

SAN DIEGO AUDUBON SOCIETY



Improving CA least tern habitat at FAA Island

Final Report

CDFW LAG Agreement No. P1182115

March 31, 2014

The following document details habitat management at FAA Island during the course of San Diego Audubon's Local Assistance Grant from the California Department of Fish and Wildlife during 2012-2014. This report includes all management actions implemented at FAA, the results of post-nesting season evaluation of management actions, evaluation of progress made towards meeting objectives, management changes in year 2 as compared to year 1, a list of data transferred to SDMMP for inclusion in SC-MTX, and a prioritized list of management recommendations for the site. Inquiries may be directed to Rebecca Schwartz, Conservation Program Manager at San Diego Audubon (schwartz@sandiegoaudubon.org).

Improving CA least tern habitat at FAA Island- Final Report

Introduction/Background

As part of a Local Assistance Grant (LAG) from the California Department of Fish and Wildlife, San Diego Audubon (a wildlife conservation non-profit organization) has been conducting habitat management efforts at FAA Island, in Mission Bay, CA. This grant covers the period March 8, 2012-March 31, 2014. California least tern (CLTE) is a state and federally listed endangered species and is a “covered species” in both the San Diego Multiple Species Program (MSCP) and the San Diego Habitat Conservation Program (MHCP) plans. Current and historically important nesting areas within these plan areas include San Diego Bay, Mission Bay, and Batiquitos Lagoon.

CLTE nest at multiple locations within Mission Bay and historically, two nesting sites (FAA Island and Mariner’s Point) supported over 80% of the Mission Bay breeding/nesting pairs and a corresponding percentage of the fledglings. However, average nesting pairs at FAA Island decreased from an average of 177 nests per year during 2000-2004 to 20 nests per year during 2005-2009. This decrease has been attributed to multiple stressors, with a change in vegetation cover at FAA Island anecdotally cited as the main cause of decline at the site.

San Diego Audubon works to manage CLTE nesting habitat at several sites throughout Mission Bay and this grant allowed for efforts to extend to FAA Island, with a goal of adaptively managing the site in a manner that provides least tern nesting habitat that is integrated with native plant species habitat, with a longer term goal of reducing management costs and increasing nesting success.

This report contains:

- Management Actions Implemented at FAA Island (Page 3-9)
- Results of Year 1 Post Season Evaluation (Page 9-10)
- Evaluation of progress made towards meeting objectives (Page 10-11)
- List of data transferred to SDMMP for inclusion in SC-MTX (Page 12)
- Prioritized list of management recommendations (Page 12-13)

Management Actions Implemented at FAA Island

- March 8, 2012: Grant agreement signed
- March 9-September 1, 2012: Action Plan Development
 - San Diego Audubon staff and partners generated the FAA Island Management Action Plan to help guide the conservation efforts of San Diego Audubon during execution of this grant. This document outlines a plan of actions to adaptively manage FAA Island to ultimately improve CLTE nesting success. As with all adaptive management efforts, which incorporate an iterative process of decision making to meet resources management objectives, on-the-ground realities are taken into account to inform conservation actions.

Year 1 Actions (September 2012-April 2013)

- September 18, 2012:
 - Mike Kelly, of Kelly and Associates, was contracted by SDAS to conduct herbicide application at FAA. Mr. Kelly and his crew spot-sprayed glyphosate to reduce cover of green plants that had not yet gone to seed. Sprayed plants¹ included Russian thistle, crystalline iceplant, Australian salt bush, immature telegraph weed, and stinkwort.
- September-November 2013:
 - San Diego Audubon staff established photo monitoring points, mapped existing vegetation, and selected a protocol to monitor percent cover and native-to-invasive species ratio (per FAA Island Management Action Plan).
- November 13, 2012:
 - Biomass removal via weed whacking and hand-pulling by San Diego Audubon staff and five volunteers, resulting in the donation of 30 hours of volunteer time to this project. Upon visiting the site, it was determined that native *Camissonia* cover far exceeded standards for CLTE nesting. Therefore, *Camissonia* was removed to create a heterogeneous landscape with areas of bare ground and areas of higher vegetation cover following methods used by San Diego Audubon at Mariner's Point (Mission Bay's historically most productive CLTE site) for over 20 years.
 - Photo monitoring of the site was conducted using 25 designated photo-monitoring points on the island. These points were chosen deliberately so that all areas of the island are captured in the photo monitoring set and also

