University California, Santa Cruz

Younger Lagoon Reserve

Annual Report 2019-2020

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Executive Summary

Over the past year Younger Lagoon Reserve continued to thrive as a living laboratory and outdoor classroom focused on supporting University-level teaching, research and public service while meeting the campus' Coastal Long Range Development Plan (CLRDP) requirements for the protection and enhancement of all natural lands outside of the development areas of the Coastal Science Campus, including native habitat restoration of the 47-acre "Terrace Lands" as outlined in UCSC CLRDP and Coastal Development Permit. Over the past year we continued to increase our support of undergraduate course use. Most formal undergraduate education users were within the Environmental Studies and Ecology and Evolutionary Biology departments. Younger Lagoon Reserve-affiliated internships also supported over 60 undergraduate students who were involved with research, education, and stewardship. Prior to the COVID-19 pandemic, the majority of interns were involved in restoration and monitoring activities on the Terrace Lands engaging in a wide range of projects, including working closely with faculty research projects on cost effective methods for native habitat restoration (PI, Karen Holl) and grassland response to drought (co-PIs Michael Loik and Justin Luong), internship curriculum/handbook materials, small mammal research, invasive species management, and more. During the COVID-19 pandemic, interns participated in virtual activities including readings, videos, and online discussion sections with reserve staff and local restoration experts. Beyond UCSC use, YLR continued to support and increase use by other groups such as the Monterey Bay Aquarium Watsonville Area Teens Conserving Habitats Program, Cabrillo College, Santa Cruz Bird Club, local K-12 programs, and other community groups.

Restoration activities in FY 2019-2020 included weed control, planting of approximately 1.5 acres and seed collection. Beyond restoration work we continued to conduct other on-the-ground stewardship activities including trash hauls, removal of illegal camps, fence repair, and public education. This was the ninth year of CLRDP CCC compliance monitoring. Habitats monitored in 2020 included coastal scrub, coastal prairie, and wetland areas. YLR is meeting or exceeding restoration targets for nearly all monitored sites and is meeting the restoration goals for Phase 2. FY 2019-2020 represented the tenth full year of implementation of the CLRDP CCC Beach Access Management Plan related activities at Younger Lagoon Reserve. The University's NOID 12 (20-1) summarized the findings of the Beach Access Management Plan to date, and proposed continuation of the Beach Access Management Plan. NOID 12 (20-1) was approved by the CCC in October 2020 with the continuation of five special conditions related to increased public access to Younger Lagoon Reserve beach.

In Summary, YLR continued to offer excellent field locations for undergraduate, graduate, and faculty ecological research, support ongoing research and meet all CLRDP related activities and requirements.

Introduction

This report provides an overview of the activities that were conducted at Younger Lagoon Reserve (YLR) during the 2019-2020 fiscal year (July 1, 2019 - June 30, 2020). Prior to the COVID-19 pandemic, Younger Lagoon continued to see increases in use and activity in general. Providing an outdoor classroom and living laboratory allows for experiential learning opportunities. During the COVID-19 pandemic, reserve staff found creative ways to maintain engagement with the reserve such as virtual class visits, virtual tours, and virtual internships. These opportunities have profound impacts on students both professionally and personally. This was the ninth year we had fulltime staff on site managing the Reserve. As a direct result, the level of academic and public engagement increased and the Reserve is on target for implementing its obligations required under the Coastal Long Range Development Plan (CLRDP).

Younger Lagoon represents a unique reserve within the UCSC's Natural Reserve portfolio as it has open public access to a portion of the Reserve. Along with the challenges of public access (i.e. impacts to resources, protecting research equipment, protecting endangered and threatened species, implementing regulations, etc.) having public present on-site provides opportunities for outreach and education. During the past year, we continued to implement restoration activities on the Terrace Lands portion of the reserve and, as a direct result, interacted frequently with public users. These interactions have continued to provide opportunities for reserve staff and students to discuss the short and long-term objectives and goals of the restoration work, interpret the flora and fauna of YLR, and discuss ongoing planning and development efforts of the Coastal Science Campus (CSC).

CLRDP Activities

Overview

This year represented the 11th year of CLRDP related activities at Younger Lagoon Reserve. The California Coastal Commission certified the CLRDP for the "Terrace Point" property in 2008. In July of 2008, approximately 47 acres of natural areas of the "Terrace Point" property were incorporated into the University of California Natural Reserve System as part of UCSC's Younger Lagoon Reserve. The inclusion of the 47 acres into YLR, along with continued management of the lagoon portion of YLR, was a requirement of the California Coastal Commission for the UCSC Coastal Science Campus development.

The CLRDP requires that the entire Reserve be protected and used as a living laboratory and outdoor classroom and that the newly incorporated Natural Reserves lands are restored over a 20-year period. Fulfilling the University's mission to support research and teaching, we continue to incorporate research and teaching into all aspects of restoration, monitoring, research and protection throughout YLR. The increased lands and access to restoration and monitoring projects are providing expanded opportunities for undergraduate experiential learning opportunities via class exercises, research opportunities, and internships.

NOID 2 (10-1), NOID 9 (18-1), & NOID 12 (20-1) Beach Access Management Plan

This year represented the tenth full year of Beach Access Management Plan related activities at Younger Lagoon Reserve. In March 2010, the California Coastal Commission (CCC) approved the University of California's Notice of Impending Development for Implementation Measure 3.6.3 of the CLRDP (NOID 2). Implementation Measure 3.6.3 of the CLRDP required that (through controlled visits) the public have access to Younger Lagoon Reserve beach and that a monitoring program be created and implemented to document the condition of native flora and fauna within Younger Lagoon and its adjacent beach. The monitoring plan was to be implemented over a 5-year time period. At the end of the 5-year period (Winter 2015) results were to be compiled and included in a report that summarizes and assesses the effect of controlled beach access on flora and fauna. That report was submitted to the California Coastal Commission in 2016.

The CLRDP requires that University submit a NOID to the CCC that summarizes findings of the Beach Access Management Plan every five years. That NOID (NOID 9) was initially submitted in the Fall of 2016; however, it was withdrawn due to CCC staff workload and was resubmitted in summer of 2017. Although CCC staff recommended approval of NOID 9 as submitted, CCC

Commissioners raised questions regarding beach access at the July 2017 meeting, and YLR staff withdrew NOID 9 prior to the Commissioners vote in order to try and better address these questions. The University resubmitted NOID 9 to the CCC in September 2018.
In September 2018, the Commission approved UCSC's NOID 9 to continue the beach tour program though through 2020 with the addition of five special conditions. These special conditions were at the suggestion of Commission staff, and included 1) requiring that the tours be offered without admission to the Seymour Center), 2) additional tour outreach and advertising, 3) additional tour signage, 4) additional tour monitoring and reporting requirements, and 5) a threat to open the beach to additional public access should the conditions not be met. Condition 5 has the potential to jeopardize not just the research integrity of the reserve, but also the security of the west side of the Marine Lab, including the seawater system and marine mammal research program. Implementation of the NOID 9 special conditions by the Seymour Center cost approximately $15,000/year.

The University submitted NOID 12 to the CCC in October 2020. In October 2020, the Commission approved UCSC's NOID 12 with the continuation of the five special conditions required in 2018. Implementation costs for the NOID 12 special conditions will need to be determined by the new Seymour Center Director in consultation with campus administration.

Due to COVID-19 precautions, the Seymour Center was temporarily closed, and the free beach tour program temporarily suspended in early March 2020. The University will restart the free beach tour program when the Seymour Center reopens (see July 10, 2020 Coastal Act Section 30611 Commission waiver letter to UC Santa Cruz).

Prior to the COVID-19 pandemic, Seymour Marine Discovery Center docent-led tours of the beach were be offered 2-4 times a month in FY 2019-2020 and biological monitoring of the lagoon and adjacent beach was conducted quarterly in FY 2019-2020. A detailed report on activities under the Beach Access Management Plan is included as Appendix 1. The NOID 9 Special Conditions Implementation Reports 2, and 3; NOID 12, and the NOID 12 Special Conditions Implementation Plan are included as Appendix 5.

NOID 3 (10-2) Specific Resource Plan for the Enhancement and Protection of Terrace Lands at Younger Lagoon Reserve

The Resource Management Plan (RMP) within the CLRDP provides a broad outline with general recommendations and specific guidelines for resource protection, enhancement, and management of all areas outside of the mixed-use research and education zones on the CSC site (areas that will remain undeveloped). In addition to resource protection, the CLRDP requires extensive restoration, enhanced public access/education opportunities on site, and extensive monitoring and reporting requirements. The entire project is to be completed over 20 years and, as a condition of inception into the University of California Natural Reserve System, UCSC Campus has committed to providing perpetual funding for the project and continued management of YLR.

The SRP for Phase 1A of restoration (first 7 years) was approved by the CCC in September 2010 (NOID 3, 10-2). Phase 1A projects included Priority 1 weed removal, re-vegetation, baseline monitoring and selection of reference systems. FY 2017-2018 marked the conclusion of the SRP for Phase 1A.

The SRP for Phase 2 of restoration (second 7 years) was submitted to the CCC as part of the 2017-2018 Annual Report.

The SRP for Phase 2 of restoration outlined detailed success criteria for each of the reserve's habitat types (Ruderal, Coyote Brush Grassland-Scrub, and Grassland, Coastal Bluffs, Wetlands, and Wetland Buffers). These criteria set an initial threshold of species richness and cover for specific habitat types throughout the restoration area. These criteria were further refined at the recommendation of the SAC based on results from reference site monitoring of local coastal terrace prairie grassland, seasonal wetland, and coastal scrub sites (See 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, and 2019-2020 Annual Reports). C compliance monitoring for restored coastal scrub, coastal prairie, and wetland areas was conducted in FY 2019-2020. A detailed compliance monitoring report is included in Appendix 2.

Restoration of the Terrace Lands continued throughout FY 2019-2020. Activities included weed control, planting, and seed collection.

Restoration Monitoring efforts in 2020-2021

During the 2020-2021 field season, UCSC graduate student Justin Luong and professor Dr. Karen Holl will conduct restoration compliance monitoring at restoration sites 2, 4 and 6 years post planting as per CLRDP requirements, as well as at any sites that have fallen below compliance standards.

NOID 5 (12-2) Public Coastal Access Overlook and Overlook Improvements Project

In August 2012, the California Coastal Commission (CCC) approved the University of California's Notice of Impending Development NOID 5 (12-2) Public Coastal Access Overlook and Overlook Improvements Project. Construction on the Public Coastal Access Overlook and Overlook Improvements Project ("Overlooks Project") began in the winter of 2012/2013 and was completed in the spring of 2013. The project consisted of three new public coastal access overlooks, and improvements to two existing overlooks at UCSC's Marine Science Campus. Several of the overlooks, which are sited at the margins of development zones, therefore are within what is now the Younger Lagoon Reserve: Overlooks C and A are within development zones at the margin of the YLR, while the sites of overlooks D, E and F are within areas incorporated into the YLR as a condition of approval of the CLRDP. The project constructed publicly-accessible overlooks from which to view the ocean coast (Overlook F), Younger Lagoon (Overlook D), a seasonal wetland (W5) (Overlook A), and campus marine mammal pools (Overlook C) for which public access is otherwise limited due to safety hazards or for the protection of marine wildlife and habitats. The facilities include interpretive signs and public amenities such as bicycle parking and benches to enhance public access to, and enjoyment of these restricted and/or sensitive areas.

NOID 6 (13-1) Coastal Biology Building and Associated Greenhouses; Site Improvements Including Road, Infrastructure and Service Yards; Public Access Trails and Interpretative

Panels; Wetland Connection in Specific Resource Plan Phase 1B; Sign Program; Parking Program; Lighting Plan.

