Pier 400 California Least Tern Nest Surveys and Monitoring

2022 Nesting Season Annual Report

prepared for

Los Angeles Harbor Department, Environmental Management Division
Rachel McPherson
425 South Palos Verdes Street
San Pedro, California 90733
Via email: RMcPherson@portla.org

prepared by

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

and

Wildlife Innovations
11629 Westridge Place
Lakeside, California 92040

Ryan Ecological Consulting
526 West Colorado Boulevard
Monrovia, California 91016

December 2022

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Environmental Scientists | Planners | Engineers
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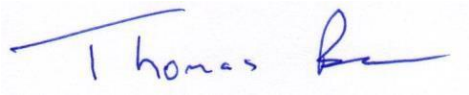
I certify that the information in this survey report, and the attached exhibits, fully and accurately represent my work.



Thomas Ryan
Biologist, Permit Number TE-097516-8
Ryan Ecological Consulting
526 West Colorado Boulevard
Monrovia, CA 91016

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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 2022 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 simultaneously conducted biweekly 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 28. Upon confirmation of breeding behavior, Rincon initiated focused nest count surveys and monitoring for CLTE on May 12. Focused surveys were conducted by Thomas Ryan (Permittee), Spencer Langdon (Authorized Independent Surveyor and Langdon Biological Consulting), Rincon, and Wildlife Innovations under U.S. Fish and Wildlife Section 10(a)1(A) recovery permit (TE-097516-8) and Mr. Ryan's California Department of Fish and Wildlife Memorandum of Understanding (3409) for authorized work with CLTE. The focused surveys took place inside the Central Nesting Site on Mondays and Fridays each week, while weekly site visits were conducted on Wednesdays outside of the Central Nesting Site (CNS) to confirm overall site conditions, CLTE activity, and potential predators. Wildlife Innovations was on-site on an as-needed basis, dependent on positive signs of CLTE predators during survey and monitoring efforts.

Monitors observed a significant drop in CLTE adult and chick activity at the CNS late June through early July, which coincided with great horned owl ([GHOW] *Bubo virginianus*) activity on-site. Although the GHOW was captured and removed from the CNS, it is suspected that its hunting prior to removal led to early adult site abandonment and resulting in chick mortality. Additionally, peregrine falcon ([PEFA] *Falco peregrinus*) and American kestrel ([AMKE] *Falco sparverius*) were observed hunting at the site during late incubation and chick-rearing, which also likely contributed to a high rate of chick mortality. With the precipitous decline of CLTE adult and chick activity, including the high rate of nest abandonment following the GHOW presence, the maximum number of fledglings observed by monitors during any one site visit was four. Therefore, it is unlikely more than four chicks fledged during the 2022 nesting season.

During the 2022 nesting season, 189 nests and 339 eggs were documented, yielding an average clutch size of 1.8 eggs. The hatch success rate for the 2022 season was 50 percent (n=169). Of the hatched eggs (n=169), 92 percent (n=155) resulted in potential chicks and 8 percent (n=14) were chick mortalities confirmed to have been lost to predation or non-predatory causes. Of the 170 non-hatches, 86 percent (n=146) were lost due to abandonment (with most loses coinciding with GHOW activity on-site), 13 percent (n=23) were lost to predation, and one percent (n=1) was lost due to a damaged egg. As previously discussed, by the conclusion of the 2022 nesting season, it was estimated that approximately 4 fledglings were produced. In comparison to the previous year, the 2022 nesting season had fewer nests but a greater number of eggs recorded. Estimated fledglings decreased by 96 percent, from 91 estimated fledglings in 2021, to 4 estimated fledglings in 2022. When comparing 2022 estimated fledglings to the average estimated fledglings from 2012-2021 ($\bar{x}$ = 61.8), the 2022 estimated fledglings were lower by 94 percent.

1 Introduction

Rincon Consultants, Inc. (Rincon), Wildlife Innovations (WI), Ryan Ecological Consulting (REC), and Langdon Biological Consulting (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 2022 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, Langdon Biological Consulting [LBC] 2021).

CLTE 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). 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 continue to be a fully protected species under the 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

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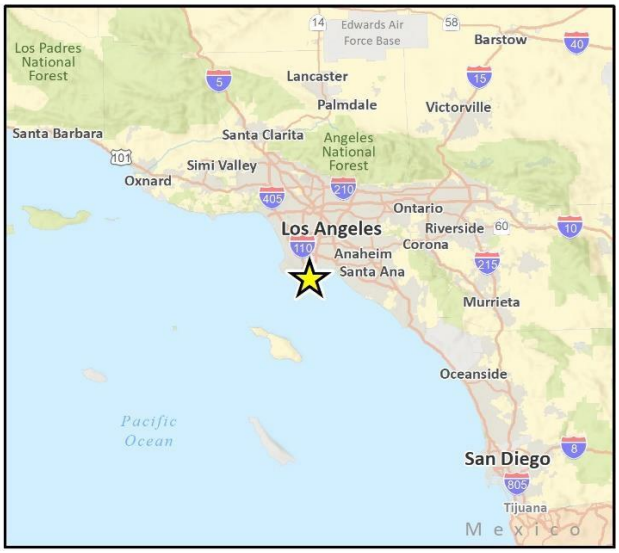


Figure 2 Survey Location Map

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 2022 breeding season at the CNS.

2.1 Site Preparation and Site Visits

In efforts to provide the best nesting conditions and productivity for CLTE, Rincon began to evaluate the existing conditions of the CNS and TMA-W in early January to determine necessary site preparation activities. A meeting at the CNS took place on January 28, 2022, with representatives from Rincon, LAHD Environmental Management Division (EMD), LAHD Construction and Maintenance (C&M), and Langdon Biological Consulting, LLC (LBC) to discuss the next steps required to prepare the CNS and TMA-W. It was determined that the 2021 site preparation methods had been effective and would be repeated for the 2022 site preparation. Additionally, a virtual meeting was held with representatives from Rincon, LAHD EMD, CDFW, and USFWS on April 7, 2022, to notify the agencies of the state and federal permit coverage approach, site preparation activities, survey and monitoring efforts, and predator management approach.

Pre-season preparation activities were done by LAHD C&M and overseen by Rincon and LBC as they conducted site visits of the CNS twice a week 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. 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 February to March. 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 2019-2021. Consistent with this approach, no vegetation removal, sand movement, or disking occurred at the TMA-W in 2022.

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 2022, 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, LADH 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 8, 2022 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 2022.

Grid Marker Establishment and No Aircraft Sign Upgrade

Grid markers were removed from the CNS by Rincon on February 24, 2022. Following fence repairs by the LAHD C&M and herbicide application by Tierra Data, Inc., Rincon replaced 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 "No Fly Zone" signs that were upgraded in 2018. One sign is located southeast of the CNS, while the second is to the west. The 2018 replacement signs were considered too small for aircraft flying over the site to see, and the signs were upgraded again in 2022. Larger signs reading "No Aircraft" were installed in the same locations on May 6, 2022. In April 2022, Rachel McPherson with 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 the arrival of CLTE, a colonial nester, predators may be attracted to investigate the site due to the increase in visual, olfactory, and/or audial stimulation produced in or near the area suggesting an influx of available food. Once aware of the new abundance of food in the form of CLTE and eggs, predators may converge on the site in larger numbers, resulting in substantial nest loss.