¹ A note about nomenclature: Plant varieties in this report will be referenced using either their common or scientific name, depending on which is most commonly used in the vernacular of those involved in management. When common names refer to several locally co-occurring species, the scientific name will be included parenthetically. Some plants will be referred to by genus name only in the case where they are not usually identified to species in the field, significant hybridization occurs, and/or management actions do not differ by species. For example, both *Salsola gobicola* and *Salsola tragus* are found on the island, but both species (collectively known as Russian thistle or tumbleweed) are dealt with in the same manner and have a tendency to hybridize.

for ease replicability (e.g., many points are directly on top of permanent government signs).

- December 19, 2012:
 - Community work party held on FAA Island to rake up remaining biomass from the November 13 weed-whacking. This event engaged 12 volunteers, including 7 first time volunteers, and resulted in the donation of 36 hours of volunteer time to this project.



Figure 1: Photos from the December 19, 2012 work party to rake up plant biomass.

- January 21, 2013:
 - Mr. Kelly and his crew applied glyphosate herbicide to the island. He was assisted by Sandy Vissman of the U.S. Fish and Wildlife Service, who has provided site access during the duration of this project.
 - Note: While the Action Plan called for pre-emergent herbicide application during November 2012, this was not feasible due to a lack of rain. Due to the likeliness of this change in schedule, it was referenced in the action plan.
- March 1, 2013:
 - Mr. Kelly, accompanied by Sandy Vissman and Stephanie Ponce (CA Department of Fish and Wildlife), visited FAA Island to conduct another round of glyphosate treatment. This treatment focused on the north-east corner of the island, which was not finished on the January 21 trip, as well as touch ups around the rest of the island. During both the January and March

trips, herbicide application targeted filaree and telegraph weed, as well as non-native grasses.

- The biomass removal efforts during fall and winter resulted in a large pile of brush on the north-east corner of the island. Bagging and removing the plant material was not feasible due to the sheer volume of biomass. During this trip, Ms. Vissman and Ms. Ponce experimented with baling up the plant material for transfer off the island.
- March 16, 2013:
 - Community work party held on FAA Island to bale up the large pile of plant biomass into smaller bundles. This event engaged 22 volunteers, including 16 new volunteers, and resulted in the donation of 36 hours of volunteer time to the project.
- March 21, 2013:
 - San Diego Audubon staff and four volunteers transferred the bales from FAA Island to Fiesta Island via flat-top boat. This turned out to be a very successful method for biomass removal.



Figure 2: SDAS and USFWS staff removing bales of plants from FAA with volunteers

- Early April 2013:
 - San Diego Audubon and its partners, including Ms. Ponce, determined that placing roofing tiles on the site as protective structures for the chicks would be a positive addition to management efforts. Per Ms. Ponce's

recommendation, 30 tiles were placed on the site in groups of three, in a pin-wheel formation.

- Following extensive discussion regarding the efficacy, appropriateness, and availability of CLTE decoys, 40 decoys were placed on FAA Island to help attract the terns. The decoys were placed in two groups of 20, one on the north side of the FAA structure and one on the south side. The decoys were placed according to the CA Least Tern Decoy Deployment Protocol (Appendix A). Though this action was not originally part of the action plan, it became clear that, like the roofing tiles, this would be a helpful addition to the management work.
- April 12, 2013:
 - A second round of photo monitoring was completed by SDAS staff.
- April 25, 2013:
 - Some significant last-minute regrowth of invasive annuals necessitated an additional round of herbicide application by Mr. Kelly on April 25. Though past the April 15th start of CLTE nesting season, this action was approved by the USFWS and CDFW prior to visiting the island. During this round, herbicide application was focused on garland chrysanthemum, cheeseweed, filaree, and bromus grasses. Mr. Kelly reported a significant amount of blooming *Camissonia*.