In August 2013, the California Coastal Commission (CCC) approved the University of California's Notice of Impending Development NOID 6 (13-1) Coastal Biology Building and Associated Greenhouses; Site Improvements Including Road, Infrastructure and Service Yards; Public Access Trails and Interpretative Panels; Wetland Connection in Specific Resource Plan Phase 1B; Sign Program; Parking Program; Lighting Plan. This project included development of a new seawater lab building, three new parking lots along with a parking management program, a research greenhouse complex, and associated site work including storm water treatment and infiltration features. It also consisted of campus utility and circulation improvements to serve both the new lab building and future campus development under the CLRDP. The Project developed a complex of public access and interpretive facilities, including pedestrian access trails, interpretive program shelters, educational signage, and outdoor exhibits. This project initiated campus wide parking, sign, and lighting programs. This project also included mandated wetland restoration and habitat improvements as described in the Specific Resource Plan Phase 1B.

<u>SRP Phase 1B</u>

The Resource Management Plan within the CLRDP requires the reconnection of Upper Terrace wetlands W1 and W2. Wetland W1, on the western margin of the Upper Terrace, is a former agricultural ditch, probably constructed to drain the adjacent agricultural field. It is separated from wetland W2 (located immediately to the east) by a slightly elevated berm that may partially represent spoils left from the ditch construction. The SRP for Phase 1B of restoration detailed Younger Lagoon Reserve's approach for implementing these mandated wetland restoration and habitat improvements.

To reconnect hydrology between W1 and W2, five brush packs (ditch plugs) were installed within W1 in the summer of 2016 and 2017 (See 2016-2017 Annual Report and SRP Phase 1 Summary Report). SRP Phase 1B is now complete. As the hydrology of the site begins to shift to become more favorable to wetland plants, native wetland plants will be installed on the site.

All of the brush packs are currently intact and functioning as designed. Although not yet observed, the ditch plugs may create small open water pool habitat and potentially provide new breeding habitat for amphibians.

Domesticated Animals

In 1999, when the University purchased the land for the expanded CSC, a special exception was made in the campus code to allow leashed dogs on the bluff top trail that rings the YLR Terrace Lands. Since that time, the site had become popular with dog owners, many of whom do not obey the leash law. The CLRDP requires that all domesticated animals be eliminated from the campus. Parallel to the start of construction, implementation of the campus "no dog" policy began in May 2015 in conjunction with activities under NOID 6 (13-1), and continued in FY 2019-2020. New trail signage was installed last year to educate the community and the public about the policy change.

Scientific Advisory Committee (SAC) Meetings / Recommendations

A critical component of the CLRDP was the creation of a Specific Restoration Plan (SRP) guided by a Scientific Advisory Committee (SAC). The SAC is comprised of four members: Dr. Karen Holl (SAC chair) Professor and Chair of the Department of Environmental Studies at UCSC; Tim Hyland, Environmental Scientist, State Parks, Santa Cruz District; Bryan Largay, Conservation Director, Land Trust of Santa Cruz County; and Dr. Lisa Stratton, Director of Ecosystem Management, Cheadle Center for Biodiversity and Ecological Restoration, University of California, Santa Barbara (UCSB). SAC members met with reserve staff on-site and through email/phone consultation in FY 2019-2020. Discussion topics included current and future projects under the CLRDP, restoration, research, and teaching activities at YLR.

Monitoring Recommendations:

Coastal prairie is notoriously difficult to restore and maintain. The 2012 coastal prairie restoration site – which was impacted by construction and drought, has fallen below its success targets. The SAC recommended continuing to monitor this site (and any others that fall below target) once a year rather than every other year, and replanting or changing management regimes if it does not rebound.

Research Recommendations:

SAC members recommend that future research include investigations into methods for seasonal wetland restoration.

Summaries of ongoing research projects undertaken at the direction of the SAC are below.

Wetland Restoration Species Selection

Studies on freshwater wet meadow restoration via perennial grass seedlings are limited on the central coast of California. Understanding the relationship of native species, soil moisture, and inundation duration can help the overall success of restoration techniques applied to coastal wetlands in California. Under the direction of SAC Chair, Dr. Karen Holl, undergraduate student Mitchell Kuwahara explored the relationship between soil inundation and the survival of four native perennial grass species: *Agrostis pallens* (FACU), *Deschampsia cespitosa* (FACW), *Elymus triticoides* (FAC), and *Hordeum brachyantherum* (FACW) in an area previously dominated by the exotic perennial grass *Lolium perenne* (FAC). These species were transplanted as part of freshwater wetland restoration efforts at Younger Lagoon Reserve. Transplant sites covered a range of elevations to see how each species survived at different inundation levels within the wetland. The overall survival ranged from 45 – 60% for the four species over the first 2.5 months (Dec.-mid-February), and there was minimal mortality from February to April. All species had a negative, linear relationship with volumetric water content (i.e. higher mortality in wetter plots) despite the relatively dry period during the study. Observations suggest that the primary cause of mortality was herbivory by waterfowl when the site was inundated in December and January. Future research should study the relative importance of length of flooding vs. waterfowl herbivory on plant survival, and utilize structures that limit waterfowl activity to enhance restoration success in these wetlands.

Management Recommendations:

In FY 2019-2020 the SAC continued to discuss the apparent post-construction hydrologic changes to some of the Terrace Lands, and the construction of California Red-Legged Frog (CRLF) Ponds in the upper terrace.

Post-Construction Terrace Lands Hydrologic Changes

CLRDP Implementation Measure 6.1.3 states that the University shall "*Construct, provide, and maintain a public pedestrian and bicycle trail system to facilitate safe and passable public access within, along, and through the Marine Science Campus*."

CLRDP Implementation Measure 7.1.3 states that the University shall "*Develop and manage a drainage system on the Marine Science Campus that maintains pre-development drainage patterns and peak flow rates for up to the 25-year return storm in the post-development drainage system to the maximum extent feasible, provided that accommodating such flows does not require drainage system sizing that exceeds 85th percentile storm event requirements (see Appendix B).*"

A public pedestrian and bicycle trail system was developed on the CSC as part of NOID 6 (13-1). The majority of these trails formalized existing trails, many of which were former dirt farm roads. The informal trails were mostly below surrounding grade (e.g. tire ruts) and conveyed some water off of the Terrace Lands during heavy storm events. Post construction, the trails are now level with the surrounding grade, and they appear to be keeping more water on the Terrace Lands than in the past. In FY 2018-2019, reserve staff observed new areas of ponding, and the emergence of wetland vegetation in areas that were formerly scrub. However, FY 2018-2019 was wetter than average, while FY 2019-2020 was drier than average, and it's possible that these shifts are not due to construction impacts, but rather to inter annual variability in rainfall. The SAC recommends continuing to monitor rainfall, water levels, and make note of vegetation shifts, as these may indicate the need to adjust restoration planting palates.

Upper Terrace CRLF Ponds

CLRDP RMP MM 9 states that the University shall "*Restore, consolidate, expand, and enhance wetlands on the northern part of the site (i.e., north of the Campus access road) to restore historic functional values lost during decades of agricultural use. The restoration program will include integrating the hydrology of Wetlands W1 and W2 to create a consolidated north-south area for wildlife movement to YLR. Hydrological surveys will be conducted by a qualified* *hydrologist to establish the elevations appropriate for optimizing expected wetland functioning. The area will be graded to provide a natural channel profile and gradient between the culvert at the Union Pacific Railroad tracks and the culvert outlet to Younger Lagoon on the west property line. The area west of the combined W1/W2 hydrologic corridor shall be restored as functioning wetland upland/transitional habitat, as shall buffer areas to the east. Maintain the CRLF potential habitat at the northern end of W-2.*

During the ACoE permitting process for projects impacting wetlands on the Coastal Science Campus (including restoration work in the upper terrace), the US Fish and Wildlife Service (USFWS) was brought in for Section 7 consultation. This discussion included members of the Natural Reserves and Physical Planning and Construction. In April 2014, USFWS approved the University's project as proposed and asked the campus to explore the feasibility of building CRLF pond(s) in the upper terrace as both a benefit to the local population and a demonstration of good faith / collaboration between UCSC and USFWS.

With the support of the reserve, campus agreed to explore the possibility and staffs from both the Resource Conservation District (RCD) and USFWS Coastal Program made a site visit to discuss feasibility and conduct initial studies in the summer and fall of 2014. RCD staff completed a soil evaluation in October 2014 and found groundwater at less than 5' deep at one of the sample points (in sandy soils and in very dry conditions) and believe that CRLF ponds could be engineered on site to hold water for long enough to support breeding. The RCD was ready to move forward with putting together a proposal for designing and building the ponds (this would need to be evaluated by the SAC with our existing RMP obligations in mind - e.g. reconnect wetlands 1 and 2, etc.); however, due to unresolved questions including permitting (e.g. would the RCD's permits work for the site within the permitting requirements and procedures for UC) and potential impacts to future projects, PP&C staff felt there was not enough information to move forward with further RCD planning and/or construction the ponds. Subsequently, PP&C staff engaged additional outside hydrologic and biologic consultants to do a feasibility study in 2016-2017. This study confirmed initial studies by the RCD, and indicated that CRLP Ponds could be engineered on site to hold water for long enough to support breeding. However, the study also warned that factors such as nearby bullfrog and crayfish populations could hinder the success of such ponds.

In 2019, USFWS Coastal Program contacted the University about an opportunity to have a CRLF Frog pond built on-site by the NRCS at little to no expense to the University. Staff representing UCSC Physical Planning, Development, and Operations (PPDO, formerly PP&C), the UCSC NRS, the RCD, and USFWS Coastal Program met throughout FY 2019-2020 to discuss the opportunity further and begin the planning process. If permits and approvals can be obtained, the University plans to move forward with plans to build a CRLF pond in the upper terrace in 2020-2021.

The SAC is generally supportive of the idea of CRLF pond(s) in the upper terrace as a way to 1) increase collaboration between UCSC, YLR, and the USFWS, 2) potentially provide opportunities for CRLF teaching, research and outreach on the reserve, and 3) meet habitat restoration and wetland reconnection goals. However, some SAC members have expressed concerns about 1) whether the ponds would function as expected and 2) more broadly, whether or not CRLF ponds are even necessary in our area. The SAC will continue to provide guidance as plans develop for building a CRLP pond in the upper terrace.

SRP Phase 1 Implementation Summary

The SRP for Phase 1A of restoration (first 7 years) was approved by the CCC in September 2010 (NOID 3, 10-2). The SRP for Phase 1B of restoration (upper terrace wetland work) was approved by the CCC in July 2013 (NOID 6, 13-1). Phase 1A projects included Priority 1 weed removal, re-vegetation, baseline monitoring and selection of reference systems. Phase 1B projects included work in wetland areas, including the reconnection of upper terrace wetlands 1 and 2. Both Phase 1A and Phase 1B of restoration are now complete.

Younger Lagoon Reserve successfully implemented Phase 1 of the Specific Resource Plan for the Enhancement and Protection of Terrace Lands at Younger Lagoon Reserve. Nearly all Priority 1 weeds have been eliminated from the Terrace Lands. Over ten acres were planted with native species during Phase 1. Nearly all of those plantings are meeting or exceeding their success criteria targets. Upper terrace wetland reconnection work has been completed. In addition, teaching, research, and public service was incorporated into every aspect of SRP Phase 1 implementation. (See 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018 and 2018-2019 Annual Reports; and SRP Phase 1 Summary Report).

SRP Phase 2

The SRP for Phase 2 of restoration (second seven years) follows the same success criteria for each of the reserve's habitat types and encompasses approximately 8.5 acres of restoration in the middle terrace. (See 2017-2018 and 2018-2019 Annual Reports).

Photo Documentation

Photo point locations were established at ten locations within YLR. These locations were chosen to ensure coverage of all major areas on the Terrace. Photos were taken on May 8, 2018. At each photo point we collected the following information:

1. Photo point number
2. Date
3. Name of photographer
4. Bearing
5. Camera and lens size
6. Coordinates
7. Other comments

Photos are included in Appendix 4.