To address this issue, predator management field efforts were initiated by WI on March 31; however, construction of CNS-customized corvid traps began during the first week of March. During the pre-nesting season, WI conducted weekly site visits and primarily focused on predator

surveillance, ELTE hazing and deterrence, and preemptive corvid management. The frequency of these site visits was adaptive and based on observations by WI, Rincon, REC, and LBC CLTE monitors, but was mostly limited to one visit per week. The duration of site visits by WI varied due to the objectives of each visit, such as the predator species targeted, the number of individuals targeted, and the management method(s) used. The duration of site visits was also dependent upon 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 common raven ([CORA] *Corvus corax*) 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 2022. These management techniques aim to increase CLTE nesting on-site and effectively mitigate predations.

Elegant Tern Deterrence

On May 16, approximately 35 ELTE were observed by CLTE monitors in the center of the CNS attempting to initiate nesting (i.e., making scrapes). WI responded to the activity and utilized hazing techniques to deter ELTE from nesting in the CNS. WI conducted hazing conducted hazing from May 16 to May 19. These aggressive hazing efforts concluded after ELTE were determined to have stopped their nesting attempts at the CNS.

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 Thomas Ryan's (REC) USFWS Section 10(a)1(A) recovery permit (TE-097516-8) and CDFW Memorandum of Understanding (3409). Under Mr. Ryan's permits, Spencer Langdon from LBC was approved as an independent monitor, while Rincon biologists Monica Jacinto, Benson Truong, and Jacob Hargis, and LBC biologists Nick Liberato, Jose Olvera, and Jason Haller were approved as supervised 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) , either Mr. Ryan or Mr. Langdon were present to oversee all activities conducted by supervised monitors. During some surveys, both Mr. Ryan and Mr. Langdon were present.

As previously noted, Rincon or LBC conducted site visits twice a week 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 twice a week, Monday and Friday, respectively, with up to four monitors. Additionally, site visits were performed on Wednesdays, 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 Wednesdays. 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 two groups of two 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

On June 27, Mr. Ryan and LBC captured, measured, and banded CLTE chicks. Mr. Ryan and LBC conducted a second session on July 11 to band any chicks hatched after June 27, and to recapture and measure the chicks captured on June 27. Chicks were captured by hand and weight was measured using a pesola 30-gram spring balance scale and a wing rule. United States Geological Survey (USGS) metal bands were placed on all chicks, and larger chicks also received a green alphanumeric band with white lettering. Chicks were released where captured.

3.2 Predator Management Techniques

Predator management efforts were conducted under POLA's depredation permit (MB156564-0) from USFWS and WI's Scientific Collecting Permit (S-190860003-20002-001-03) from CDFW. Additionally, Jake Manley from WI was approved as an independent monitor under Mr. Ryan's USFWS Section 10(a)1(A) recovery permit (TE-097516-8) to apply predator management techniques at the CNS. The objective of the predator management efforts was to mitigate predation pressure on nesting CLTE and increase their reproductive success. Predator management efforts encompassed digital and physical predator surveillance, deterrence, and corvid, raptor, and mammal removal, using a variety of techniques.

For the purposes of this report, one *trap night* was defined as a 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 not included as trap nights. The number of trap nights was calculated by multiplying the number of available traps set in area by the number of nights traps were run. Trap success rate was also calculated by dividing the number of captures by the number of trap nights, which conveys how many predator captures occurred per trap night. Predation rate was calculated to demonstrate the number of nests predated relative to the total nests on-site (Predated nests/Total nests = Predation Rate).

3.2.1 Predator Surveillance

Predator surveillance was accomplished through the use of a singular cellular trail camera and multiple predator surveys and investigations. Camera footage and observation data were used to inform predator management efforts during the 2022 nesting season.

Trail Camera

A single cellular trail camera (Reconyx, Holmen, WI) was positioned at the CNS to monitor predator activity remotely and help inform predator managers while personnel were off-site. Camera trap locations were selected based on either providing the best overall view of the nesting area or a more focused view on an ingress or egress area known to be used by predators entering and leaving the CNS. Additionally, it was essential to the function of the cellular camera to select a location on-site that had adequate cellular reception in order to receive footage 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 was powered by a solar panel (Reconyx, Holmen, WI, SC10). Camera footage was monitored 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 patrols, 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 more predators were observed by either WI or monitors, when predator signs were discovered, or predations were reported by monitors. Predator control personnel could monitor the entire colony and conduct predator surveys from multiple locations outside the CNS, especially on the east and south areas. All predator observational data was used to inform and adjust the focus of predator management efforts.

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 sign, 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 determine the frequency of site visits by WI.

3.2.2 Mammalian Predator Management

Mammal trapping methods were focused to target and remove individuals on-site utilizing 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 mammal predators could be captured while moving in or out of the CNS. Traps were covered with vegetation or plastic covers in order 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 mammal 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. Cats captured were euthanized with a .22 caliber rimfire pistol, and 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, owls, 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

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. 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 eight birds between trap checks. The larger lure-bird chamber was positioned on the ground, and up to three lure-birds (CORA or AMCR) were placed inside. The trap chambers were then placed in a tight formation touching the sides of the central lure-bird chamber. A collapsible perch-trigger was used to hold the spring-loaded door of each trap chamber open. 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. The lure-bird chamber was positioned on the ground and up to two lure-birds were placed inside. The trap chambers were then placed on top of the lure -bird chamber and attached securely. The spring-loaded trapdoors were held open using two perch-triggers (3/4 in. square dowelrod bisected with a hinge), and bait was scattered inside and outside of the lure -bird and trap-chambers.

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. In the event that trapping was necessary in an area where natural funnels did not occur, WI subtly created funnels using vegetation and rocks. Foothold traps were positioned within the narrowed opening in the funnels and bait was placed towards the rear of the funnel. 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 themselves were buried lightly in sand in order 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 live 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, were deployed to deter ravens that were not removed from foraging on Pier 400. Effigies were strategically positioned to be highly visible to ravens 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 monitors or WI, 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, such as AMKE and GHOW, 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 was then 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 such as GHOW, while the opposite was used for small raptors including AMKE. 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) consisted 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 was monitored and under constant surveillance by WI.

Elegant Terns

Hazing efforts were employed to deter ELTE from nesting in the CNS, where they may deter CLTE from nesting or damaged/destroyed 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. Th is 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 2022 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 20 CLTE were first observed flying over the CNS on April 28. Shortly after, CLTE were observed landing in the CNS on May 5. The last day CLTE were observed on-sitewas July 20, which consisted of four adults and two fledglings observed south of the CNS along the riprap. Follow-up visits were conducted on July 22 and July 27 to confirm the departure of CLTE, and the 2022 nesting season was closed on July 27.