Year 2 Actions (September 2013-March 2014)

- November 15, 2013:
 - Three San Diego Audubon staff, one volunteer (who donated 5 hours of his time), Mr. Kelly, and Ms. Vissman visited the island to conduct photo monitoring of the island, transect-based vegetation monitoring, initial brush clearing, and to confirm the scheduled course of herbicide application for the coming months. Russian thistle (*Salsola* spp.), telegraph weed, and *Bassia* were common on the site, as was the native *Camissonia*. Salt heliotrope (*Heliotropium cicutarium*) was present but not prevalent, and no coast wholly heads were identified.
 - San Diego Audubon used a transect-based vegetation monitoring protocol consistent with the one used by San Diego Audubon and its partners at other CLTE nesting sites in Mission Bay (Appendix B). Transects were assigned randomly as described in the Year 1 Outcomes Report.
 - A third round of photo monitoring was completed.
- December 15, 2013:
 - Community work party held on FAA Island to help control Russian thistle (tumbleweed) and other non-native plants. This event engaged 13 volunteers, including two new volunteers, and resulted in the donation of 39 hours of volunteer time.

- February 13, 2014:
 - Following an unseasonable dry winter in San Diego, San Diego Audubon staff visited FAA Island with Sandy Vissman and Mike Kelly to determine an updated herbicide strategy (the lack of rain precluded the use of pre-emergent herbicide). The partners agreed that San Diego Audubon would hold a community work event to clear as much blooming vegetation as possible, followed by an herbicide treatment by Mr. Kelly. During this visit, the group conducted preliminary vegetation removal of filaree and bromus grasses that had gone to seed.
- February 22, 2014:
 - Community work party held on FAA Island to clear all blooming invasive annual plants from the site. This event engaged 20 volunteers who donated 80 hours of their time.
 - During this visit, San Diego Audubon found and flagged a patch of coast wholly heads on the north side of the island.
- March 7, 2014:
 - Mr. Kelly and his crew applied glyphosate herbicide to the island, as per our February 13 meeting. He was assisted by Sandy Vissman of the U.S. Fish and Wildlife Service in terms of site access.
 - During this visit, the group found that the major rain event of February 28-March 2 resulted in a significant amount of weed growth since the last visit, with 60-70% cover of these non-native annual plants. Mr. Kelly and his crew sprayed the entire island, avoiding native and sensitive plant species (like the coast wholly heads identified on February 22).
 - Per Mr. Kelly's recommendation, community weeding events will not occur for at least two weeks following this herbicide application to allow for its full effect.
- March 25, 2014:
 - Three SDAS staff, Sandy Vissman, and two volunteers completed more vegetation removal to clear the biomass sprayed by Mr. Kelly on March 7.
 - A second round of transect-based vegetation monitoring was conducted.
- March 28, 2014:
 - A final round of photo monitoring was completed, bringing the total to four rounds (fall 2012, spring 2013, fall 2013, spring 2014).

Management Notes

Though no changes in vegetation management were specifically called out during the post-season evaluation meeting held on November 20, 2013, there were several aspects that San

Diego Audubon had hoped to modify during Year 2, as were outlined in the Year 1 Outcomes Report. The first was the application of pre-emergent herbicide on the island. This was not done during Year 1 due to access issues on the site. However, this is an important step in helping control annual invasive species. San Diego Audubon and our partners were on track to ensure that this was accomplished during Year 2 management actions. However, pre-emergent herbicide requires a heavy rainfall event of at least one inch within two weeks of application (in lieu of that, irrigation is acceptable; however no irrigation is possible on FAA Island). Due to the historically low rainfall levels this year, there was not an opportunity to apply pre-emergent herbicide during the biologically effective growth window. While pre-emergent herbicide was not applied, San Diego Audubon has been working closely with weed experts to come up with an appropriate herbicide application regime consistent with rainfall realities of this year and we are optimistic that our efforts will be successful in managing non-native cover.

The second aspect San Diego Audubon changed during Year 2 activities was the formal removal of monthly photo monitoring from the management plan. Based on the species composition of vegetation growing on FAA, along with the growing season of these plants, it was concluded that monthly monitoring was unnecessary as it would not be more informative for this project than bi-annual monitoring. Bi-annual monitoring in the fall and spring was found to be sufficient to accurately describe vegetation on the island and is consistent with other similar habitat management efforts throughout Mission Bay.