Restoration Activities

Restoration activities continued on the Terrace Lands of YLR and throughout the lagoon portion of the Reserve. Implementation was conducted largely by undergraduate students and community volunteers; thus, utilizing the reserve in a manner consistent with the programmatic objectives (facilitating research, education, and public service) of the University of California

Natural Reserves, as well as leveraging funding to increase restoration work (Figure 1). Here we summarize some of the restoration activities that occurred on YLR during the past year.

Figure 1. Volunteers and undergraduate student interns transplant native seedlings in preparation for native planting (photo taken pre-pandemic).

Priority One Weed Removal

Under the SRP, all priority-one weeds (Ice plant, Jubata grass, Monterey cypress, Cape Ivy, Panic veldgrass, Harding grass, French Broom and Monterey Pine) are to be controlled as they are detected throughout the Terrace Lands. Elimination of reproductive individuals is the goal; however, YLR is surrounded by priority-one weed seed sources and it is likely that there will always be a low level of priority-one weeds persisting on the terrace. In FY 2019-2020, reserve staff conducted weed patrols of the entire terrace, continued removing ice plant from the coastal bluffs, removed all Jubata grass re-sprouts from the terrace, removed all French Broom re-sprouts from the terrace, and removed all Cape Ivy re-sprouts from the west arm of the lagoon. In FY 2020-2021, reserve staff will continue weed control projects and patrols. Due to the long-lived seed bank of French Broom, proximity of mature Jubata grass and Panic veldgrass on adjacent properties, and known ability of Cape Ivy fragments to re-sprout, regular patrols and maintenance of these sites will be critical. Removal of new recruit Monterey Pine and Cypress will continue as will targeted removal of current individuals.

Seed Collection and Plant Propagation

In the summer and fall of 2019, reserve staff and student interns collected seeds for restoration growing. These seeds were propagated by the UCSC Teaching Greenhouse in the fall and winter of 2019/2020.

Restoration Planting

In FY 2019-2020, approximately 1.5 acres of wetland and wetland buffer areas were planted with native seedlings (Figure 2). Post planting, the 2019-2020 site was inundated with water during late winter rains and subject to significant waterfowl herbivory resulting in the initial failure of some of the plantings; however, a portion of the site was successfully re-planted in the sping of 2020 and is now thriving. Additional supplemental plantings will be installed at the site as part of 2020-2021 restoration efforts as needed.

Figure 2. 2020 Restoration Site.

Education

Instructional use at Younger Lagoon Reserve continued to be strong this year; however, due to the COVID-19 pandemic, some spring 2020 field courses were canceled while others transitioned to remote instruction. Several courses participated in virtual visits of the reserve. Courses encompassed a wide variety of disciplines. The steady course use is a direct result of having fulltime staff on site that are able to actively engage faculty and students through outreach efforts in the classroom as well as providing on-the-ground assistance in teaching activities – despite the pandemic. The proximity of Younger Lagoon to the campus enables faculty and students to easily use the Reserve for a wide variety of instructional endeavors ranging from Restoration Ecology to Natural History Illustration.

Undergraduate Students – Providing hands-on learning opportunities for future leaders

YLR's proximity to the UCSC Campus and Long Marine Laboratory make it an ideal setting for undergraduate teaching and research (Figure 3). In FY 2019-2020 the reserve hosted classes in Coastal Field Studies, Ecology, Freshwater Ecology, Plant Ecology, Restoration Ecology, Environmental Field Methods, Ecology and Society, Systematic Botany of Flowering Plants, Freshwater / Wetland Ecology, and Natural History Illustration (Table 1). Due to COVID-19 precautions, many field courses were offered online or not offered at all during the spring 2020 quarter. Reserve staff hosted virtual class visits and virtual tours of the reserve; however, the number of spring class visits (usually the busiest time of the year) was lower than in previous years due to the COVID-19 pandemic.

Figure 3. Students from *ENVS 167 – Freshwater/Wetland Ecology* practice wetland delineation in the rain at Younger Lagoon Reserve (photo taken pre-pandemic).

Internships

In FY2019-2020, YLR staff sponsored over 60 undergraduate interns through the UCSC Environmental Studies Internship Office. The students ranged from entering freshman to graduating seniors and spent between 6 and 15 hours a week learning about on-going restoration projects at the reserve. Prior to the COVID-19 pandemic, interns participated in hands-on projects including invasive species removal, re-vegetation with native species, seed collection, and propagation. During the COVID-19 pandemic, students participated in a virtual internship that included readings, videos, and weekly online discussion sections with reserve staff and local experts. Student-interns report a deep appreciation for the opportunity to obtain experience in their field of study (Figure 4).

Figure 4. Undergraduate student interns collect native seeds for restoration plantings (photo taken pre-pandemic).

Table 1. Younger Lagoon Courses

Course Title	Institution (Department)	Instructor's Name
BIO 11C - Ecology	Cabrillo Community College	Alison Gong
HORT 164 – CA Native Plants and Communities	Cabrillo Community College	Nicky Hughes
ENVS 189 – Coastal Field Studies	San Jose State University	Rachel Lazzeri-Aerts
BIOE 107 – Ecology	University of California, Santa Cruz (Dept. of Ecology and Evolutionary Biology)	Tim Brown
BIOE 117/L – Systematic Botany of Flowering Plants	University of California, Santa Cruz (Dept. of Ecology and Evolutionary Biology)	Kathleen Kay
BIOE 137 – Molecular Ecology	University of California, Santa Cruz (Dept. of Ecology and Evolutionary Biology)	Beth Shapiro
BIOE 112 – Ornithology	University of California, Santa Cruz (Dept. of Ecology and Evolutionary Biology)	Bruce Lyon
ENVS 18 – Natural History Illustration	University of California, Santa Cruz (Dept. of Environmental Studies)	Emily Underwood
ENVS 100 – Ecology and Society	University of California, Santa Cruz (Dept. of Environmental Studies)	Greg Gilbert
ENVS 104A/L - Environmental Field Methods (Summer)	University of California, Santa Cruz (Dept. of Environmental Studies)	Josie Lesage
ENVS 160 - Restoration Ecology	University of California, Santa Cruz (Dept. of Environmental Studies)	Karen Holl
ENVS 167 - Freshwater / Wetland Ecology	University of California, Santa Cruz (Dept. of Environmental Studies)	Katie L Monsen
ENVS 83 / 183 - Younger Lagoon Reserve Stewardship Interns	University of California, Santa Cruz (Dept. of Environmental Studies)	Vaughan Williams
ENVS 84 / 184 - Younger Lagoon Reserve Stewardship Interns	University of California, Santa Cruz (Dept. of Environmental Studies)	Vaughan Williams

Research

Due in part to its relatively small size and lack of facilities, YLR is unlikely to host many single-site research projects in biology or ecology. However, as one of the few remaining coastal lagoons in California, YLR is well suited to act as one of many research sites in a multi-sited project. Additionally, the close proximity to campus makes it an ideal place for faculty to conduct pilot and our small-scale studies as well as for undergraduate research opportunities.

Last year, research conducted at Younger Lagoon Reserve resulted in the publication of two peer-reviewed articles. Younger Lagoon Reserve was also featured in a case study in a new book A list of those publication is below. The full articles are included as Appendix 6.

Leopold, D.J. Karen D. Holl. Primer of Ecological Restoration. J Environ Stud Sci (2020). https://doi.org/10.1007/s13412-020-00621-w

Wasserman, B.A., Paccard, A., Apgar, T.M., Des Roches, S., Barrett, R.D.H., Hendry, A.P. and Palkovacs, E.P. (2020), Ecosystem size shapes antipredator trait evolution in estuarine threespine stickleback. Oikos, 129: 1795-1806. https://doi.org/10.1111/oik.07482

Madison T. Ginn, Timothy M. Brown, Rick Flores, and Karen D. Holl (2020). Germination of multi-year collections of California grassland and scrub species. Madroño 67(2), 105-111. https://doi.org/10.3120/0024-9637-67.2.105

In FY 2019-2020 we approved eleven research applications. Examples and summaries of new and ongoing research are included below.

Graduate Student Research Highlight: California Frog Susceptibility to Chytrid

Over the past two decades, amphibians around the globe have been decimated by a devastating pathogen, the *Batrachochytrium dendrobatidis* fungus, also known as Bd or the chytrid fungus. More than 30 percent of the world's frog, toad, salamander, and newt species have been affected, with consequences ranging from population crashes to outright species extinctions. Frog susceptibility to Bd has been shown to differ between populations, even within the same species, which leads to some populations being driven to extirpation while others remain seemingly unaffected. Bd virulence has also been shown to differ by strain within the same lineage. To date, several candidate genes have been identified that may contribute to host susceptibility and pathogen virulence in this system, but so far the results have been inconclusive - in some populations, alleles confer resistance and in other cases, the same ones do not. UC Santa Barbara graduate student Imani Russell seeks to determine the genetic basis for this difference in susceptibility and resulting disease dynamics in both the host and pathogen across California. She is sampling across a broad range of species and populations to find a pattern between genotype, disease, and location.

Figure 5. Graduate Student Researcher Imani Russell collects samples from a frog.

Faculty Research Highlight: International Drought Experiment

Several UC Natural Reserve sites in California are participating in the International Drought Experiment. The experiment is compliant with the *DroughtNet* protocol for comparison to 100 other sites worldwide (drought-net.org). Effects of drought on plant growth and biodiversity are being measured at a number of grassland and shrubland sites along a north-south and coastal-inland gradient in California. At UCSC, professors Michael Loik, Kathleen Kay, and Karen Holl are collaborating with graduate student Justin Luong on this project.

The UCSC Drought Experiment was built with support from the Institute for the Study of Ecological and Evolutionary Climate Impacts (ISEECI) during 2015 at three sites including Younger Lagoon UC Natural Reserve, the UCSC Arboretum, and the UCSC Campus Natural Reserve. The main goal of the experiment is to better understand how long-term drought affects which plant species grow, and by how much, in California coastal prairie. The UCSC Drought Experiment sites span an elevation gradient of about 300 m with changes in rainfall, temperature, and fog. Fog-collectors are co-located with shelters at each site. Initial plot establishment made up the laboratory section activities for ENVS 162/L Plant Physiological Ecology at Younger Lagoon, the Arboretum, and the Campus Natural Reserve during Spring 2015.

Effects of soil water on species composition and productivity will be compared for invaded grassland with 60% rainfall removal, and for ambient, invaded coastal prairie grassland ("control"; no rainfall shelters). At Younger Lagoon, Loik et al. are also conducting experiments with a restoration context by comparing effects of drought on planted native seedlings in comparison to planted native seedlings with 60% rainfall removal. Loik et al. also have water addition plots available for experiments. There are n = 5 plots per treatment. Size = 2 X 2 m, with a 1 m buffer around the 4 m^2 square plot.

Shelter construction commenced in July 2015. Plots were trenched to 50 cm deep and lined with 6 mil plastic to prevent lateral water flow and root encroachment. Shelters were initially constructed of lightweight metal and rainfall is intercepted using clear, v-shaped polycarbonate troughs. In 2017, the shelters were rebuilt using wooden posts. Rainfall interception commenced during the first significant rainfall between 2 -3 November 2015. With *ISEECI* support, Loik et al. began to automatically monitor soil moisture and temperature, as well as air temperature and relative humidity near the ground under the shelters in 2016.

