protection from predators. Broken roof tiles to be replaced each year, as necessary.

6.4 Herbicide Application

To reduce the percent cover of vegetation at the CNS, vegetation to continue being removed from the site prior to the application of herbicides as this has been determined to be most effective.

Herbicide shall include an Imazapyr-based herbicide containing both pre and post emergent components.

6.5 TMA-W Weed Management

Hand-removal of noxious weeds and invasive vegetation was successful for 2023, as it was in previous years, and is recommended again for 2024. Application of post-emergent herbicide on vegetation in the TMA-W following mowing should also be performed again to minimize the spread of weed seeds from prevailing westerly winds into the nesting site. The dead vegetation should be left on the site to maximize the effectiveness of the herbicide, reduce sand transport from exposed areas of soil, reduce the potential of dispersing seed, and discourage nesting in the TMA-W.

6.6 Worker Education Program

Conduct a Worker Education Program for new Pier 400 personnel with access to Pier 400 to avoid any potential impacts to CLTE or tampering of wildlife traps during the nesting season. The Worker Education Program shall cover a brief overview of CLTE history and their federal and state protection, the nature and importance of the CNS, specific nesting site work conditions and nesting site protections, and avoidance of predator management on-site traps.

6.7 Human Disturbance

To avoid potential impacts to CLTE during the nesting season, personnel should document and report to LAHD EMD or Port Police, when necessary, human disturbance including, but not limited to, activities such as aircrafts flying over the CNS, jet-ski use in the vicinity of the CNS, or unauthorized personnel on-site. Additionally, replace the current “No Trespassing” and “Least Tern Nesting Area” signs on the existing chain-link fence with bilingual and larger signs and place them in more frequent intervals to visually assist with transmitting the no trespassing message and extending the existing chain-link fence that goes over the riprap on the eastern side of the site (fence that separates the Pier 400 nesting site from the APM Terminals) further into the water to deter humans from gaining access to the CNS.

6.8 Increase Site Visits

As budget permits, increase the duration and frequency of site visits by Rincon and/or WI to facilitate earlier detection of predators, faster response times, better behavioral data for predators, and longer trapping sessions. Implementing these recommendations may lead to a reduction or prevention of predation events and predator foraging, and more efficient removal of targeted individuals. Furthermore, longer trapping sessions may lead to an increase in chances for trap exposure, thus capturing both predators that visit the site less frequently, as well as "educated" predators, such as CORA, that may require a multistep process.

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Appendix A

California Least Tern Nesting Statistics and Productivity Tables

Table 1 Nesting Statistics for Pier 400 with Comparisons to 2005-2023

	Average 2005-2023	% Change from 2022	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Total Nests	312.84	-70.37	56	189	198	182	200	133	5	141	110	126	254	211	10	216	435	529	710	907	1,332
Re-nesting Terns[2]	26.16	-100.00	0	17	0	182[f]	38	36	0	15	0	14	17	8	2	52	64	43	41	72	78
Total Nesting Pairs[2]	287.47	-67.44	56	172	198	182	162	97	5	126	110	93	245	203	8	190	371	486	669	835	1,254
Total Eggs	520.74	-77.29	77	339	332	284	304	230	9	209	178	205	392	358	16	345	685	891	1,135	1,494	2,411
Mean Clutch Size (average eggs per nest)	1.62	-22.22	1.4	1.8	1.7	1.5	1.5	1.7	1.8	1.5	1.6	1.6	1.5	1.7	1.6	1.6	1.6	1.6	1.6	1.65	1.8
Number of Eggs Hatched	345.05	-100.00	0	169	196	129	219	149	0	103	13	143	274	268	5	49	302	582	742	1031	2,182
Hatching Success (eggs hatched of total eggs)	0.50	-100.00	0	0.5	0.59	0.45	0.72	0.65	0	0.49	0.07	0.7	0.7	0.75	0.31	0.14	0.44	0.65	0.65	0.69	0.91
Eggs Lost to Predators/Trampling	41.84	73.91	40	23	24	148	39	27	9	18	143	20	22	13	0	138	55	33	8	29	6
Percent of Total Eggs Lost to Predators/Trampling	0.21	642.86	0.52	0.07	0.07	0.52	0.13	0.12	1	0.09	0.8	0.1	0.06	0.04	0	0.4	0.08	0.04	0.01	0.02	0
Eggs Abandoned and/or Infertile	133.16	-74.66	37	146	112	7	46	54	0	88	20	42	96	77	11	158	328	276	385	434	213
Percent of Total Eggs Abandoned/Infertile	0.29	11.63	0.48	0.43	0.34	0.02	0.15	0.24	0	0.42	0.11	0.21	0.25	0.22	0.69	0.46	0.48	0.31	0.34	0.29	0.09
Known Mortality (dead & depredated chicks)	117.74	-100.00	0	14	52	18	33	33	0	14	13	31	127	86	5	6	126	172	349	260	898
Percent Mortality (% of total chicks hatched)	0.31	-100.00	0	0.08	0.27	0.14	0.15	0.22	0	0.14	1	0.22	0.46	0.32	1	0.12	0.42	0.3	0.47	0.25	0.41
Minimum Fledglings[3]	117.21	-100.00	0	2	38	3	60	22	0	46	0	16	31	35	0	4	75	201	186	641	867
Maximum Fledglings[4]	82.58	-100.00	0	4	144	111	186	116	0	89	0	112	147	82	–	–	–	–	–	–	–
Final Fledglings[5]	51.83	-100.00	0	4	91	57	123	69	0	66	0	64	89	59	–	–	–	–	–	–	–
Fledglings per Nest	0.24	-100.00	0	0.02	0.46	0.31	0.62	0.16	0	0.47	0	0.13	0.12	0.17	0	0.02	0.17	0.38	0.26	0.71	0.65
Fledglings per Hatched Egg (chick survival[4])	0.24	-100.00	0	0.02	0.46	0.44	0.56	0.15	0	0.64	0	0.11	0.11	0.13	0	0.08	0.25	0.34	0.25	0.62	0.40
Fledglings per Pair (minimum)	0.26	-100.00	0	0.02	0.46	0.31	0.76	0.23	0	0.36	0	0.17	0.13	0.17	0	0.02	0.2	0.41	0.28	0.77	0.69