The management plan originally called for mapping of where on the island different management strategies occur (for example, where volunteers raked vs pulled, where herbicide was applied, etc). Due to the small size of the island and the heterogeneous distribution of vegetation across the island (i.e. one cannot say that the north side of the island is “all telegraph weed” and the south side is “all Russian thistle”), management actions are uniform across the site. Effectively all areas of the island are subjected to the same management regime- some pulling, some raking, some spraying. Therefore, mapping where specific management strategies are implemented across the island would not be informative and have not been included.

Finally, San Diego Audubon placed decoys and tiles across the site consistent with methods used in Year 1 and due to little re-growth of native *Camissonia* on the site, thinning was not necessary.

Management Summary

All together, San Diego Audubon management activities at FAA Island engaged 71 volunteers, including 37 first-time volunteers, and resulted in the donation of 237 hours of

volunteer time. Five rounds of herbicide application were conducted and over 50 bales of plant material (each containing approx. 36 cubic feet of biomass) were removed from the island. Approximately 294 meters of chick fencing was maintained through inspection and repair, 40 CLTE decoys and 30 roofing tiles were deployed in 2013 and 2014, and at least 7 separate organizations/entities were involved (San Diego Audubon, CA Department of Fish and Wildlife, US Fish and Wildlife Service, California Native Plant Society, SD Management and Monitoring Program, USDA Aphis, City of San Diego Lifeguards).

Results of Year 1 Post Season Evaluation

San Diego Audubon held a post-season evaluation meeting on November 20, 2013 to discuss the results of the 2013 nesting season. Note that there has not yet been a Year 2 post-season evaluation meeting because, while Year 2 management actions are under way, the Year 2 breeding season (April 15-September 15, 2014) has not yet occurred.

The November 2013 meeting included a discussion of management actions taken by SDAS to date, community involvement, nesting reports, and predator management on the island. The group also discussed potential modifications to the grant in order to meet project objectives and strategies for funding CLTE work at FAA Island after the completion of this local assistance grant. The meeting was attended by Sylvia Busby (San Diego Audubon), Betsy Miller (City of San Diego), Ryan McCreery (USDA Aphis), Yvonne Moore (San Diego Management and Monitoring Program [SDMMP]), Stephanie Ponce (CDFW), Chris Redfern (San Diego Audubon), Ron Rempel (SDMMP), Rebecca Schwartz (San Diego Audubon), Mark Stahl (USDA Aphis), and Sandy Vissman (USFWS). Nancy Frost, Jennifer Jackson, David Mayer, and Kris Preston were also invited, but unable to attend.

During this meeting, there were no suggested modifications to SDAS vegetation management strategies at the site for the coming year as compared to actions taken during Year 1 of the grant.

In terms of predator management, Mark Stahl and Sandy Vissman indicated that perching continues to be a problem, especially the ladder rungs on the tallest tower on the island, and a pipe that extends beyond the perimeter wall of the FAA building structure. Sandy Vissman met FAA representatives following the November meeting and recommended adding Nixalite to more structures and changing the ladder rungs to removable pegs. Mark reported that fewer mice were trapped this year, no gulls were taken, and no raptors trapped. No adult CLTEs were predated during the season, one gopher snake was removed pre-season, and no rats were trapped. SANDAG funding of predator management is part of a 5-year grant, which is likely to be extended.

Ants were identified as a possible source of chick predation, as well as a nuisance for USDA Aphis traps (the ants eat the bait). Ron Rempel reached out to Robert Fisher at UC Riverside to conduct an assessment of ants on the island and identify the problem species, so that control options could be discussed. This effort is currently being scheduled by San Diego Audubon staff and will likely occur during the last two weeks of March. Mark Stahl also indicated that rodenticide would be a good addition to predator control efforts on the island to help control mice.

As with other sites in Mission Bay, predator removal has become logistically very difficult in recent years due to increased complication with respect to permitting by the wildlife agencies. Many entities, including those working with other target species and at other sites, are working together to try to address this problem.

Overall, meeting attendees were pleased with the efforts of San Diego Audubon to control vegetation on FAA Island and provide appropriate nesting habitat for the terns.