During 2019-20120, the drought experiment activities at Younger Lagoon Reserve (YLR) were greatly reduced due to COVID-19. Primary activities included:: 1. Researchers paused the monitoring of plots inaccordance with the International Drought Experiment protocol; 2. Researchers continued collection of micrometeorological data from a sensor system set up in a prior year; 3. Faculty and graduate student researchers prepared YLR IDE Restoration research for publication; 4. Researchers measured *Baccharis pilularis* recruitment within the research area; 5. Sampled soil within IDE planted and unplanted plots; 6. Researchers conducted a glasshouse experiment to determine the interactive effect of drought and competition on native species and 7. Researchers prepared for a new glasshouse experiment to determine the effect of fog and drought on *Stipa pulchra* and *Sidalcea malviflora*. (Figure 6). Undergraduate students assisted will all aspects of the project. A full report on the International Drought Experiment is included in Appendix 3.

Figure 6. Undergraduate students prepare soil samples at the experimental *DroughtNet* shelters.

Public Service

Public service use at Younger Lagoon Reserve continued to increase this year. Public service users encompassed a wide variety of groups. The increase in public service use is a direct result of having fulltime staff on site that are able to actively engage public groups through outreach efforts as well as providing on-the-ground assistance in public service activities. The proximity of Younger Lagoon to the town of Santa Cruz enables members of the public to easily use the Reserve for a wide variety of approved endeavors ranging from birding to K-12 teaching (Table 2, Table 3).

Monterey Bay Aquarium Watsonville Area Teens Conserving Habitats (WATCH) Program

YLR's proximity to the urban center of the city and county of Santa Cruz make it an ideal setting for public service. In FY 2019-2020 the reserve continued its partnership with the Seymour Marine Discovery Center (SMDC) and the Monterey Bay Aquarium Watsonville Area Teens Conserving Habitats (WATCH) program. WATCH is a program offered only at Pajaro Valley, Watsonville and Aptos high schools in Watsonville, California. This year-long program begins in the summer and extends throughout the school year. During the two-week summer component, students explore the Pajaro River Watershed and Younger Lagoon Reserve, meet with local scientists and participate in inquiry-based learning. They also learn about environmental issues in their community and participate in local restoration efforts. After the summer, the same students enroll in a WATCH science class at their high school and develop their own field research project based on an environmental topic at either Elkhorn Slough (Pajaro Valley and Watsonville High Schools) or Younger Lagoon Reserve (Aptos High School). Students visit their field sites once a week for ten weeks in the fall to collect data, and work during the winter and spring to analyze, write-up, and present their data (Figure 7). They work with Monterey Bay Aquarium staff and teachers, SMDC staff, YLR staff and undergraduate interns, as well as scientists and educators from the community to complete their projects. Upon completion of the projects, students receive a scholarship and community service hours needed for graduation.

Figure 7. WATCH program participants explore the lagoon.

Reserve Use

The greatest educational user group for YLR in FY 2019-2020 was once again undergraduate education, a breakdown of all user groups is included in Table 2. YLR was used by UC Santa Cruz, UC Berkeley, UC Davis, UC Los Angeles, UC Santa Barbara, CSU San Jose, Rutgers University, Tulane University, Cabrillo College, Aptos High School, Half Moon Bay High School, Pacific Collegiate School, Pajaro Valley High School, Watsonville High School, Audubon Society, Black Oystercatcher Monitoring Project, Monterey Bay Aquarium, Santa Cruz Museum of Natural History, Seymour Marine Discovery Center, Santa Cruz Bird Club, and UCSC Wilderness Orientation (Table 3).

Table 2. Younger Lagoon Total Use

RESERVE USE DATA Fiscal year: 2019-2020

Campus: University of California, Santa Cruz
Reserve: Younger Lagoon Reserve

	UC Home		UC Other		CSU System		CA Comm College		Other CA College		Out of State College		International University		Government		NGO/Non-Profit		Business Entity		K-12 School		Other		Total	
	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs
UNIVERSITY- LEVEL RESEARCH																												
Faculty	2	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	40
Research Scientist/Post Doc	1	1	1	1	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	6	6
Research Assistant (non-student/faculty/postdoc)	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	1	66	3	68
Graduate Student	6	168	1	7	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	8	176
Undergraduate Student	34	1410	14	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	1436
Professional	3	90	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	5	92
Other	2	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	4	94
Volunteer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	6	6	7	7
SUBTOTAL	48	1801	16	34	0	0	0	0	0	0	2	2	0	0	6	6	2	2	2	2	0	0	7	72	83	1919
UNIVERSITY - LEVEL INSTRUCTION (CLASS)																												
Faculty	4	4	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
Research Scientist/Post Doc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Graduate Student	4	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	11
Undergraduate Student	393	2111	0	0	45	45	43	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	481	2199
Professional	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50
Other	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
SUBTOTAL	403	2177	0	0	46	46	45	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	494	2268
OTHER																												
Faculty	6	6	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	7	8
Research Scientist/Post Doc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	6	12	0	0	0	0	0	0	0	0	7	13
Graduate Student	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25
Undergraduate Student	129	430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129	430
K-12 Instructor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	76	0	0	32	76
K-12 Student	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	698	0	0	93	698
Professional	3	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	6	63	0	0	2	2	0	0	12	70
Other	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	1052	0	0	0	0	15810	15810	15847	16864
Docent	38	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	38
Volunteer	35	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	46	0	0	0	0	0	0	38	81
SUBTOTAL	238	541	1	1	0	0	0	0	0	0	0	0	0	0	7	14	45	1161	0	0	127	776	15810	15810	16228	18303

	UC Home		UC Other		CSU System		CA Comm College		Other CA College		Out of State College		International University		Government		NGO/Non-Profit		Business Entity		K-12 School		Other		Total	
	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs
TOTALS	**689**	**4519**	**17**	**35**	**46**	**46**	**45**	**45**	**0**	**0**	**2**	**2**	**0**	**0**	**13**	**20**	**47**	**1163**	**2**	**2**	**127**	**776**	**15817**	**15882**	**16805**	**22490**

*Other includes members of the public who took the SMDC's docent-led tours. All daily tours in FY 2019-2020 visited the Younger Lagoon / Marine Mammal Overlook and received information about the reserve.

Table 3. Younger Lagoon Group Affiliations

University of California Campus	**Non-governmental organizations**
University of California, Berkeley	Audubon Society
University of California, Davis	Black Oystercatcher Monitoring Project
University of California, Los Angeles	Monterey Bay Aquarium WATCH Program
University of California, Santa Barbara	Santa Cruz Bird Club
University of California, Santa Cruz	Santa Cruz Museum of Natural History
California State Universities	Seymour Marine Discovery Center
California State University, San Jose	
	Governmental Agencies
California Community College	US Geological Survey
Cabrillo Community College	NOAA
Universities outside California	
Rutgers University	
Tulane University	
	Volunteer Groups
K-12 system	UCSC Wilderness Orientation
Aptos High School	
Half Moon Bay High School	
Pacific Collegiate School	
Pajaro Valley High School	
Watsonville High School	

Summary

Despite the COVID-19 pandemic, FY 2019-2020 was a successful year for YLR. The reserve continued to move forward with restoration, initiated new projects, strengthened collaborations, and developed new relationships. The increase in student and course use is a direct result of having superb staff on sight that are actively engaged with students, faculty, and the public. In turn, we are able to achieve our mission of supporting education, research, and public education as well as meet the environmental stewardship obligations the University of California has committed to with the California Coastal Commission and the State of California in general. We look forward to continuing this exciting and important work in FY 2020-2021.

UCSC Natural Reserves Advisory Committee

Charge

The committee provides oversight of on- and off-campus natural reserves of instructional and research interest. It is responsible for developing program vision and policy for the management and use of the UCSC Campus Reserve and of the four UC Natural Reserves System holdings: Año Nuevo Island Reserve, Landels-Hill Big Creek Reserve, Younger Lagoon Reserve and Fort Ord Reserve. The committee coordinates with the systemwide NRS Advisory Committee that advises on policy for all NRS reserves.

In addition to the chair (Faculty Director), membership of the committee is comprised of faculty advisors to each reserve, one faculty representative at large, one non-senate academic appointment, one staff representative, one graduate student and two undergraduate students. The Faculty Director, in consultation with the Dean and the Administrative Director of the UCSC Natural Reserves, appoints the committee. Membership terms begin September 1 unless otherwise specified.

DURATION OF APPOINTMENTS

Faculty Director: 5 years

Faculty Advisors: 3 years

Non-Senate Academic, Staff, and Students: 1 year

Members may be reappointed at the discretion of the Faculty Director in consultation with the Administrative Director.

Hours/Quarter: Chair/NRS Representative-20, Members-10
Reports to: Division of Physical & Biological Sciences Dean

MEMBERSHIPS

Faculty Director of the Natural Reserve System	Don Croll Professor, Ecology & Evolutionary Biology Long Marine Lab, Center for Ocean Health (831) 459-3610 – croll@biology.ucsc.edu
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Younger Lagoon Reserve Scientific Advisory Committee (SAC)

Charge

As outlined in the in the CLRDP, restoration, enhancement, and management activities on the Marine Science Campus will be guided by a Scientific Advisory Committee (SAC) that is made up of independent professionals and academicians experienced in and knowledgeable about the habitats of the natural areas on the Marine Science Campus. The SAC shall guide the development of Specific Resource Plans, which shall be consistent with the performance standards set forth in the Resource Management Plan (RMP), and which may be adapted periodically based on findings from ongoing restoration work. The RMP goals and performance standards may be adjusted as directed by the SAC in coordination with the Executive Director to ensure the success of Campus restoration, enhancement, and management efforts. As such, the RMP goals and performance standards are not static requirements per se so much as initial guidelines that may be refined during the SAC process so long as such refinement is consistent with current professional restoration, enhancement, and management goals and standards, and with achieving high quality open space and natural habitat area in perpetuity consistent with this CLRDP. RMP adjustments in this respect may require a CLRDP amendment, unless the Executive Director determines that an amendment is not necessary.

The committee provides guidance for the restoration, enhancement, and management efforts at YLR, and collaborates with YLR staff on the creation and implementation of the Specific Resource Plan as outlined in CLRDP Implementation Measure 3.2.10 (below).

Implementation Measure 3.2.10 – Natural Areas Habitat Management. *Within six (6) months of CLRDP certification, the University in consultation with the Executive Director of the California Coastal Commission shall convene a scientific advisory committee (SAC) to guide the restoration, enhancement, and management of natural areas (i.e., all areas outside defined development zones, except for Younger Lagoon Reserve) on the Marine Science Campus (see Appendix A). Natural areas restoration, enhancement, and management may be completed in up to three phases corresponding to dividing the natural area into thirds (i.e., where Phase 1 accounts for at least one-third of the natural area, Phase 1 plus Phase 2 accounts for at least two thirds, and all of the three phases together account for all of the natural area). All restoration, enhancement, and management activities shall be guided by Specific Resource Plans developed by the University in accordance with the SAC and the criteria contained in the Resource Management Plan (Appendix A) and current professional standards for such plans. The SAC shall be responsible for guiding development of Specific Resource Plans and shall complete its work on the Specific Resource Plan for Phase I restoration and enhancement efforts within four (4) months of convening. The content of Specific Resource Plans shall be consistent with the performance standards set forth in Appendix A, which may be adapted periodically based on findings from ongoing restoration work. The University shall file a Notice of Impending Development for Phase I work within one (1) year of CLRDP certification. All natural areas restoration and enhancement shall be completed within 20 years of CLRDP certification, with* *interim benchmarks that at least one-third of the restoration and enhancement shall be completed within seven years of CLRDP certification and that at least two-thirds shall be completed within 14 years of CLRDP certification.*

The SAC was seated in January 2009. In addition to the chair, membership of the committee is comprised of three independent professionals and academicians experienced in and knowledgeable about the habitats of the natural areas on the Marine Science Campus. Brief bios of the four SAC members are below.

Dr. Karen Holl- Professor, Environmental Studies, University of California at Santa Cruz (UCSC).