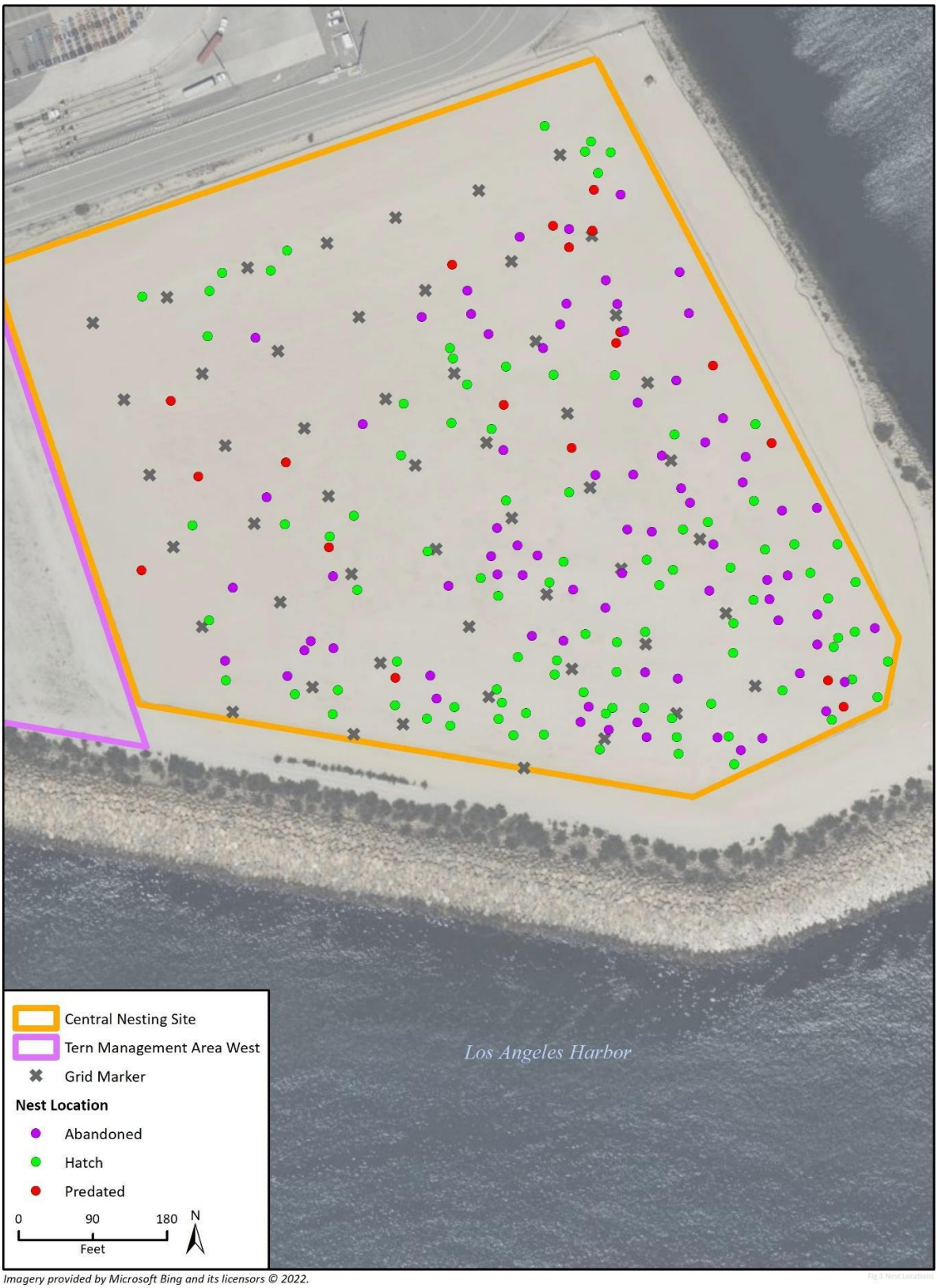
Nest Initiation and Outcomes

Nest count surveys in the CNS were conducted from May 12 through July 15. During the first nest count survey on May 12, several CLTE scrapes were observed throughout the CNS; however, the first nest was not documented until the second nest count survey on May 19. The last of the 189 nests was documented on July 8. Figure 3 displays the location of each nest throughout the CNS and Figure 4 exhibits the nesting chronology in 2022. 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 2022.

Table 1 Nest Classification and Outcome

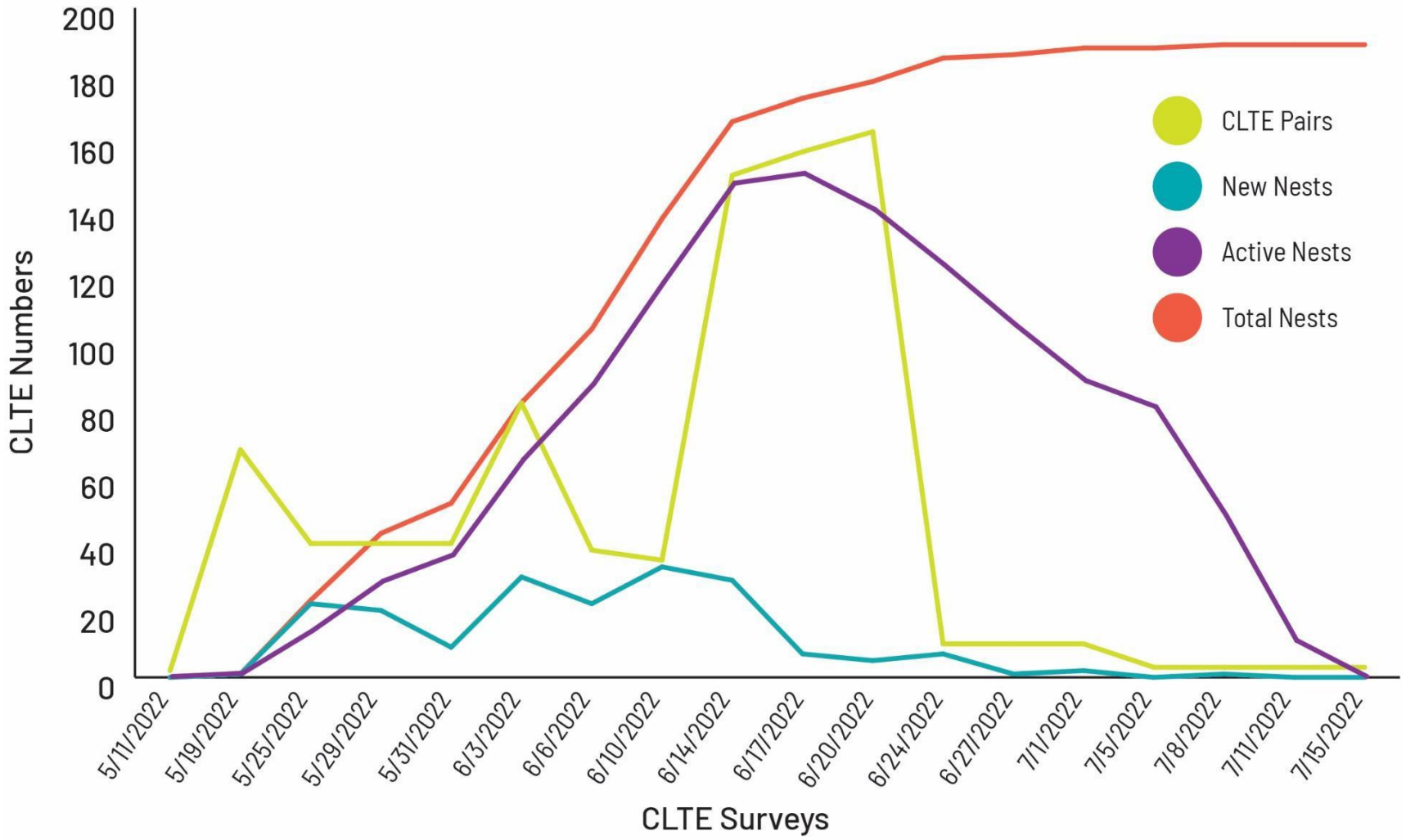
Classification	Definition	Number of Nests
Hatch	Live or deceased chick(s) observed in nest; nest observed vacant during the anticipated hatch date timeframe, no evidence of predation or other failure reasons observed	93
Predated	Evidence of egg predation (e.g., cracked egg shells with yolk, predator prints) observed at the nest prior to anticipated hatch date timeframe	19
Abandoned	Unattended eggs in nest prior to the anticipated hatch date timeframe, no evidence of adult CLTE activity or predation observed	77
Total	**--**	**189**

Figure 3 California Least Tern Nest Locations



Imagery provided by Microsoft Bing and its licensors © 2022.