Evaluation of progress made towards meeting objectives

Project Objectives:

1. Increase the number of nesting pairs of least terns utilizing FAA Island to greater than 80 pairs per year within three years
2. Increase the number of fledglings to more than 60 young per year within three years
3. Manage FAA Island in a manner to reduce non-native vegetation cover to less than 20% of total vegetation on the island within two years

Objective #1: Increase the number of nesting pairs of least terns utilizing FAA Island to greater than 80 pairs per year within three years.

Progress towards this objective has been incredibly successful. The 2013 CLTE nesting season at FAA saw 156 nests from approximately 80 breeding pairs. This is up from a 5-year average of 25.5 nests and 18 pairs. Wildlife agency staff have consistently remarked that this 6-fold increase in nests is due to the management actions of San Diego Audubon (staff and contractors) and the efforts of our volunteers.

Objective #2: Increase the number of fledglings to more than 60 young per year within three years.

During the 2013 CLTE breeding season, there were a total of 7 fledges from FAA Island. While this is far below the goal of 60 young per year, it still represents a 4-fold

increase from the previous 5-year average of 1.8 fledges per year. However, the 2013 total represents only one year of management, leaving two years left to complete this objective. Of bigger issue, however, is a continuing downward trend in fledgling per pair ratios for CLTE across its range. This trend (and its associated upward trend in chick mortality) over the past four years has been anecdotally linked with limited or inappropriate food sources, underscoring the need to better understand the relationship between nesting productivity, food availability, and predation pressure.

Objective #3: Manage FAA Island in a manner to reduce non-native vegetation cover to less than 20% of total vegetation on the island within two years.²

Significant progress has been made towards achieving this objective. After one season of vegetation management by San Diego Audubon, transect-based vegetation monitoring efforts conducted in November 2013 indicated that approximately 67% of the vegetation on the site was characterized as non-native and 33% was native. After a second season of vegetation management, those numbers were reversed. Transect-based vegetation monitoring efforts in March 2014 indicate that non-native vegetation cover has dropped to approximately 34% (down from 67%). When considering this figure, it is important to note that these monitoring efforts occurred during different seasons. In terms of overall vegetation cover, March 2014 monitoring efforts indicate a current total cover of approximately 6% (as opposed to 13% in November 2013), which is down from a visually-estimated high of 70-80% before management activities began in 2012.

Vegetation monitoring revealed that the native plant community on FAA Island is dominated by *Cammissonia*, while the non-native community is more diverse. Non-native species on the island recorded during March 2014 vegetation monitoring included filaree, telegraph weed, bromus grasses, and devil's thorn. Note that no emerging Russian thistle plants were identified during this effort, but devil's thorn (previously unrecorded) was identified in >50% of quadrats. Though not identified during this effort, informal observations identified salt heliotrope (*Heliotropium cicutarium*), pygmy weed (*Crassula connata*), and coast wholly heads (*Nemacaulis denudate*) on the island. Coast wholly heads are located almost exclusively along the brick walls of the FAA structure and were noted as being incredibly dense inside of the FAA walls (visual observation only).

² For a visual representation of progress made towards this objective, see Appendix C- Photo Monitoring Results.

List of data transferred to SDMMP for inclusion in SC-MTX

The South Coast Multi-Taxa Database (SC-MTX) is a joint project of the San Diego Management and Monitoring Program (SDMMP) and the U.S. Geological Survey San Diego Field Station to develop a centralized database to house both management and monitoring data collected in the South Coast EcoRegion of Southern California (includes all or portions of Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties). San Diego Audubon will transfer the following data to the SDMMP for inclusion in their SC-MTX as a deliverable of this Local Assistance Grant:

1. Digital photographs from photo monitoring efforts
2. Raw data from transect-based vegetation monitoring conducted in November 2013 and March 2014
3. CLTE decoy deployment protocol
4. Photo monitoring and transect-based vegetation monitoring protocols
5. Maps of CLTE nesting activity
6. Maps characterizing dominant vegetation types across the island.

Prioritized list of management recommendations

From 2011-2013, San Diego Audubon has led a large-scale conservation planning process for Mission Bay Park, a designated Globally Important Bird Area (according to BirdLife International). This planning process has convened 40+ stakeholders from 15 separate organizations, including the California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, City of San Diego – Open Space Division, City of San Diego – Developed Regional Parks Division, San Diego River Park Foundation, and several independent biologists. The result of this planning process is the Mission Bay Conservation Action Plan, which was delivered to planning process participants in early March 2014.