Dr. Karen Holl has been on the faculty in the Environmental Studies Department at the University of California, Santa Cruz for nearly 20 years. She has conducted research on restoration ecology in a wide variety of ecosystems, including tropical rain forests, eastern hardwood forests, chaparral, grassland, and riparian systems in California. She has published over 50 journal articles and book chapters on restoring damaged ecosystems and is on the editorial board of the journal Restoration Ecology. She teaches the Restoration Ecology class at UCSC and supervises many of the undergraduate students who work on the UCSC Natural Reserves. She regularly advises numerous public and private agencies along the Central California Coast on land management issues. She recently was selected as an Aldo Leopold Leadership Fellow. Dr. Holl's expertise in restoration ecology, experimental design and data analysis, as well as her affiliation with UCSC and her excellent rapport with University students and staff make her an irreplaceable member of the Scientific Advisory Committee.

Dr. Holl received a Ph.D. in Biology from Virginia Polytechnic Institute and State University, and a Bachelors degree in Biology from Stanford University.

Tim Hyland - Environmental Scientist, State Parks, Santa Cruz District.

Mr. Hyland has worked in the field of wildlands restoration for nearly 20 years. Much of his work has focused on coastal scrub, dune, and wetland restoration at sites throughout the Central Coast, including Wilder Ranch State Park (located approximately one mile west of YLR). He has extensive experience in restoration planning and implementation, vegetation mapping, exotic species control, and native plant propagation. In addition, Mr. Hyland is highly skilled in public education and outreach. His long tenure with California State Parks and direct experience in designing and implementing large-scale restoration projects make him a valuable member of the Scientific Advisory Committee.

Mr. Hyland has a B.A. from California Polytechnic State University, San Luis Obispo.

Bryan Largay – Conservation Director, Land Trust of Santa Cruz County.

Mr. Largay has worked in the fields of hydrology, water quality, and wetlands for fourteen years with a focus on restoration and wildlife habitat. He has conducted wetland restoration, watershed hydrology, and water quality investigations and designed measures to control erosion and treat water quality problems using vegetation. Much of his work has focused on collaborative water quality protection projects with agricultural landowners and growers. He has worked to solve water resource problems with a broad array of individuals, including scientists, planners, engineers, growers, private landowners, and contractors. Prior to joining the staff of The Land Trust of Santa Cruz County, he worked as the Tidal Wetland Project Director at Elkhorn Slough National Estuarine Research Reserve (ESSNER) and participated in the Tidal Wetland Project as a member of the Science Panel and Model Advisory Team. Mr. Largay's experience working on complex, large-scale restoration projects with agricultural neighbors in a non-profit setting make him a very important addition to the Scientific Advisory Committee.

Mr. Largay received an M.S. in Hydrologic Sciences at U.C. Davis, and a Bachelor's degree at Princeton University.

Dr. Lisa Stratton - Director of Ecosystem Management, Cheadle Center for Biodiversity and Ecological Restoration, University of California, Santa Barbara (UCSB).

Dr. Lisa Stratton has worked in the field of science-based restoration for nearly 20 years. She has extensive experience in restoration planning and implementation in conjunction with campus construction projects. Much of her work at UCSB has focused on involving students and faculty in the Cheadle Center's restoration projects. Dr. Stratton's work at the UCSB has provided her with a rare understanding of some of the unique challenges and opportunities YLR staff face as they undertake the restoration project at YLR. Her combined experience in wildlands restoration and management, scientific research, and working within the University of California system make her a very important member of the Scientific Advisory Committee.

Dr. Stratton received a Ph.D. in Botany and Ecology from the University of Hawai'i, a M.S. in Conservation Biology and Sustainable Development from the University of Wisconsin-Madison, and a Bachelors degree in Comparative Literature from Stanford University

Appendix 1. California Coastal Commission beach monitoring report

Younger Lagoon Reserve

Beach Monitoring Report

2020

***Watsonville Area Teens Conserving Habitats* (WATCH) *Program* Participants at Younger Lagoon**

Elizabeth Howard and Gage Dayton
Younger Lagoon Reserve

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Overview and Executive Summary

In March 2010, the California Coastal Commission (Coastal Commission) approved the University of California's Notice of Impending Development Implementation for Implementation Measure 3.6.3 of the CLRDP (NOID 10-1). NOID 10-1 requires that (through supervised visits) the public have access to Younger Lagoon Reserve beach and that a monitoring program be created and implemented to document the condition of native flora and fauna within Younger Lagoon and its beach. The monitoring plan was to be implemented over a 5-year time period. At the end of the 5-year period (Winter 2015) results were to be compiled and included in a report that summarizes and discusses the potential effect of controlled beach access on flora and fauna at Younger Lagoon and submitted as a NOID to the CCC.

The campus began implementing the public access plan and monitoring program in spring 2010, and submitted the report on the results of the monitoring to the Coastal Commission in February of 2016 as part of the Younger Lagoon Reserve Annual Report. The campus submitted NOID 9 (16-2) Public Access to and Within Younger Lagoon Reserve to the Coastal Commission in December 2016. At the request of local coastal staff, the campus withdrew NOID 9 (16-2) resubmitted it as NOID 9 (17-1) in June 2017. The campus presented NOID 9 (17-1) at the July 2017 CCC and although CCC staff found the NOID consistent with the CLRDP, a Commissioner requested the University provide significantly more tours to the beach and that children be allowed for free. The campus withdrew NOID 9 (17-1), made changes to address these requests, and resubmitted it as NOID 9 (18-1) in August 2018.

On September 13, 2018, the Coastal Commission approved UC Santa Cruz's NOID 9 (18-1) as consistent with UCSC's approved Coastal Long Range Development Plan with the addition of five staff-recommended special conditions. These included 1) Free Beach Tours, 2) Beach Tour Outreach Plan, 3) Beach Tour Signs, 4) Beach Tour Availability and Monitoring, and 5) Beach Access Management Plan Duration. Within 30 days of the approval (i.e., by October 13, 2018), UCSC was required to submit a plan for implementation of the special conditions to the Executive Director of the California Coastal Commission. The plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on October 15, 2018. UCSC received feedback from Coastal Commission staff on the plan, and a revised plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on December 15, 2018. The revised plan for implementation of the special conditions was approved by the Executive Director on January 30, 2019.

Special Condition 4 requires that at least every six months (i.e., by June 30th and December 31st each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval. UCSC's initial report on the implementation of these special conditions for the period of January 1, 2019 through June 30, 2019 was submitted on June 28, 2019. Upon review, local Coastal Commission staff requested more detail regarding the implementation of Special Condition 2. UCSC's revised report on the implementation of the special conditions for the period of January 1, 2019 through June 30, 2019 was submitted on September 5, 2019. The report for the period of July 1, 2019 through December 31, 2019 was submitted on December 23, 2019. The report for the period of January 1, 2020 through June 30, 2020 was submitted on June 30, 2020. The report for the period of July 1, 2020 through December 31, 2020 was submitted on December 22, 2020.

On October 8, 2020, the Coastal Commission approved UC Santa Cruz's NOID 11 (20-1) as consistent with UCSC's approved Coastal Long Range Development Plan with the continuation of five staff-recommended special conditions from NOID 9 (18-1), an increase in the number of participants per tour and an increase in outreach efforts. Within 30 days of the approval (i.e., by November 8, 2020), UCSC was required to submit a plan for implementation of the special conditions to the Executive Director of the California Coastal Commission. The plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on November 6, 2020. The plan for implementation of the special conditions was approved by the Executive Director on November 12, 2020.

This document serves as both a summary report for activities under NOIDs 2 (10-1) and 9 (18-1) that have taken place since our previous report at the end of fiscal year 2019 and a summary report for the entire 10-year monitoring program. All year's results are included. Data collected indicate that Younger Lagoon Reserve (YLR) supports a wide variety of native flora and fauna, provides habitat for sensitive and threatened species, supports a very unique beach dune community, and is extensively used for research and education. In general, in comparison to the other local beaches surveyed native plant species richness is greatest at YLR and Natural Bridges; however, there is quite a bit of annual variation among the sites. A parameter that we quantified in 2012, and is evident from visual observation and photo documentation, is the presence of dune hummocks and downed woody material at YLR, both of which are almost entirely absent at local beaches due to human use. These features provide habitat for plant species such as the succulent plant dudleya, which grow on downed woody material and dune hummocks at YLR, as well as burrowing owls that use burrows in hummocks and seek shelter beneath downed woody material at YLR.

The relatively natural state of YLR beach and dune vegetation is unique among most pocket beaches in Santa Cruz County and likely represents a glimpse into what many of the pocket beaches in the greater Monterey Bay area looked like prior to significant human disturbance. Open access to the beach would likely result in the loss of the unique ecological characteristics of the site, likely have a negative impact on sensitive and protected species and certainly reduce its effectiveness as a research area for scientific study. Controlled beach access through the Seymour Center docent led tours, provides an appropriate level of supervised access that enables people to see and learn about the lagoon habitat while limiting impacts to the system. It is important to note, however that avian data collected during the 2020 docent led beach tours indicate that the tours have a significant negative impact on birds (see NOID 9 (18-1) Special Conditions Implementation Report 4, December 23, 2020). We recommend that the current docent-guided tour program continue while we continue to monitor the biological impacts of the tours.

Although only required to monitor the YLR beach, YLR staff, faculty, and the Scientific Advisory Committee decided to monitor nearby beaches with varying levels of use (Natural Bridges and Sand Plant Beach) during the first 5-year period in order to examine differences in the flora, fauna and use among the three sites. This effort required hundreds of hours of staff and student time, as well as coordination with State Parks staff. As reported in the 2015 YLR Beach Monitoring Report, beginning in the summer of 2015 and moving forward, YLR staff will continue to monitor YLR as required in IM 3.6.3; however, we will no longer monitor at Natural Bridges State Beach or Sand Plant Beach as the previous 5 years of data collection have provided us with adequate information to assess beach resources.

Introduction

Over 50 years ago, the University of California Natural Reserve System (UCNRS) began to assemble, for scientific study, a system of protected sites that would broadly represent California's rich ecological diversity. Today the UC Natural Reserve System is composed of 41 reserves that encompass approximately 750,000 acres of protected natural land available for university-level instruction, research, and public service. The University of California Natural Reserve System supports research and education through its mission of contributing "*to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California*." By creating this system of outdoor classrooms and laboratories and making it available specifically for long-term study and education, the NRS supports a variety of disciplines that require fieldwork in wildland ecosystems. UC Santa Cruz administers four UC Reserves: Younger Lagoon Natural Reserve, Año Nuevo Island Reserve, Landels-Hill Big Creek Reserve, and Fort Ord Natural Reserve.

The objective of the beach monitoring program is to document the presence and distribution of flora and fauna within Younger Lagoon Natural Reserve (YLR) and to evaluate changes in distribution and density over time. Additionally, YLR staff decided to monitor nearby beaches with varying levels of use (Natural Bridges and Sand Plant Beach) in order to examine differences in the flora and fauna among the three sites. Importantly, the data collected in this study provides a quantitative assessment of various attributes (species composition, abundance, etc.) but it is realized that the sites vary significantly from one another and that there is no replication. Thus, although these data comparisons are informative there are significant constraints that make meaningful statistical comparisons between the sites impossible. As such, results shouldn't necessarily be used to create strict prescriptions.

This report is a report for activities under NOIDs 2 (10-1), 9 (18-1), and 11 (20-1) during Fiscal Year (FY) 2019-2020 (July 1, 2019 – June 30, 2020) which surveyed YLR. In addition, although we are no longer monitoring Natural Bridges and Sand Plant beaches, we have included all year's results from all sites in this report in order to show the entire effort to date. Data for each monitoring objective have been added to previous year's data; thus, the results for this reporting period have been combined with all previous findings. As a result, this report provides a running summary of our findings starting from the inception of the study and running through the end of FY 2019-2020.