[1] Historical data from LBC, 2016, 2017, 2018, 2019, 2020, 2021,2022; eGIS 2015, and KBC 2013

[2] The estimated number of pairs is the total number of nests, minus the estimated number of nests initiated by re-nesting pairs (from the same or other sites).

[3] The minimum fledgling estimate is based upon one of the four methods recommended by CDFW: Method 3WD; Beginning two weeks after the first fledgling observation, the number of fledglings at the end of each 2-week period. However, this method likely results in an underestimate, since fledglings may be away from the nesting site learning to forage with parents. In addition, persistent predator presence, whether observed or not, can result in early departure from the nesting site by adults and fledglings. Thus, an alternative method was also used to estimate fledglings; see note “4” and “5”, below.

[4] In previous years, the maximum number of chicks that could have survived to fledging (total eggs hatched, minus the number of dead and depredated chicks/fledglings) were considered the Maximum Fledglings Estimated and the Minimum Fledglings Estimated was the sum of the maximum number of fledges observed during a 2-week, observation period as in note "3", above. In 2022, this method was applied as an alternative method and is not displayed in this table for that given year. The Maximum Fledglings total in for 2022 is based on field observations. Maximum Fledglings Estimated. The Minimum Fledglings Estimated was simply the sum of the maximum number of fledges observed during a 2-week, observation -period as in note “3”, above.

[5] The median value between the minimum and maximum estimates was used as a final estimate of productivity. In 2022, this method was applied as an alternative method and is not displayed in this table. The estimated Final Fledglings total in this table is based on field observations.

[6] All nests were assumed to be second nesting due to the late nesting season

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Table 2 Nesting and Productivity at Los Angeles Harbor Nesting Sites, 1973-2023

Year	Pairs[a]	% Statewide Pairs[b]	Nests	Fledglings	Fledglings per Pair	Fledglings per Nest	% Statewide Fledglings[b]
1973-1980 (avg)	31	4.6	31	27.5	0.4	0.4	unknown
1981	46	4.7	43	7	0.2	0.2	0.8
1982	70	6.8	70	14	0.2	0.2	2.7
1983	91	8.9	91	70	0.8	0.8	7.8
1984	133	13.8	134	105	0.8	0.8	20.3
1985	99	9.7	99	65	0.7	0.7	9.9
1986	104	10.8	104	78	0.8	0.8	8.8
1987	40	4.3	50	5	0.1	0.1	0.9
1988	5	0.4	2	0	0.0	0.0	0.0
1989	19	1.5	20	6	0.3	0.3	0.8
1990	32	1.9	41	12	0.4	0.3	0.7
1991	2	0.1	2	0	0.0	0.0	0.0
1992	0	0.0	0	0	0.0	0.0	0.0
1993	10	0.4	10	8	0.8	0.8	0.4
1994	31	1.1	37	3	0.1	0.1	0.1
1995	15	0.6	16	9	0.6	0.6	1.0
1996	56	1.8	68	48	0.9	0.7	2.8
1997	80	2.0	105	105	1.3	1.0	4.2
1998	172	4.2	218	148	0.9	0.7	6.4
1999	235	6.5	367	165	0.7	0.5	23.8
2000	437	9.5	565	551	1.3	1.0	14.4
2001	404	8.4	459	228	0.6	0.5	10.0
2002	287	8.0	320	34	0.1	0.1	6.1
2003	894	13.0	963	659	0.7	0.7	25.0
2004	951	14.8	1071	556	0.6	0.5	37.4
2005	1254	17.4	1332	867	0.7	0.7	45.0
2006	835	11.9	907	641	0.8	0.7	20.1
2007	669	9.8	710	186	0.3	0.3	8.0
2008	486	6.7	529	210	0.4	0.4	8.8
2009	371	5.2	435	75	0.2	0.2	3.9
2010	190	3.0	216	4	0.0	0.0	0.2
2011	8	0.15	10	0	0.0	0.0	0.0
2012	203	3.8	211	35	0.2	0.2	9.0
2013	245	4.4	254	31	0.1	0.1	2.2
2014	93	1.7	126	16	0.6	0.1	3.9
2015	110	2.4	110	0	0.0	0.0	0.0
2016	126	2.9	141	66	0.5	0.5	3.6
2017	5	0.3	5	0	0	0	0.0
2018	97	0.024	133	69	0.7	0.2	0.076
2019	161	0.041	200	123	0.8	0.6	0.145
2020	182	TBD[c]	182	57	0.3	0.3	TBD[c]
2021	198	TBD[c]	198	90	0.5	0.5	TBD[c]
2022	172	TBD[c]	189	4	0.02	0.02	TBD[c]
2023	**56**	**TBD[c]**	**56**	**0**	**0**	**0**	**TBD[c]**