This Action Plan is the result of workshops and species-specific working groups' efforts over two years to define conservation targets in Mission Bay, their threats, and priority action items for their conservation. One of these targets is the CA least tern, and San Diego Audubon has worked closely with the CLTE Working Group to understand conservation of this species in Mission Bay. The CLTE Target Assessment, included in the MBCAP, specifically addresses FAA Island and its needs. This effort, along with almost two years of working with partners from the wildlife agencies to manage FAA Island as a CLTE nesting site, resulting in a seven-fold increase in nesting activity, has informed recommendations for effective continued management of FAA Island.

The following prioritized list of recommendations aims to improve outcomes of CLTE nesting, reduce future management costs, and recommendations regarding future monitoring that would better inform future management decisions. As there are three main subject areas requiring recommendation, each recommendation below includes a reference to the subject area it most specifically addresses, based on the following: 1 = improve outcomes of CLTE nesting, 2 = reduce future management costs, 3 = future monitoring to inform management.

1. Continue active vegetation management, including herbicide treatment (1,2,3)
2. Continue CLTE nest monitoring by permitted biologists (1,3)
3. Continue predator management activities (1,2)
4. Reduce predation through increased use of predator-deterrence strategies (e.g., Nixalite installed on major perches on the island, including pipes/poles associated with the FAA compound) (1,2)
5. Increase pest control activities to specifically address ants and rodents (1,2)
6. Implement camera-based predator/nest monitoring (1,3)
7. Increase appropriate nesting substrate through sand addition (1)
8. Continue efforts to simplify and streamline predator trapping and relocation activities (1,2)
9. Continue vegetation monitoring, ideally bi-annually, using photo and transect-based methods (1,3)
10. Test alternative vegetation management strategies (e.g., salt water inundation) (1,2,3)
11. Continue to increase cross-agency cooperation to simplify site access (1,2)

Appendix A

California Least Tern Decoy Deployment Protocol

Drafted by: Rebecca Schwartz, Conservation Program Manager, San Diego Audubon (schwartz@sandiegoaudubon.org)

Date drafted: April 1, 2013

Drafted from: Email correspondence between Chris Redfern (Executive Director, San Diego Audubon, redfern@sandiegoaudubon.org), Brian Collins (Refuge Manager, San Diego Bay and Tijuana Slough National Wildlife Refuges, US Fish and Wildlife Service, brian_collins@fws.gov), Robert Patten (Independent Biologist, rpatton@san.rr.com), and Lauren Kershek (Fish and Wildlife Biologist, US Fish and Wildlife Service, lauren_kershek@fws.gov)

Background

As part of San Diego Audubon's efforts to adaptively manage sand dune habitat in Mission Bay Park to promote nesting by the California Least Tern, tern decoys are placed at city- or state-designated nesting sites. These decoys are the size/shape/color of the CA Least Terns and are thought to attract the migratory birds to sites where the decoys are deployed. Decoys are not only useful as attractants, but also serve as an indicator of possible problems at the site. Once placed on-site, they should be regularly monitored for signs of disturbance, damage, or attempted predation. Toppled or missing decoys and predator tracks adjacent to decoys should be noted and communicated to predator control staff. If using papier mache decoys (rather than plastic, wood, or plaster), then teeth, claw, and bite marks can reveal potential predator problems.

In March 2013, San Diego Audubon engaged Brian Collins and Lauren Kershek (both of the USFWS) and Robert Patten (an independent biologist) in a discussion of the proper deployment of CA Least Tern decoys. The following is the result of that discussion.