Figure 4 2022 California Least Tern Nesting Chronology



*The decrease in CLTE pairs in late June is believe to coincide with the GHOW activity confirmed on July 1. Nests were gradually classified as abandoned the weeks following July 1 once confirming no activity was observed at the nest.

Clutch Size

The season yielded 189 nests with 339 eggs. The average CLTE clutch size at the nesting site was 1.8 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, Abandoned, or Damaged. Table 2 summarizes the outcome of the 339 eggs documented during the 2022 season.

Table 2 Egg Classification and Outcome

Classification	Number of Eggs
Hatch	169
Predated	23
Abandoned	146
Damaged	1
Total	**339**

Out of the 339 eggs documented, 169 eggs were determined to have been a hatch, yielding a hatch success rate of 50 percent. Of these 169 hatches, 14 chicks were found dead (12 of non-predatory causes and 2 taken by an AMKE [take observed by WI]) amounting to 8 percent of the total hatch and 4 percent of the total egg production. This resulted in 155 potential fledglings. However, no more than four fledglings were confirmed by monitors during site visits.

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.

Consistent with the method used in previous years to determine number of fledglings, the median number of possible fledglings was calculated by using the maximum number of observed fledglings (n=4) on site and the maximum possible surviving chicks (n=155). With this approach, it is estimated that 80 fledglings would have been produced. This estimate is based on: 1) the observation of 4 fledglings south of the CNS at the end of the nesting season, and 2) knowing that total fledglings cannot exceed 155 (due to known mortality of 14 chicks of the 169 eggs that hatched). As such, the median value of the range between 4 and 155 was used as an estimate range. However, this year, the previous years' approach is not appropriate due to the significant drop in CLTE adult and chick activity observed at the CNS in late June through early July and the maximum number of fledglings observed by monitors during any one site visit being four. Based on the lack of CLTE activity observed, it is unlikely more than four chicks fledged during the 2022 nesting season. Figure 5 displays an overview of the egg outcomes based on field observations.

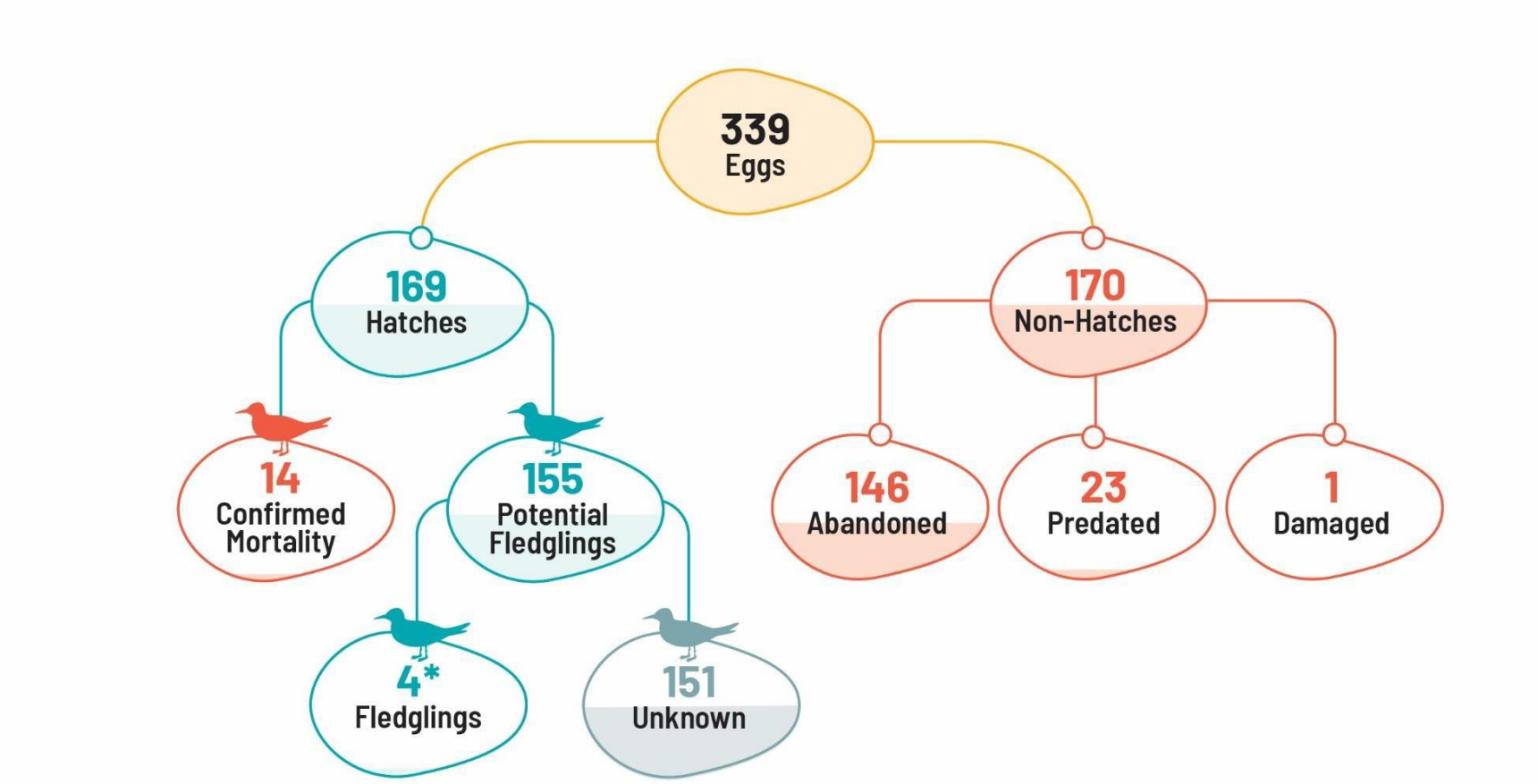
Chick Banding

Ryan Ecological Consulting banded 25 chicks on June 27 with USGS Bands (band span: 2891-46285 to 2891-46298, 2891-46300, and 2921-55601 to 2921-55610). Most chicks were newly hatched and weighed between 4.8 and 16.4 grams and had a wing chord between 13-24 mm. This is consistent with 1 to 5-day-old chicks, indicating hatching began approximately June 22. Most chicks were still too small to be banded with larger alphanumeric bands, therefor only one individual was marked with a green-white band K17.