Younger Lagoon Access History

History of Public Access to Younger Lagoon Beach

Prior to 1972, Younger Beach was privately owned and closed to the public. The owners (Donald and Marion Younger) actively patrolled for, and removed, trespassers from their property, including the beach. In 1972, the Younger Family donated approximately 40 acres of their property to the University of California for the study and protection of the marine environment. These lands included Younger Lagoon and Beach (approximately 25 acres), and an adjoining parcel of land (approximately 15 acres) which became the site of the original Long Marine Laboratory (LML). At the time of their donation, Donald and Marion Younger intended that the lagoon, beach and surrounding slopes be protected in perpetuity by the University as a bird sanctuary.

In the years between the donation of the property and the start of LML construction (1976), the University leased the future LML site back to farmers who had been farming the property for the Younger family prior to the donation. During those years, the same no trespassing rules for the beach were enforced as they had been when the property was owned by the Younger family.

Once construction of LML began in 1976, the land was no longer under the watch of the farmers, and public pressure on the beach began to increase. Many Santa Cruz locals remember the next several years at Younger Beach fondly as it became a popular nude beach. The increased public access had a noticeable impact on the flora and fauna of the beach, and was not in accordance with the intention of the original donation by the Younger family. By 1978 discussions had begun between the University and the California Coastal Commission regarding the impact of uncontrolled public access to the beach. In 1981, it was decided that the impacts to Younger Beach were significant and the California Coastal Commission, under coastal permit P-1859, closed uncontrolled access to the beach.

After the approval of coastal permit P-1859, the University began to actively patrol the beach for trespass, educate the public about the closure, and use the site for research and education. After YLR was incorporated into the UCNRS in 1986, users were required to fill out applications, or contact NRS staff, for specific research, education, or outreach efforts. As the LML campus grew, a protective berm and fencing were constructed around the perimeter of the lagoon, and informational 'beach closed' signs were posted on the cliffs above the beach. Over time, trespass decreased and the reduced public access had a noticeable positive impact on the flora and fauna of the beach.

Public access to YLR beach came to the forefront again during the CLRDP negotiation process (2000-2008). At the time negotiations began, YLR supported a rich composition of plant and animal species despite being surrounded by agricultural and urban development. Reserve staff were concerned that any increase in public access could threaten the already heavily impacted habitat. At the time of CLRDP certification (2010), all parties agreed to the Beach Access Management Plan outlined in NOID 10-1. Under the Beach Access Management Plan, the YLR beach remains closed to unsupervised public access and the reserve is implementing a management and monitoring plan that includes docent-guided tours.

Because of the importance of maintaining a natural and pristine environment (Figure 1) and protecting scientific studies and equipment, uncontrolled access to YLR is not allowed. Uncontrolled use of YLR is likely to have a negative impact on native coastal flora and fauna that inhabit the reserve, hamper research endeavors, and impact the area for future scientific and educational endeavors. Rather than an open public access policy, users are required to fill out applications, or contact NRS staff, for specific research, education, or outreach efforts. In 2010 YLR began hosting docent-guided tours that are offered by the Seymour Marine Discovery Center (Seymour Center).

Beach Access Tours

Due to COVID-19 precautions, the Seymour Center was temporarily closed and the free beach tour program temporarily suspended in March 2020. The University will restart the free beach tour program when the Seymour Center reopens and Orders of the State Public Health Officer and County of Santa Cruz Health Officer currently in effect are rescinded or amended (see UC Santa Cruz's Pub. Res. Code section 30611 notification letter to the Commission).

From 2010 - 2017, docent-led beach tours were offered twice monthly through the Seymour Marine Discovery Center (Seymour Center). Starting in January 2018, tours are offered twice a month during the slower fall and winter months (October-February), and four times a month during the busier spring and summer months (March-September), for a total of 38 tours per year. From 2010-2018, these tours were offered free with admission to the Seymour Center, Starting in 2019, these tours are now offered for free. In addition, all of the docent led daily tours run by the Seymour Center (prior to the COVID-19 pandemic, approximately 1,500 tours annually) include an informational stop about YLR that includes visual access to the beach.

The extent of the beach access area varies depending on tidal conditions and the location of plants, as foot traffic is only permitted seaward of the dune vegetation. Thus, the exact access area may vary slightly from the areas depicted in Figure 2 below and Figure 3.11 of the CLRDP. The trail provides an interpretive experience for visitors that begins with a narrative history of the UC Natural Reserve System (UCNRS), an overview of the lagoon, a walk through a restored coastal scrub habitat with opportunities to view the rear dune, and ends on the beach. Tours are led by Seymour Center docents trained in the natural history and ecology of YLR and provide detailed information about flora, fauna, geology, and the UCNRS. Tour curriculum, which was first presented to the Seymour Center docents during the regular winter docent-training program in 2010, focuses on the unique ecology of the YLR beach.

In addition to the docent-guided beach tours, visual access to the lagoon and back dune is provided to the public via Overlook E along McAllister Way. Overlook E is open to the public from dawn to dusk. Visual access to the Younger Lagoon beach and information about Younger Lagoon Reserve is also provided to all visitors taking the Seymour Center's docent-guided Reserved and Daily Tours via the Overlook C. Prior to the COVID-19 pandemic, nearly 25,000 visitors annually took these tours.

In order to maintain public access and engagement during the COVID-19 pandemic, the University has created a virtual bilingual beach tour that will be available on the Seymour Center and Younger Lagoon Reserve websites in early 2021. The virtual tour will allow visitors from around the world to learn about the unique ecology and programs at the reserve in English and Spanish from the comfort of home.

The virtual tour websites feature a map of the reserve with marked locations where visitors can click to watch videos about the features of each type of habitat.

Virtual Tour Links:
English: https://arcg.is/11m1Ga
Spanish: https://arcg.is/0q0Czv

A UC Santa Cruz undergraduate student created the virtual tour websites and edited the videos as part of an internship project. This student completed all of the work on this project remotely, including learning about the reserve itself. A Younger Lagoon Reserve undergraduate student employee who assisted with the free in-person tours prior to the pandemic acts as the on-camera guide for both tours.

Public Education and Outreach Programming on the Coastal Science Campus

Seymour Marine Discovery Center

The free docent guided beach tours are part of broader public education and outreach programming on the Coastal Science Campus offered through the Seymour Center. Prior to the COVID-19 pandemic, nearly 70,000 people visit the Seymour Center, and nearly 15,000 visitors take docent-guided tours annually. The Seymour Center provides marine science education to hundreds of classes, comprised of thousands of students, teachers, and adult chaperones from across the country. Many of the classes served come from schools classified as Title 1—schools with high numbers of students from low-income families. Scholarships are made available to Title 1 schools, making it possible for students to participate who would not otherwise have the opportunity to experience a marine research center. Teachers often incorporate the Seymour Center into their weeklong marine science field study courses.

Prior to the COVID-19 very year, dozens of children ages 7-14, enroll in weeklong summer science sessions known as Ocean Explorers. Students actively learn about and participate in marine research at the Seymour Center and Long Marine Laboratory, where participants work alongside marine mammal researchers and trainers. Participants gain experience with the scientific process, focusing on honing their observation and questioning skills. Ocean Explorers also investigate the coastal environment at field sites around Monterey Bay, including rivers and watersheds, sandy beaches, rocky intertidal areas, and kelp forests by kayak. Young participants generally come from Santa Cruz, Santa Clara, and San Mateo Counties. Full and partial scholarships are extended to low-income participants. This program has been temporarily suspended for the 2020 summer due to COVID-19 precautions.

While part of UC Santa Cruz, the Seymour Center must raise its ~$1.5 million budget annually (including all operating costs, salaries, and benefits) from earned revenue, private donors and grants. Earned revenue—admissions, program fees, facility rentals, and the Ocean Discovery Shop—makes up approximately half of its general operating requirements.

The Seymour Center actively promotes its activities with press releases and calendar listings throughout the region. Every year, traditional print ads are placed in newspaper and magazines. The Seymour Center's activities are also often covered in the local newspaper, the Santa Cruz Sentinel. Public radio ads run throughout the year on the NPR-affiliate, KAZU.

Coupons for discounted admissions are available in various formats. The most highly used program is through the many Bay Area municipal libraries. Called Discover and Go, hundreds of families from across the region utilize these discount coupons. The Seymour Center continued to connect with the public through Facebook, Twitter, Instagram, Pinterest, Flickr, and bi-monthly e-blasts.

Watsonville Area Teens Conserving Habitat (WATCH)

Last year, the Seymour Center, Younger Lagoon Reserve and the Monterey Bay Aquarium again partnered to support high school students in the Watsonville Area Teens Conserving Habitats (WATCH) program. WATCH students from Aptos High School design and carry out field-based research projects in Younger Lagoon Reserve on topics including endangered fish, aquatic invertebrates, and birds. These students make repeated visits to the Reserve throughout the year. Find out more at: https://www.montereybayaquarium.org/education/teen-programs/watsonville-area-teens-conserving-habitats-watch

Community Bioblitz
Due to the COVID-19 pandemic, the annual Younger Lagoon Reserve Bioblitz / California Academy of Sciences was canceled. A bioblitz is a community event that brings together a wide variety of people – citizen scientists - to rapidly inventory the living organisms found in a particular place. The Younger Lagoon Reserve Bioblitz is held during the spring, and is open to members of the public. Participants explored the lagoon and beach areas as part of this event. A link to the page advertising this community event can be found here: https://www.inaturalist.org/projects/younger-lagoon-reserve-bioblitz-2020

Volunteer Stewardship Days
Last year, prior to the COPVID-19 pandemic, Younger Lagoon Reserve hosted several volunteer stewardship days. These events are advertised on social media and open to the public. Volunteer stewardship days provide members of the public with the opportunity to learn about the reserve and its unique habitats, wildlife, research, restoration, and teaching programs while giving back.

Figure 1. Burrowing owl on the beach at Younger Lagoon.

Study Areas

Flora, fauna, and human use were monitored at Natural Bridges State Park, Younger Lagoon Reserve, and Little Wilder/Sand Plant Beach from 2010-2015 (Figure 2). These three sites have similar characteristics (all have beach and lagoon habitat), are within close proximity to one another, and experience varying levels of human use. Although site characteristics are similar in many ways, they are also different in many ways, and these differences likely influence species composition. Three of the primary differences among the sites are human use levels, composition of adjacent upland habitat, and the overall size of the beach and wetland areas. Starting in FY 2015-2016 and moving forward, only Younger Lagoon Reserve has been and will continue to be monitored.

Younger Lagoon Reserve

Younger Lagoon Reserve is located in Santa Cruz County, approximately 4.5 miles from the main UC Santa Cruz campus; adjacent to the UC Santa Cruz Long Marine Laboratory. One of the few relatively undisturbed wetlands remaining on the California Central Coast, Younger Lagoon Reserve encompasses a remnant Y-shaped lagoon on the open coast just north of Monterey Bay. For most of the year, the lagoon is cut off from the ocean by a sand barrier. During the winter and spring months, the sand barrier at the mouth of Younger Lagoon breaches briefly connecting the lagoon to the ocean. The lagoon system provides protected habitat for 100 resident and migratory bird species. Approximately 25 species of water and land birds breed at the reserve, while more than 60 migratory bird species overwinter or stop to rest and feed. Opossums, weasels, brush rabbits, ground squirrels, deer mice, coyote, bobcat, woodrat, raccoon, and skunk are known to occupy the lagoon; gray and red foxes as well as mountain lion have also been sighted. Several species or reptiles and amphibians, including the California Red-legged Frog, also are found in the Reserve. Reserve habitats include salt and freshwater marsh, backdune pickleweed areas, steep bluffs with dense coastal scrub, pocket sand beach, grassland, and dense willow thickets.