Protocol

- Place decoys in groups of 15-25
- Groups should be placed every 100-200 meters across a site
- Decoys should be placed in a loosely associated group, about 1 to 1.5 meters apart
- Up to half of the decoys in a group should be placed in pairs, with 2 decoys set approx. 6 inches apart (with at least 1 meter between pairs or nearby non-pair decoys)
- Point decoys into the prevailing wind
- While decoys should be placed in an open area, care should be taken to limit the amount of prime nesting area occupied by the decoys
- Once placed, decoys should be left in place if nesting begins nearby as the birds may rely on them as a landmark
- To minimize weather damage, decoys should be removed, cleaned, and stored at the end of each season

Notes

Remember: because decoys are attractants and California Least Terns respond well to them, decoys should only be placed at sites that are well-protected from human and pet disturbance, and have adequate monitoring and daily predator management. This will help to minimize luring the terns into danger. If one plans to attract nesting to a particular usage area, there must be adequate site monitoring, management (especially for vegetation), and predator control in place to ensure that decoy use does not inadvertently contribute to the creation of a sink population. Be sure to consider other factors specific to each site before deploying decoys (*e.g.*, environmental changes, disturbance history and sources, availability of appropriate long-term management funding, Migratory Bird depredation permits, etc). Lastly, the biologist who is monitoring the colony should be consulted prior to decoy deployment. This is especially important because once terns have arrived at the site, access to place and/or check the decoys will be limited to that biologist (and those accompanying him/her) per USFWS endangered species permit conditions.

References

1. Burger. 1988. Social attraction in nesting least terns: effects of numbers, spacing, and pair bonds. *Condor* 90:575-582.
2. Ward et al. 2011. Consequences of using conspecific attraction in avian conservation: a case study of endangered colonial waterbirds. *Waterbirds* 34(4):476-480.

Appendix B

FAA Island Vegetation Monitoring Protocol

Modified from: Mission Bay Vegetation Monitoring Protocol

Drafted by: San Diego Audubon, San Diego State University, Institute for Ecological Management and Monitoring

Note: Modifications made to the original Mission Bay protocol only reflect elimination of management procedures relating to the adaptive management study being conducted at other Mission Bay sites (e.g., sand amendment, treatment plots, etc.) which are not being conducted at FAA Island. Point-intercept and quadrat methodology taken from the Mission Bay protocol remain unaltered in the following protocol.

Vegetation Management Goals:

1. Maintain dune vegetation consistent with good CA least tern nesting habitat (*i.e.*, < 40% cover, < 10 cm high; Ryan *et al.* 2010)
2. Introduce and maintain native coastal dune species through active seeding and management of invasives (weeding, etc.)

Given the above goals, monitoring should focus on 3 primary targets:

1. Percent cover
2. Species composition (*e.g.*, presence/richness)
3. Vertical structure (*e.g.*, vegetation height)

Percent cover and species composition

A **combination of point intercept transects and quadrats** will adequately measure % vegetation cover and species composition/richness. A complete census of plant species at the site should not be necessary using these methods and will avoid excess disturbance to the site. If certain plants are obviously being missed, they should be noted opportunistically.

A 10 m transect should be established from eight randomly chosen grid points on the island (1 m to 11 m along a meter tape extending out from the grid point). Point intercept data should be read every 0.25 m, yielding 80 points for each 20 m transect and 40 points for each 10 m transect. All species touching the sampling stick should be recorded, and ground surface should be characterized. Ground cover options include:

- Sand/Shell – sand with shell fragments
- Bare Ground – dirt or dirt with sand (little or no shell fragments)
- Litter – 50% or more organic dead material under stick
- Rock – large rock that is not easily nudged

For each 10 m transect, 3 ocular estimates of vegetation cover should be conducted utilizing a 1 m² quadrat. Relative cover of vegetation should be categorized as either 0, 1-10, 11-25, 26-50, 51-75, or 76-100% cover. Quadrats should be conducted every 5 meters (*i.e.*, 1 m, 6 m, 11 m), beginning on the left and alternating sides for each quadrat (see Figure 1).

Vertical Structure

Vertical structure measures habitat structure in terms of height and homogeneity of vegetation cover, which provides information about habitat suitability for wildlife.

Using the same transect as above, height category (0 cm, 1-10 cm, 11-20 cm, 21-30 cm) will be recorded every 0.25 m using tape marks on the point-intercept stick, yielding 40 datapoints for each 10 m transect.