On July 11, 14 days later, the 25 chicks were calculated to be between 14 to 19 days old. Chicks marked during the first banding were recaptured, remeasured to obtain growth trajectories, and marked with alphanumeric bands. During this second survey, only one (band 2921-55607) of the 25 chicks was recaptured. A second unbanded chick with a wind chord of 73 mm, and a weight of 36 grams was captured, indicating it was approximately 14 days old. The unbanded chick was banded on this day (band 2921-55612) . Additionally, two chicks were observed outside the chick fence, one of which had alphanumeric band 2921-55609 (green-white K17).

In summary, 23 of the 25 chicks banded on June 27 were not seen again two weeks later at the second banding effort on July 11. On July 11, four chicks were observed, 2 of which had been banded on June 27. A total of 26 chicks were banded in 2022.

Figure 5 2022 Nesting Season Egg Outcomes



*Maximum number of fledglings (n=4) observed by monitors during a single site visit.
Accounts for the decrease in CLTE adult activity at the CNS due to the great horned owl depredation event.

4.2 Predator Management

Predator management efforts resulted in the removal and/or translocation of 25 predators, including 21 AMCR, two CORA, one feral cat (*Felis catus*), and one GHOW. Avian predators comprised 96 percent (n=24) of removals, with corvids accounting for 95.8 percent of these. More predators were removed in April (n=21; 84 percent) than in other months.

Camera Trapping

A single trail camera was positioned on the northwestern section of the CNS chick fence on March 17. This camera did not record any predators within the CNS and had consistent connectivity issues during its deployment, therefore it was subsequently moved to the sand fence just southeast of the CNS on April 20. A total of two predator detections were made in the 102 camera trap nights (0.02 detection rate) of deployment. This camera recorded a photograph of a single feral cat on April 25 and multiple photographs of a single raccoon (*Procyon lotor*) on July 1. The camera was also used briefly to monitor CORA leghold trap sets remotely, while WI observed from a few hundred meters west of TMA-W, during the last trapping efforts in July. The camera was pulled from the field on July 8 for off-season maintenance.

Feral Cats

A total of 21 trap nights, resulting in the removal of one feral cat and a trap success rate of 4.8 percent. Trapping for feral cats continued after this individual was removed, as new observations of tracks indicating at least one more individual was active in the area. However, no other cats were captured. Based on morphological characteristics of the individual that was removed, WI believes that it was the same cat captured by the cellular trail camera on April 25, although, this could not be confirmed.

Corvids

A total of 23 corvids were removed, with AMCR comprising 91.3 percent of these removals. Common ravens accounted for the remaining 8.7 percent (n=2) of corvid removals. All CORA and 85.7 percent of AMCR (n=18) were removed via trapping, while only three AMCR (14.3 percent) were removed directly via firearm. Common raven removals occurred in April and May. The majority of AMCR removals occurred in April (95.2 percent; n=20) with the remaining occurring in May (4.5 percent; n=1).

Raptors

A total of 32 trap hours were expended to target two individual raptors for trapping and translocation on the Pier 400 nesting site this season. An adult male AMKE was first targeted on July 1, with trapping efforts continuing for this individual the following afternoon and evening, using a BC trap and bownet; however, this bird did not appear the next day and was never captured. A GHOW was targeted for trapping, via BC, on the night of July 1 within an hour of initiating efforts. The GHOW was banded and moved to a temporary holding facility at Skyhunters where it was held until it could be translocated to a location approved by the USFWS and CDFW.

Elegant Terns

Hazing of ELTE was initiated on May 16 and was conducted for three consecutive days (ending on May 19) until observations suggested they gave up on their nesting attempts at CNS. Nesting attempts by ELTE were more frequent/aggressive during early evening hours and just prior to sunrise, especially on May 16 and 17. On May 18, there were fewer nesting attempts, and, on May 19, there were none observed. Therefore, hazing efforts were concluded.

4.3 Predations

A total of 24 CLTE predations were reported during the 2022 nesting season, of which 79 percent were nests (n=19), 13 percent were adults (n=3), and eight percent were chicks (n=2). Common ravens were responsible for 90 percent of nest predations (n=17), whereas the remaining 10 percent (n=2) were caused by unknown predators. All three adult predations were attributed to unknown raptors, although it is believed that a GHOW was responsible. An AMKE was responsible for both chick predations observed on-site. Predations occurred throughout the season; the majority (63 percent; n=15) occurred in May, and the remaining occurred between June and July (38 percent; n=9).

5 Discussion

5.1 California Least Tern

Comparing 2022 CLTE activity to previous years may elucidate trends and highlight irregularities usefulforinforming future management recommendations. In this sense, the 2022 nesting season was rather typical in some ways, although marked differences in CLTE activity were evident when compared with previous years. These differences are discussed below and include higher egg counts but fewer nests and successful fledglings than in 2021.

Arrival and Departure

California least tern were estimated to have arrived at the Pier 400 site on April 28, 2022. Based on past data reported, the arrival of CLTE on April 28 was typical of previous years. For example, CLTE were first observed over the CNS on April 19 in 2021, on April 20 in 2020, and on April 24 in 2019 (LBC 2019; LBC 2020; LBC 2021). However, their 2022 departure date of July 27 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. In 2021, the departure date was August 3. The early 2022 CLTE departure is believed to be the result of a GHOW, and possibly great blue heron (*Ardea Herodias*), aggressively hunting the site in late June which led to the rapid reduction of chick numbers, adult CLTE nest attendance, and ultimately site abandonment. The details of the GHOW incident are discussed in further detail below.

Nest Initiation and Outcomes

During the 2022 nesting season, 189 nests and 339 eggs were recorded. In comparison to the 2021 nesting season, during which 198 nests and 332 eggs were recorded, the 2022 nesting season saw lower nest numbers but higher egg counts than the previous year. Based on the CNS historical nest data (LBC 2021), the 2022 nesting season was not significantly different from that of the previous 10 years with respect to the number of nests (one sample t-test, p=0.17). However, the 2022 nesting season had significantly more associated eggs than the previous 10 years (one sample t-test, p=0.03) (LBC 2021). From 2005 to 2021, an average of 205.5 nests and 324.5 eggs per year was calculated (Appendix A, Table 1).

These results may be best understood within their historical context. 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 significantly across the state since 2007 (Lewison and Deutschmann 2014). Still, a modest recovery occurred at the Pier 400 nesting site from 2010 to 2022, with nest numbers averaging around 152 nests per season (excluding 2011 (n=10) and 2017 (n-5) when the site experienced a drastic decrease in nests) (Appendix A, Table 1). Previous biologists/surveyors attributed this increase in nest numbers to local conditions, such as improved environmental conditions and the recruitment of CLTE from other regional sites (LBC 2021). This increase may have also been a result of the improved statewide population conditions, which also showed an overall

increase in the population of CLTE (Keane 2013, LBC 2021). The 2022 results are similar to those of recent years, and thus may indicate that this modest recovery effort appears to be holding steady.

Looking beyond the Pier 400 nesting site, the population of CLTE has increased statewide since 1997. This is thought to be primarily due to improved predator management, improved prey base, and the addition of nesting sites throughout the years. The overall statewide population peaked in 2011 at approximately 7,100 nesting pairs and declined in the following three years to approximately 5,350 pairs in 2014. Interestingly, nest initiations at the Pier 400 site have rebounded modestly since 2011 (2017 notwithstanding) while statewide recorded nest initiations have declined. Still, nesting trends statewide and within Pier 400 are not always so dissimilar. For example, a long-term analysis of statewide CLTE data indicated the number of nesting pairs and nests declined significantly across the state since 2007 (Lewison and Deutschmann 2014); a period when Pier 400 had also shown an overall decline in the number of nests (LBC 2021).