Sand Plant Beach ("Little Wilder")

Sand Plant Beach is located in Santa Cruz County, approximately 1.5 miles west of YLR adjacent to Wilder Ranch State Park. Sand Plant Beach is approximately 23 acres and includes a pocket beach, dunes, cliffs and lagoon. It is open to the public for recreational use from dawn until dusk, 365 days a year; however, requires a hike to get to it and thus experiences less human use than many of the more accessible beaches in Santa Cruz. The surrounding Wilder Ranch State Park covers approximately 7,000 acres and allows human, bike and equestrian access. Much of the interior lagoon/upland habitat has been modified for agricultural production and/or ranching over the past century. Today most of the vegetation that persists inland of the lagoon is dominated by freshwater emergent vegetation and willow thickets. Major wetland restoration projects have increased native flora and fauna in the area (Friends of Santa Cruz State Parks, 2010).

Natural Bridges Lagoon

Natural Bridges Lagoon is located in Santa Cruz County, approximately 0.5 miles east of YLR on the urban edge of the city of Santa Cruz CA in Natural Bridges State Park. Natural Bridges Lagoon, beach, and State Park encompasses approximately 63 acres and includes a wide pocket beach, lagoon, cliffs, and diverse upland habitat (scrub, grass, iceplant, willow thicket, live oak, eucalyptus, and cypress). The park is world-renowned for its yearly migration of monarch butterflies and famous natural bridge. Natural Bridges State Park allows human access as well as dogs that are on leash and remain on paved roads and in parking lots (Friends of Santa Cruz State Parks, 2010). The beach is a popular destination at all times of the year; however, it is especially popular in the spring, summer, and fall months.

Figure 2. Study Areas.

Methods

User Data

User data from tours conducted by the Seymour Center, as well as research and education use of YLR, were recorded and maintained by Seymour Center and YLR Staff. User data from educational programs and fee collection are recorded and maintained by California State Parks staff for Natural Bridges State Parks. No user data was available for Sand Plant Beach.

Human Beach Use

We used remote cameras to quantify human use quarterly througout the study peroiod. Cameras were placed along the eastern edge of Sand Plant Beach and Natural Bridges Beach from FY 2010-2011 – FY 2014-2015 and at the western edge of Younger Lagoon from FY 2010-2011 – present with each separate quarterly sampling events each consisting of two days. Cameras were set to automatically take photos at 15 minute intervals. Number of people were quantified for 15 minute intervals during the day (camera times varied across sampling periods due to day length and postion; however, were standardized within each sampling period). The total survey area varied between sites and among individual sampling efforts due the placement of the camera and available habitat for human users at the time of the survey (i.e. often less beach area surveyed at Sand Plant Beach compared to Younger Lagoon and Natural Bridges). In order to control for area, specific regions of photos were chosen and number of individuals within each region were counted; thus, the number of people counted per unit area and time was standardized. We used the largest survey area during each sampling period to standardize use within each specific region of the beach during each sampling effort. Thus, if a particular site had more or less habitat monitored, the number of individuals was standardized across sites making comparisons comparable.

Photo Documentation of Younger Lagoon Natural Reserve

Photo point locations were established at four locations within YLR (Figure 3). These locations were chosen to ensure coverage of all major areas of the beach. Photos were taken once during the reporting period. At each photo point we collected photo point number, date, name of photographer, bearing, and camera and lens size.

Tidewater Goby Surveys

Tidewater goby surveys were conducted quarterly throughout the study period. Surveys were conducted using a 4.5 ft x 9 ft beach seine with 1/8 inch mesh. The objectives of the surveys were to document tidewater goby presence and evidence of breeding activity (determined by the presence of multiple size/age classes). All fish were identified to species and counted. When individuals exceeded ~50 per seine haul, counts were estimated. Sampling was conducted with the goal of surveying the various habitats within each site (e.g. sand, sedge, willow, pickleweed, deep, shallow, etc.); thus, different numbers of seine hauls were conducted at each site. Species richness was compared among sites.

Figure 3. Locations of monitoring points, plots, and regions for YLR beach. Monitoring areas varied between sampling efforts depending upon the high water mark, vegetation patterns, and water levels.

Species Composition and Coverage of Beach Dune Vegetation

Dune vegetation from the lowest (nearest to the mean high tide line) occurring terrestrial plant to 10 meters inland into the strand vegetation was surveyed quarterly throughout the study period. The exact location and extent of the area surveyed each time varied depending upon the location of the "lowest" plant detected during each sampling effort. At each location we established a 50-m east-west transect across the dune vegetation and measured the distance from the estimated mean high tide line to the "lowest" plant on the beach. Herbaceous species composition was measured by visual estimation of absolute cover for each species in ten 0.25 m^2 quadrats along the transect. Quadrats were placed every 5 m on alternating sides of the transect starting at a randomly selected point between 1 and 5 meters (a total of 10 quadrats per transect). A clear plastic card with squares representing 1, 5, and 10% of the sampling frame was used to help guide visual cover estimations. Species cover (native and exotic), bare ground, and litter were estimated at 5% intervals. Litter was specifically defined as residue from previous year's growth while any senescent material that was recognizable as growth from earlier in the current growing season was counted as cover for that species. After all cover estimates had been made, we conducted surveys within 2 m of either side of the transect (a 4 × 50 m belt). In the belt transects, individual plants were recorded as either seedlings or greater than 1 year old. Presence of flowers and seeds was also noted.

Non-avian Vertebrate Monitoring

Tracks

Vertebrate tracks were measured using raked sand plots at each site quarterly throughout the study period. Tracking stations were placed throughout the beach area in constriction zones where vegetation was absent. The objective of these surveys was simply to detect what species use the beach habitat. As such, size of plot varied from approximately depending upon the amount of available open sandy area at each location. Track stations were raked each evening and checked for tracks in the morning. Stations remained open for two days during each monitoring bout. Tracks were identified to species when possible. Species composition was summarized; however, abundance was not quantified due to the fact that most often tracks cannot be used to identify individual animals (e.g. a single individual could walk across the plot multiple times).

Small Mammals

Sherman live traps were placed for two nights every quarter of the study period - a total of 30 traps were placed used (60 trap nights per sampling bout). Traps were set at dusk and collected at dawn. Each trap was baited with rolled oats and piece of synthetic bedding material was placed in each trap to ensure animals did not get too cold. Individuals were identified to species, marked with a unique ear tag, and released at the site of capture.

Invertebrate Monitoring
Terrestrial invertebrates on beach habitat were monitored by placing 12 oz plastic containers (pit fall traps) at each tracking station (one at each corner of the plot) during tracking efforts. Traps were buried to the lip of the container and checked each morning and all individuals were collected, identified, and counted.

Avian Monitoring
We conducted ocular surveys of birds on the beach, lagoon, and cliff habitats quarterly throughout the study period. Survey locations were selected along one edge of the beach on the cliff. At Sand Plant Beach the entire beach area, fore portion of the lagoon, and western cliff were surveyed from the eastern edge of the lagoon (FY 2010-2011 – FY 2014-2015). At YLR the entire beach area, fore portion of the lagoon, and western cliff were surveyed from the eastern edge of the lagoon and the top and western face of the rock stack that is located at the beach/ocean edge was surveyed (FY 2010-2011 – present). At Natural Bridges surveys were conducted from the eastern edge of the beach on the cliff adjacent to De Anza Mobile Home Park or from the beach to the west; fore lagoon and approximately the western ¼ of the beach area (including beach/ocean interface) was included in the survey area (FY 2010-2011 – FY 2014-2015). Survey areas were chosen with the goal of surveying approximately the same area and types of habitat. Counts were recorded quarterly throughout the study. Surveys were conducted in the dawn or dusk hours within approximately 2 hours of sunrise or sunset and of one another. Data from the two days during each sampling effort were combined and individuals were identified and counted.

Results

User Data

Younger Lagoon Reserve
There were a wide variety of public and non-profit research and educational groups that used Younger Lagoon (Table 1). The greatest educational user group for YLR was undergraduate education, a breakdown of all user groups is included in Table 2. The greatest user group was "other" which consists primarily of public tour groups attending daily tours at the Seymour Center. Those users were provided an overlook of the beach, interpretive information via docent led tours, and opportunities to read interpretive material presented on signs about the reserve; however, did not access the beach. During the 19-20 fiscal year a total of 222 participants went on the free Seymour Center docent led Younger Lagoon beach tours, the same number as in the pervious fiscal year despite the temporary cessation of the tours in March 2020 due to the COVID-19 pandemic. Since the start of the Seymour Center docent led beach access tours, 203 tours have gone out and more than 1,260 visitors have participated. The beach access tours are part of a broad offering of public outreach and education programming on the Coastal Science Campus managed by the Seymour Center, including K-12 school visits to the Seymour Center, the Ocean Explorers Summer Camp, Bay Area Libraries Discover and Go Program, as well as print, web, social media, and radio campaigns.

Despite ongoing staff efforts towards public outreach and education, some unauthorized uses of Younger Lagoon Reserve, including trespass and vandalism occurred in FY 2019-2020. Thus far, no significant damage to ecologically sensitive habitat areas, research sites, research equipment, or facilities has occurred; however, new and concerning trends in mammal use of the beach are likely the result of unauthorized human use. For the first time since the beach monitoring program began in 2010, no bobcats were detected during track plate monitoring, while human footprints were observed during every sampling effort (Table 7). Track plates are prepared at night and checked in the morning. This unauthorized overnight use of the reserve may be having a negative impact on native mammals such as bobcats. Unauthorized overnight use of the reserve is not captured through photo monitoring (Table 3) which occurs during daylight hours. Reserve staff will continue their public outreach and education efforts, and continue to partner with UCSC campus police to ensure the security of the reserve and protect sensitive resources and ongoing research.

Table 1. Younger Lagoon user affiliations.

University of California Campus	**Non-governmental organizations**
University of California, Berkeley	Audubon Society
University of California, Davis	Black Oystercatcher Monitoring Project
University of California, Los Angeles	Monterey Bay Aquarium WATCH Program
University of California, Santa Barbara	Santa Cruz Bird Club
University of California, Santa Cruz	Santa Cruz Museum of Natural History
	Seymour Marine Discovery Center
California State Universities	
California State University, San Jose	**Governmental Agencies**
	US Geological Survey
California Community College	NOAA
Cabrillo Community College	
Universities outside California	
Rutgers University	
Tulane University	
	Volunteer Groups
K-12 system	UCSC Wilderness Orientation
Aptos High School	
Half Moon Bay High School	
Pacific Collegiate School	
Pajaro Valley High School	
Watsonville High School	

Table 2. Younger Lagoon Total Use.