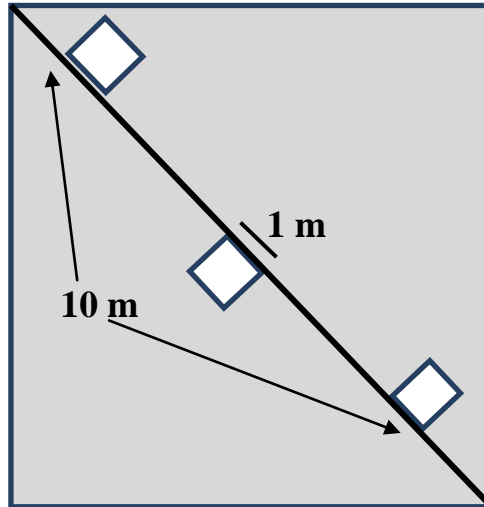


Figure 1. Transect layout (not completely to scale) for 10 m transects

Notes on procedure:

- A meter tape can be latched around the starting grid marker and pulled to a grid marker diagonally adjacent to it.
- The meter tape should be stretched to be as straight as possible.
- Point-intercepts should start at 1 m and continue every 0.25 m to 11 m.
- Conduct point-intercepts followed by quadrats to minimize impact of trampling on intercept data

Point Intercept Procedure:

- **Start at 1m** (the origin), proceeding every 0.25 m to 11 m.
- **At each 0.25 m point**, drop the stick perpendicular to the meter tape (or the transect axis) as possible.
- **Record** the ground cover
 - S = Sand/Shell – sand with shell fragments
 - B = Bare Ground – dirt or dirt with sand (little or no shell fragments)
 - L = Litter – 50% or more organic dead material under stick
 - R = Rock – large rock that is not easily nudged
- **Record ONLY** the plant species that are touching the stick
 - Make sure to check the side and top to avoid optical illusions.
 - Use 6 letter code: the first three letters of the genus and the first three letters of the species.
 - Standing Dead Material: is dead woody material that is still attached to the ground or living shrub. Only record a dead shrub if the dowel touches a primary or secondary stem—ignore fine feathery material because many shrubs dieback naturally and the dead material isn't a sign of bad health.
- **Unknown species** should be recorded with a unique number or designation, preferably with the same number of characters and a code to mark it as unknown (UK##).
- **Species known to genus**—If you know the genus of a plant but not the species record the first 6 letters of the genus. In the past we used the first 3 of the genus and “sp.” However this created several intersecting codes.
- **Handel unknowns** by collecting a sample off the transect, place in a baggie, and label it
 - If an herb is highly abundant collect a whole plant (if you are not sure leave it)
 - Try to get as many of the following structures as possible without excessive damage: Leaves, Flowers, Fruit, Stem
 - Labels should look something like this:

Date: M/D/YR

Team: use initials

Site: E.G. Reserve Name

Plot: The specific plot designation

Unknown #: unique number for this plot

Quadrat Procedure:

Materials:

- A 1 m² quadrat can be made out of ½ inch PVC pipe
- Be sure inside dimensions of quadrat measure 1 m.
- You may opt to drill holes in regular intervals (10cm, for example) on the sides of the quadrats and rung string through the holes
 - These strings will delineate sections for estimating cover. This makes estimation easier; however, moving through dense vegetation gets much harder.
- Quadrat data sheet
- Pen/pencil
- Clip board

Procedure:

- **Begin at the origin (1 m), on the left side**
 - Measurements will be taken every 5m on alternating sides.
- **Place the quadrat** between the 1-2 m markers on the meter tape
- **Estimate** the percent vegetation cover using the following categories:
 - 0 (all bare ground – dirt or sand w/ dirt)
 - 1-10%
 - 11-25%
 - 26-50%
 - 51-75%
 - 75-100%
- Move up the transect to the 6 m mark
- Place the quadrat on the right side of the tape and **repeat procedure.**
- Continue to end of transect, alternating sides and spacing sample plots 5m apart.



Appendix C

Results of Photo Monitoring Efforts

Fall 2012 (11-13-12)

Spring 2013 (4-12-13)

Fall 2013 (11-15-13)

Spring 2014 (3-28-14)



Results of Photo Monitoring Efforts (con't)

Fall 2012 (11-13-12)

Spring 2013 (4-12-13)

Fall 2013 (11-15-13)

Spring 2014 (3-28-14)