Clutch Size

The 2022 season had an average CLTE clutch size of 1.8 eggs. This clutch size is both similar to the previous year (1.7 eggs) and slightly increased from the Pier 400 10-year average of 1.6 eggs (LBC 2021; Appendix A, Table 1). Statewide, clutch size has remained constant at an average 1.5 eggs per nest from 1990 to 2013 (Lewison and Deutschmann 2014).

Egg and Hatching Outcomes

Egg and hatching outcomes from the 2022 nesting season were relatively similar to those from the previous year. Of the total eggs in 2022, hatch success rate was 50 percent, predation rate was 7 percent, and abandonment rate was 43 percent. In 2021, the hatch success was 59 percent, predation rate was 7 percent, and abandonment rate was 34 percent. In comparison to 2021, 2022 was lower in hatch success rate, the same in predation rate, and higher in abandonment rate.

Fledgling Productivity

We documented that between 2-4 chicks fledged in 2022. Using the same method as previous years, which does not apply to 2022, it is estimated that 80 fledglings would have been produced at the Pier 400 nesting site in 2022. This is slightly less than the 91 fledglings produced in 2021 (LBC 2021), and not significantly different from fledglings produced in the previous 10 years (one sample t-test, p=0.06). This estimate has been used in previous years to assume that not all fledges were observed, and neither were all mortalities. However, this year, the estimate is high and not accurate. There was no confirmation through direct observation but the precipitous decline of CLTE adult (e.g., approximately 200 adults present on June 27 vs. approximately 6 adults present on July 5) and chick activity, including the high rate of nest abandonment following the GHOW's presence, does not support the traditional estimate method. It appears that after the GHOW threatened the colony and the adults abandoned the site, chicks that were not able to depart on their own likely succumbed to the GHOW or other predators and scavengers (additional predator information noted below in *5.2 Predator Management*). Additionally, no more than four fledglings were confirmed by monitors during any one site visit and therefore it is it unlikely more than four chicks fledged during the 2022 nesting season. As such, estimated fledglings decreased by 96 percent, from 91 estimated fledglings in 2021, to 4 estimated fledglings in 2022. When comparing 2022 estimated fledglings to the average estimated fledglings from 2012-2021 ($\bar{x}$ = 61.8), the 2022 estimated fledglings were lower by 94 percent.

No recent statewide data is currently available from the CDFW; however, local nesting data shows that the number of fledglings reported from the seven nesting sites in the Los Angeles and Orange County regions increased from 187 in 2015 to 202 in 2017 (LBC 2019). Considering this regional data, the 2022 nesting season at the Pier 400 nesting site would be considered a low production year in comparison.

5.2 Predator Management

To maximize the effectiveness of the predator program, WI prioritized management efforts for predators based on their perceived threat level. As previously noted, 189 CLTE nests and 339 eggs were documented during the 2022 nesting season, with 23 eggs (12.2 percent) predated. Much like previous seasons, CORA were responsible for most of these nest predations, based on the tracks that were discovered during predation investigations. Although the two chick predations, by an AMKE, were observed by WI, the three adult CLTE remains were not investigated by predator control staff, as they were not on-site upon their discovery and no evidence remained by the time of their arrival. Initially, the three adult predations were attributed to a PEFA; however, observations and further evidence discovered by WI later revealed that a GHOW was aggressively hunting the site and may have been responsible for these predations. The substantial reduction of chicks and adult CLTE observed between June 27 and 30 indicates that the number of chick losses from predation were much higher than what was observed by predator control and monitoring staff. Due to observations and discovery of predator signs within CNS on July 1, multiple predators, including great blue heron, AMKE, and GHOW, are suspected to be responsible for the loss of chicks.

5.2.1 Mammalian Predator Management

Mammalian predators detected on Pier 400 this season included feral cats and one raccoon. Feral cats rank as one of the worst invasive species globally and were detected on-site during the 2022 nesting season. Fortunately, although evidence of an inactive feeding station was discovered far west outside of the CNS, no cat tracks were detected within the chick fence and no predations were suspected from feral cats this season.

Feral cats or free-roaming domestic cats were detected on-site this season both during track surveys and on camera trap footage. Free-roaming domestic cats have been listed among the 100 detrimental non-native invasive species in the world and are estimated to kill billions of native birds and mammals annually within the United States (Loss et al. 2013). A threat to CLTE at all life stages (adults, fledglings, chicks, and eggs), feral cats were targeted for removal immediately upon detection in order 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.

Feral cat tracks were sporadically detected on Pier 400 throughout the nesting season, although, activity for consecutive nights was never observed. This behavior limited the opportunity for trap exposure during trapping efforts, as traps could not be run for extended periods of time. Additionally, evidence of a feeding station in the far western corner of the site was discovered on June 11. Supplemental feeding stations have a major influence on numbers, home range, and behavior of cats in an area (Tennent and Downs 2008). This feeding site appeared to be nonactive when it was discovered; however, due to its presence, WI believes there may be additional feeding

stations in the surrounding area. Monitors as well as WI continued to observe tracks following the removal of the feral cat on May 27. Although tracks were found on the borders of the chick fence, no cat tracks were detected within the interior of the chick fence, and no predations were suspected from feral cats this season.

No raccoons or their signs were observed this season inside the chick fence. Racoon activity was limited to the camera trap photographs on July 1 outside of the chick fence and no predations were suspected from racoons this season. No raccoons were captured or euthanized.

5.2.2 Avian Predator Management

During the 2022 nesting season, the primary avian predators were corvids and raptors. Initially, AMCR were the most prolific potential nest predator on-site, although CORA presented the highest threat to nests. Once nests hatched, predators like raptors became the focus of predator management efforts.

American Crows

American crows are aggressive and primary predators of nesting CLTE on-sites throughout Southern California (Manley and Johnson 2019, Brinkman and Garcelon 2016, Liebezeit and George 2002). 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). The effective removal of AMCR early in the season is essential to providing a safe nesting habitat for CLTE. Therefore, predator management efforts to remove AMCR residing in and around the Pier 400 nesting site were initiated early in the season, prior to CLTE arrival on-site on April 28.

Resident crows were primarily targeted for removal outside the CNS in the TMA-Wby utilizing innovative traps designed specifically for capturing corvids. Inherently with trapping, some individual AMCR were initially or became "trap shy" or wary of trapping efforts, making them more challenging to remove. In order to comprehensively reduce the local AMCR population, and ultimately the threat of predation from these birds from the nesting area, trap shy individuals were targeted directly using a firearm. Using a combination of these methods, WI personnel were able to reduce the threat of nest predations from AMCR early in the season, with 85.7 percent of removals occurring within the first 24 hours of trapping. This removal effort substantially reduced AMCR activity in and around the CNS for the remainder of the season. As such, no predations by AMCR were reported on-site this year. However, WI personnel believes AMCR will continue to be a threat to CLTE at Pier 400 in upcoming seasons, requiring regular management during the pre-nesting season to mitigate.