[a] Values are approximate numbers of CLTE pairs nesting at one or more nest sites in the Los Angeles Harbor. This number does not include pairs likely re- nesting (nesting for a second or third time in the same year after nest failure at the same or another nesting site). The number of nesting pairs is less accurate than the number of nests but is used to estimate the statewide population, since many nests are probable re-nests during years of high losses to predators or other nest failures.

[b] Percentages are derived from averages of ranges presented in annual reports prepared for the California Department of Fish and Wildlife. Pier 400 is among the approximately 48 sites statewide.

[c] Data is to be determined. Statewide figures were not available at the time of this report.

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Appendix B

Wildlife Observed at Pier 400 During the 2023 Nesting Season

Wildlife Species Observed at Pier 400 During the 2023 Nesting Season

Scientific Name	Common Name	Status	Native or Introduced
Birds			
Anas platyrhynchos	mallard		Native
Ardea herodias	great blue heron*	state special animal	Native
Athene cunicularia	burrowing owl*	state species of special concern	Native
Buteo jamaicensis	red-tailed hawk*		Native
Cardellina pusilla	Wilson's warbler		Native
Charadrius nivosus nivosus	western snowy plover**	federally threatened state species of special concern	Native
Charadrius vociferus	killdeer		Native
Corvus brachyrhynchos	American crow*		Native
Corvus corax	common raven*		Native
Empidonax difficilis	Pacific-slope flycatcher		Native
Falco columbarius	merlin	state watch list	Native
Falco peregrinus	peregrine falcon*	federally delisted state delisted	Native
Falco sparverius	American kestrel*		Native
Geococcyx californianus	greater roadrunner*		Native
Haematopus bachmani	black oystercatcher		Native
Haemorhous mexicanus	house finch		Native
Hirundo rustica	barn swallow		Native
Hydroprogne caspia	Caspian tern*	state special animal	Native
Lanius ludovicianus	loggerhead shrike*	state species of special concern	Native
Larus heermanni	Heermann's gull*		Native
Larus occidentalis	western gull*		Native
Melospiza melodia	song sparrow		Native
Melozone crissalis	California towhee		Native
Mimus polyglottos	northern mockingbird		Native
Myiarchus cinerascens	ash-throated flycatcher		Native
Nannopterum auritum	double-crested cormorant	state watch list	Native
Numenius americanus	long-billed curlew*	state watch list	Native
Numenius phaeopus	whimbrel*		Native
Pandion haliaetus	osprey*	state watch list	Native
Passer domesticus	house sparrow		Introduced
Pelecanus occidentalis	brown pelican	federally delisted state delisted	Native
Phalacrocorax penicillatus	Brandt's cormorant		Native
Piranga ludoviciana	western tanager		Native
Rynchops niger	black skimmer*	state species of special concern	Native
Sayornis saya	Say's phoebe		Native

Scientific Name	Common Name	Status	Native or Introduced
Sternula antillarum browni	California least tern	federally endangered state endangered state fully protected	Native
Sternus vulgaris	European starling*		Introduced
Thalasseus elegans	elegant tern	state watch list	Native
Tyrannus verticalis	western kingbird		Native
Tyrannus vociferans	Cassin's kingbird		Native
Vermivora celata	orange-crowned warbler		Native
Zenaida macroura	mourning dove		Native
Zonotrichia leucophrys	white-crowned sparrow		Native
Mammals			
Felis catus	feral cat*		Native
Mephitis mephitis	striped skunk*		Native
Procyon lotor	raccoon*		Native
Sylvilagus audubonii	desert cottontail		Native

* CDFW-listed predator to CLTE; **No western snowy plover breeding behavior observed at Pier 400