Common Ravens

Common ravens have been documented to have negative 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.

Although CORA were observed throughout the nesting season, based on observations, only three adults are believed to have been a predation threat to CNS CLTE, with one responsible for most of the CORA predations reported this year. Being aggressive nest predators, CORA, were targeted with trapping in the pre-nesting season, in conjunction with AMCR management. Though one CORA was removed early on April 7, a pair of CORA was observed later in May and remained within the vicinity of the site. This remaining pair were believed to be residents of the area and to have been tending a nest nearby the site. This pair proved to be a challenge to remove due to their extreme weariness to come to the site when any vehicles or personnel were nearby. This behavior may be attributed to their interactions with hazing and deterrents during previous nesting seasons, although this cannot be confirmed. These CORA were believed to be "educated" and wary of control methods including traps they had never been exposed to. Additionally, it was difficult for WI personnel to approach within range to effectively remove them directly via firearm. Trapping efforts also had to be re-evaluated early into the trapping attempts after a non-Project related maintenance staff member came into TMA-W on May 11 and released one of WI's CORA lure birds. Following this incident, WI no longer left traps out of visual range. This likely reduced trapping success, as WI's vehicle had to remain in the area, which the CORA were weary of.

Approaching either in a vehicle or on foot proved to be ineffective throughout the season. Continued trapping efforts using a CORA lure-bird resulted in the capture of one of these CORA in a padded-jaw foothold trap on May 26. The remaining uncaptured individual became increasingly wary after observing the capture of its mate. Though trapping continued to target this bird for two days and during several additional site visits, it was not removed. During this time, WI personnel attempted to lure the bird within firearm range. These attempts were repeated unsuccessful due to limited safe shot windows and the wariness of the CORA. The captured mate was ultimately euthanized, once WI determined it would not be used successfully as a lure bird and was displayed as an effigy within the CNS on May 29 to deter any CORA from foraging on-site. This effigy was moved to different locations during subsequent site visits in an effort to prolong the efficacy of the deterrent. Only one nest predation by CORA was reported later in the season on June 10. Following site abandonment by CLTE, several scavenging events occurred from a suspected individual CORA. WI personnel strongly believed that this was the same targeted individual from earlier based on its behavior. Although a few attempts were made to remove this individual during this time, ultimately, efforts were terminated as this bird was no longer a predation threat for 2022. Wildlife Innovations anticipates that this CORA will remain in the area and will likely present a predation threat to CLTE during the 2023 nesting season; therefore, this individual will be a primary target for pre -season removal efforts next year.

Raptor Management

Observations of raptors were infrequent during the early portion of the season, other than a GHOW observed during the night of April 7 and a PEFA that was observed flying over the site from the north on May 5. Despite these early season observations, raptor activity was not observed again until June 24, when CLTE monitors reported seeing two PEFA passing through the site and briefly perching on the rocks outside the CNS. Predations by raptors were not suspected until June 27 when three adult feather piles were found by monitors. Though a PEFA was initially believed, by CLTE monitoring personnel, to have been responsible for the take, based on predator surveillance and the discovery of signs collected within the CNS by WI, it was then believed that a GHOW was responsible for the adult predations. Surveillance for raptors continued throughout the remaining season, but no other observations were recorded until June 29 when an AMKE was reported on-site. Based on monitoring observations on June 27 and 30, there was an apparent reduction of both chicks and adult CLTE active on-site, and ultimately site

abandonment, between those dates. WI believes this was the result of intense hunting pressure from a GHOW for at least two to three consecutive nights during this time.

Great Horned Owls

Great horned owls are documented predators of CLTE in southern California (Keane 1999; Zimmerman 2008; Frost 2015, 2017). Although a GHOW was observed early in the nesting season it was not suspected of hunting on CNS or predating CLTE until much later. On July 1, WI conducted an in-colony search to find evidence that would aid in determining the cause of the drastic chick loss reported by monitors. This resulted in the discovery of numerous GHOW tracks and impact points from prey capture attempts within the CNS. Predator management priorities shifted to targeting this individual for immediate trapping and translocation off site. Given the severity of the threat this owl posed on the remaining CLTE on-site, a request was made by Rachel McPherson, with LAHD EMD, to USFWS permitting agents for a one-time permission to trap and translocate this individual, as GHOW were not listed on the POLA MBTA Depredation permit. Permission was granted on July 1 and WI deployed raptor traps that same evening to target the owl. The GHOW was subsequently captured that night within an hour of trap deployment and then banded and translocated.

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). An AMKE was observed on-site by monitors on June 29. However, no hunting behavior targeting CLTE was directly observed until July 1. On this afternoon, WI observed an adult male AMKE enter the CNS and immediately depredate a CLTE chick. Once the AMKE was off site, WI deployed a BC trap within the southern edge of CNS. Immediately upon its return to the site, the AMKE flew to the trap. Over a period of approximately 15 minutes, the AMKE transitioned between the top of the trap and to the ground several times; however, it was not snagged by the trap and took flight from the trap to depredate another chick several meters away. After consuming the second chick, the AMKE then returned to the trap once again but did not get captured. After approximately 5 minutes, the bird left the site and was not observed again for the remainder of the season, although WI continued trapping efforts with BC traps and a bownet the following day. Although only two confirmed chick depredations were observed from an AMKE, it is likely that there were more chicks taken by this individual that were not observed.

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). Therefore, GBHE were elevated in their threat level and WI increased awareness and surveillance for them in the CNS and surrounding area. No direct observations were made of GBHE within the CNS; however, tracks were discovered inside the CNS on two occasions, one being on July 1, following the disappearance of chicks. Based on WI's investigation of these tracks (short flights within the CNS), the tracks suggested that this individual was responsible for at least some of these chick losses. Although GBHE were not listed on the POLA Depredation Permit in 2022, due to their high threat level to CLTE chicks, it is strongly suggested that individuals observed within nesting areas, away from water where they could be foraging for fish or other aquatic prey items, be targeted for immediate removal in subsequent years.

5.2.3 Non-Predator Deterrence

Elegant terns pose a significant threat to CLTE nesting, as ELTE occupy similar nesting habits to that of CLTE. During the 2022 nesting seasons, hazing techniques were successfully implemented to deter a group of ELTE making scrapes on-site.

Elegant Terns

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). Occupying similar nesting habitat as CLTE, competition between the two species can lead to negative impacts on CLTE nesting. At Pier 400, ELTE nesting was documented in the CNS during the 2019 nesting season, resulting in the trampling of CLTE eggs (LBC 2019). Should management efforts not be implemented to deter ELTE from congregating/nesting in an area, due to their large size and aggressive behavior, they could quickly take over a site and exclude other species like CLTE from nesting and/or destroy their nests.

To prevent ELTE from overtaking the CNS during the 2022 nesting season, WI personnel responded immediately to employ hazing upon reports of ELTE on the ground and making scrapes on-site. A handheld green laser was primarily used to haze ELTE out of the nesting area. Initially, when WI arrived on-site during mid-day hours, the laser was ineffective due to the lower visibility of the beam; therefore, WI began hazing ELTE on foot. However, once the sun began setting, the laser effectiveness was elevated, resulting in immediate responses from ELTE both in flight and on the ground. The laser was extremely effective at night, and WI was able to prevent the ELTE from congregating on-site for four consecutive days. After 48 hours of intense hazing, landing attempts by ELTE in the CNS were reduced substantially and eventually stopped completely. Although the efforts required to successfully deter ELTE from nesting on CNS in future years could be highly variable, it is important that hazing be employed immediately following their first attempts at congregating on-site to help increase the chances of deterrence prior to them laying eggs.

6 Recommendations

The following recommendations for the 2023 nesting season are provided in the interest of ensuring the best conditions for CLTE productivity.

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 three years, silt fence placement along the east end of the buffer zone has helped to reduce sand loss. The site may need a new layer of sand sometime in the future.

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 addition of 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 to help prevent unwanted mammals from gaining access to the CNS. Based on previous years of fence establishment, the chick-fence should be at minimum 18 in. above ground and buried at least 12 in. below ground extending horizontally away from the CNS to deter burrowing animals.

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.

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.

TMA-W Weed Management

Hand-removal of noxious weeds and invasive vegetation was successful for 2021, as it was in previous years, and is recommended again for 2022. 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.

Worker Education Program

Conduct a Worker Education Program for new Pier 400 personnelwith 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.

Human Disturbance

To avoid potential impacts to CLTE during the nesting season, personnel should document and report to LAHD EMD or Harbor Patrol, 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.

Increase Site Visits

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.

Depredation Permit Amendment

Amending the POLA's Migratory Bird Treaty Act depredation permit may lead to an increase in the number of species and individuals that can be removed for predator control purposes. This may allow for quicker management response to high threat individuals, while also addressing the limited current avian predator removal.

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8 List of Preparers

Rincon Consultants, Inc.

Primary Author

- Monica Jacinto, Senior Biologist/Project Manager

Secondary Author

- Benson Truong, Biologist
- Andrew Sandahl, Biologist

Technical Review

- Jennifer Turner, Natural Resources Director

Graphics

- Isabelle Radis, GIS Analyst
- Jessica Ripley, Graphic Designer

Publishing

- Dario Campos, Technical Editor
- Luis Apolinar, Publishing Specialist

Wildlife Innovations

Primary Authors

- Jake Manley, President/Wildlife Biologist
- Blake Johnson, Wildlife Biologist

Ryan Ecological Consulting

Technical Reviewer

- Thomas Ryan, President/Wildlife Biologist

Langdon Biological Consulting

Technical Reviewer

- Spencer Langdon, President/Wildlife Biologist

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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 – 2022

Table 2 Nesting and Productivity at Los Angeles Harbor Nesting Sites, 1973 to 2022

Table 1 Nesting Statistics for Pier 400 with Comparisons to 2005 – 2022

	Average 2005-2022	% Change from 2021	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
Total Nests	**327.11**	**-4.55**	**189**	198	182	200	133	5	141	110	126	254	211	10	216	435	529	710	907	1332
Re-nesting Terns[b]	**27.61**	**0**	**17**	0	182[f]	38	36	0	15	0	14	17	8	2	52	64	43	41	72	78
Total Nesting Pairs[b]	**300.33**	**-13.13**	**172**	198	182	162	97	5	126	110	93	245	203	8	190	371	486	669	835	1254
Total Eggs	**545.39**	**2.11**	**339**	332	284	304	230	9	209	178	205	392	358	16	345	685	891	1135	1494	2411
Mean Clutch Size (average eggs per nest)	**1.63**	**5.88**	**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	**365.11**	**-13.78**	**169**	196	129	219	149	0	103	13	143	274	268	5	49	302	582	742	1031	2182
Hatching Success (eggs hatched of total eggs)	**0.53**	**-15.25**	**0.50**	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	**41.78**	**-4.17**	**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	**0.20**	**-3.08**	**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	**137.78**	**30.36**	**146**	112	7	46	54	0	88	20	42	96	77	11	158	328	276	385	434	213
Percent of Total Eggs Abandoned/Infertile	**0.28**	**26.67**	**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)	**124.28**	**-73.08**	**14**	52	18	33	33	0	14	13	31	127	86	5	6	126	172	349	260	898
Percent Mortality (% of total chicks hatched)	**0.33**	**-69.32**	**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[c]	**123.72**	**-94.74**	**2**	38	3	60	22	0	46	0	16	31	35	0	4	75	201	186	641	867
Maximum Fledglings[d]	**90.09**	**-97.22**	**4**	144	111	186	116	0	89	0	112	147	82							
Final Fledglings[e]	**64.18**	**-95.60**	**4**	91	57	123	69	0	66	0	64	89	59							
Fledglings per Nest	**0.28**	**-95.40**	**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[d])	**0.28**	**-94.85**	**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	0.4
Fledglings per Pair (minimum)	**0.30**	**-94.94**	**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

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

[b] 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).

[c] The minimum fledgling estimate is based upon one of the four methods recommended by CDFW: Method 3WD; Beginning two weeks after the first fledglingobservation, 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 nestingsite by adults and fledglings. Thus, an alternative method was also used to estimate fledglings; see note "d" and "e", below.

[d] 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 estimatedand the Minimum Fledglings estimated was the sum of the maximum number of fledges observed during a 2-week, observation period as in note "c", above. In 2022, this method was applied as an alternative method and is not displayed in this table. The Maximum Fledglings total in this table is based on field observations.

[e] 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.

[f] 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 to 2022

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]**

[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 2022 Nesting Season

Wildlife Species Observed at Pier 400 During the 2022 Nesting Season

Scientific Name	Common Name	Status	Native or Introduced
Birds			
Aechmophorus occidentalis	western grebe		Native
Anas platyrhynchos	mallard		Native
Ardea herodias	great blue heron*		Native
Arenaria melanocephala	black turnstone		Native
Bubo virginianus	great horned owl*		Native
Calidris maur	western sandpiper		Native
Calidris virgata	surfbird		Native
Charadrius nivosus nivosus	western snowy plover**	federally threatened	Native
Charadrius vociferus	killdeer		Native
Columba livia	rock pigeon		Introduced
Corvus brachyrhynchos	American crow*		Native
Corvus corax	common raven*		Native
Falco peregrinus	peregrine falcon*		Native
Falco sparverius	American kestrel*		Native
Haematopus bachmani	black oystercatcher		Native
Haemorhous mexicanus	house finch		Native
Hirundo rustica	barn swallow		Native
Hydroprogne caspia	Caspian tern*		Native
Larus californicus	California gull*		Native
Larus heermanni	Heermann's gull*		Native
Larus occidentalis	western gull*		Native
Melanitta perspicillata	surf scoter		Native
Melozone crissalis	California towhee		Native
Mimus polyglottos	northern mockingbird		Native
Nannopterum auritum	double-crested cormorant		Native
Numenius phaeopus	whimbrel*		Native
Pandion haliaetus	osprey*		Native
Passer domesticus	house sparrow		Introduced
Pelecanus occidentalis	brown pelican		Native
Rynchops niger	black skimmer*		Native
Sternula antillarum browni	California least tern	federally and state endangered	Native
Thalasseus elegans	elegant tern		Native
Thalasseus maximus	royal tern		Native
Urile pelagicus	pelagic cormorant		Native
Zonotrichia leucophrys	white-crowned sparrow		Native
Mammals			
Didelphis virginiana	Virginia opossum*		Native
Felis catus	feral cat*		Native
Procyon lotor	raccoon*		Native

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

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