RESERVE USE DATA Fiscal year: 2019-2020

Campus: University of California, Santa Cruz
Reserve: Younger Lagoon Reserve

	UC Home		UC Other		CSU System		CA Comm College		Other CA College		Out of State College		International University		Government		NGO/Non-Profit		Business Entity		K-12 School		Other		Total	
	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs
UNIVERSITY- LEVEL RESEARCH																										
Faculty	2	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	40
Research Scientist/Post Doc	1	1	1	1	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	0	6	6
Research Assistant (non-student/faculty/postdoc)	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	1	66	3	68
Graduate Student	6	168	1	7	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	8	176
Undergraduate Student	34	1410	14	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	1436
Professional	3	90	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	5	92
Other	2	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	4	94
Volunteer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	6	6	7	7
SUBTOTAL	48	1801	16	34	0	0	0	0	0	0	2	2	0	0	6	6	2	2	2	2	0	0	7	72	83	1919
UNIVERSITY - LEVEL INSTRUCTION (CLASS)																										
Faculty	4	4	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
Research Scientist/Post Doc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Graduate Student	4	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	11
Undergraduate Student	393	2111	0	0	45	45	43	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	481	2199
Professional	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50
Other	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
SUBTOTAL	403	2177	0	0	46	46	45	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	494	2268
OTHER																										
Faculty	6	6	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	7	8
Research Scientist/Post Doc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	6	12	0	0	0	0	0	0	0	0	7	13
Graduate Student	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25
Undergraduate Student	129	430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129	430
K-12 Instructor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	76	0	0	32	76
K-12 Student	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	698	0	0	93	698
Professional	3	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	6	63	0	0	2	2	0	0	12	70
Other	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	1052	0	0	0	0	15810	15810	15847	16864
Docent	38	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	38
Volunteer	35	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	46	0	0	0	0	0	0	38	81
SUBTOTAL	238	541	1	1	0	0	0	0	0	0	0	0	0	0	7	14	45	1161	0	0	127	776	15810	15810	16228	18303

	UC Home		UC Other		CSU System		CA Comm College		Other CA College		Out of State College		International University		Government		NGO/Non-Profit		Business Entity		K-12 School		Other		Total	
	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs
TOTALS	**689**	**4519**	**17**	**35**	**46**	**46**	**45**	**45**	**0**	**0**	**2**	**2**	**0**	**0**	**13**	**20**	**47**	**1163**	**2**	**2**	**127**	**776**	**15817**	**15882**	**16805**	**22490**

*Other includes members of the public who took the SMDC's docent-led tours. All daily tours in FY 2019-2020 visited the Younger Lagoon / Marine Mammal Overlook and received information about the reserve.

Sand Plant Beach (Little Wilder)

Sand Plant Beach is located adjacent to Wilder State Park and is frequented by Wilder State Park visitors along a coastal bluff trail. Because of the size of Wilder Ranch State Park (over 7,000 acres, with over 35 miles of trails) and its multiple points of access, it is unknown exactly how many people visit Sand Plant Beach each year. However, even though it requires a hike it is one of the more popular beaches along this section of Wilder Ranch as there is relatively easy access along the coastal bluff trail. We surveyed Sand Plant Beach from FY10-11 – FY14-15.

Natural Bridges Lagoon

We did not obtain user data for Natural Reserves during the survey period; however, more than 925,000 people are estimated to have visited Natural Bridges State Park in 2005 (Santa Cruz State Parks 2010). The proportion of those visitors that use the beach and lagoon habitat is unknown. It is likely that the number of visitors remains in this range from year to year. We surveyed Natural Bridges Lagoon from FY10-11 – FY14-15.

Human Use During Survey Efforts

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. Number of users at YLR beach during the survey efforts varied among beach as well as between sampling dates. However, the pattern of total use and the number of people per photo (15 minute interval standardized for area surveyed) was consistent across sampling periods (Table 3). Examples of photos captured during a typical monitoring session in 2010 are included as Figure 4.

Table 3. Number of people observed in photo human use monitoring.

Site	Month	[1]Total # of people	[1]Ave # of People / 15 minute
Natural Bridges	May, 2010	313	3.13
Sand Plant	May, 2010	92	1.21
Younger Lagoon	May, 2010	2	0.28
Natural Bridges	August, 2010	224	2.69
Sand Plant	August, 2010	15	0.17
Younger Lagoon	August, 2010	0	0
Natural Bridges	November, 2010	207	2.07
Sand Plant	November, 2010	7	0.17
Younger Lagoon	November, 2010	1	0.02
Natural Bridges	February, 2011	185	2.64
Sand Plant	February, 2011	10	0.25
Younger Lagoon	February, 2011	2	0.06

Site	Month	[1]Total # of people	[1]Ave # of People / 15 minute
Natural Bridges	May, 2011	236	2.8
Sand Plant	May, 2011	13	0.38
Younger Lagoon	May, 2011	5	0.18
Natural Bridges	July, 2011	795	2.44
Sand Plant	July, 2011	7	0.25
Younger Lagoon	July, 2011	0	0
Natural Bridges	December, 2011	49	0.63
Sand Plant	December, 2011	39	1.16
Younger Lagoon	December, 2011	0	0
Natural Bridges	April, 2012	442	6.93
Sand Plant	April, 2012	120	2.05
Younger Lagoon	April, 2012	0	0
Natural Bridges	May, 2012	624	2.67
Sand Plant	May, 2012	14	0.19
Younger Lagoon	May, 2012	0	0
Natural Bridges	October, 2012	210	4.84
Sand Plant	October, 2012	83	1.06
Younger Lagoon	October, 2012	3	0.04
Natural Bridges	January, 2013	100	4.90
Sand Plant	January, 2013	24	0.81
Younger Lagoon	January, 2013	9	0.11
Natural Bridges	May, 2013	615	19.81
Sand Plant	May, 2013	21	0.52
Younger Lagoon	May, 2013	0	0
Natural Bridges	July, 2013	560	25.42
Sand Plant	July, 2013	29	0.96
Younger Lagoon	July, 2013	5	0.06
Natural Bridges	November, 2013	3.44	13.04
Sand Plant	November, 2013	6	0.19
Younger Lagoon	November, 2013	12	0.15
Natural Bridges	February, 2014	71	6.37
Sand Plant	February, 2014	6	0.20
Younger Lagoon	February, 2014	1	0.01

Site	Month	[1]Total # of people	[1]Ave # of People / 15 minute
Natural Bridges	June, 2014	1723	21.01
Sand Plant	June, 2014	239	2.92
Younger Lagoon	June, 2014	2	0.02
Natural Bridges	August, 2014	852	23.68
Sand Plant	August, 2014	227	2.52
Younger Lagoon	August, 2014	2	0.02
Natural Bridges	November, 2014	2131	21.69
Sand Plant	November, 2014	146	1.78
Younger Lagoon	November, 2014	2	0.02
Natural Bridges	January, 2015	1889	23.04
Sand Plant	January, 2015	225	2.75
Younger Lagoon	January, 2015	11	0.13
Natural Bridges	April, 2015	699	7.13
Sand Plant	April, 2015	-	-
Younger Lagoon	April, 2015	0	0
Younger Lagoon	July, 2015	6	0.02
Younger Lagoon	October, 2015	0	0
Younger Lagoon	February, 2016	0	0
Younger Lagoon	May, 2016	1	0.02
Younger Lagoon	July, 2016	0	0
Younger Lagoon	November, 2016	0	0
Younger Lagoon	February, 2017	0	0
Younger Lagoon	April, 2017	0	0
Younger Lagoon	August, 2017	19	0.16
Younger Lagoon	October, 2017	6	0.05
Younger Lagoon	February, 2018	0	0
Younger Lagoon	May, 2018	27	0.22
Younger Lagoon	July, 2018	11	0.09
Younger Lagoon	November, 2018	14	0.15
Younger Lagoon	February, 2019	62	0.65
Younger Lagoon	May, 2019	0	0
Younger Lagoon	July, 2019	0	0
Younger Lagoon	November, 2019	0	0
Younger Lagoon	February, 2020	0	0
Younger Lagoon	May, 2020	0	0

[1]Standardized by area surveyed.

Figure 4. Photos captured by remote camera during the Spring 2010 monitoring effort. Top to bottom: Sand Plant Beach, Natural Bridges, and Younger Lagoon.

Photo Documentation of YLR

Photos were taken one time during each reporting period. Photos for FY19-20 report are included as Appendix 1.

Tidewater Goby Surveys

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. Evidence of breeding (multiple size classes) continued to be observed at YLR during the reporting period (Table 4).

Table 4. Fish species encountered during sampling efforts.

	Tidewater Goby	Stickleback	Sculpin	Mosquito Fish	Halibut	CRLF [1]	Bluegill
April 9, 2010							
Little Wilder	X	X					
Younger Lagoon	X	X					
Natural Bridges	X	X	X				
August 13, 2010							
Little Wilder	X	X					
Younger Lagoon	X	X					
Natural Bridges	X	X	X	X			
November 18, 2010							
Little Wilder	X	X					
Younger Lagoon	X						
Natural Bridges	X	X	X	X			
February 23, 2011							
Little Wilder	X	X					
Younger Lagoon	X						
Natural Bridges	X	X	X	X			
May 12, 2011							
Little Wilder	X	X					
Younger Lagoon	X	X	X		X		
Natural Bridges	X	X	X				
August 8, 2011							
Little Wilder	X	X					
Younger Lagoon	X	X					
Natural Bridges	X	X					
December 12, 2011							
Little Wilder	X	X					
Younger Lagoon	X						
Natural Bridges	X	X					
March 8, 2012							
Little Wilder	X	X					
Younger Lagoon	X						
Natural Bridges	X	X					
May 15, 2012							
Little Wilder	X	X					
Younger Lagoon	X	X					
Natural Bridges	X	X	X				
August 29, 2012							
Little Wilder	X	X				X	

Younger Lagoon	X	X		X
Natural Bridges	X	X		
October 23, 2012				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges	X	X		
February 2, 2013				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges	X	X		
May 6, 2013				
Little Wilder	X	X		X
Younger Lagoon	X	X		X
Natural Bridges	X	X		
July 16, 2013				
Little Wilder	X	X		X
Younger Lagoon	X	X		
Natural Bridges	X	X	X	
November 14, 2013				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges				
February 21, 2014				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges	X			
May 2, 2014				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges	X			
August 11, 2014				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges	X	X		
November 25, 2014				
Little Wilder	X	X		
Younger Lagoon	X	X		
Natural Bridges	X	X		
January 26, 2015				
Little Wilder	X	X		
Younger Lagoon	X	X		

Natural Bridges	X		
April 13, 2015			
Little Wilder	X	X	
Younger Lagoon	X	X	
Natural Bridges	X	X	X
July 8, 2015			
Younger Lagoon	X	X	
November 4, 2015			
Younger Lagoon	X	X	
February 9, 2016			
Younger Lagoon	X	X	
May 13, 2016			
Younger Lagoon	X	X	
July 20, 2016			
Younger Lagoon	X	X	
November 17, 2016			
Younger Lagoon	X	X	
March 1, 2017			
Younger Lagoon			
May 3, 2017			
Younger Lagoon	X	X	
August 9, 2017			
Younger Lagoon	X	X	
November 9, 2017			
Younger Lagoon	X	X	
February 9, 2018			
Younger Lagoon	X	X	
May 2, 2018			
Younger Lagoon	X	X	
July 16, 2018			
Younger Lagoon	X	X	
November 18, 2018			
Younger Lagoon	X		
February 21, 2019			
Younger Lagoon			

May 14, 2019 Younger Lagoon	X	X				X	
August 15, 2019 Younger Lagoon	X	X					
October 31, 2019 Younger Lagoon	X	X					
February 13, 2020 Younger Lagoon	X						
May 21, 2020 Younger Lagoon	X	X					
No. of sites	3	3	2	2	1	2	1

[1]CRLF = California Red-legged Frog (*Rana draytonii*). Tadpoles have been observed at Little Wilder. Tadpoles, juveniles, young of year, and adults have been observed at YLR and Little Wilder.

Species Composition and Coverage of Beach Dune Vegetation

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. Evidence of reproduction (flowers, seeds, and seedlings) of native and non-native vegetation has been detected at all three sites. Distance from mean high tide to the lowest plant on the beach was consistently greatest at Natural Bridges and lowest at Sand Plant Beach and Younger Lagoon (Table 5). Plant cover was generally higher at Sand Plant and Younger Lagoon (as exhibited by proportion of bare ground) but varied across sampling efforts (Figure 5).

Native plant species richness was consistently greatest at Younger Lagoon; however, it varied across sampling periods (Figure 6). Mean proportion of non-native species was greatest at Natural Bridges (69%) and least at Younger Lagoon (27%) (Table 6).

Table 5. Distance (m) from mean high tide to the lowest plant on the beach.

Site	Spring, 10	Summer, 10	Fall, 10	Winter, 11	Spring, 11	Summer, 11	Fall, 11	Winter, 12	Spring, 12
Younger Lagoon	56	51	20	42	55	49	26	30	28
Sand Plant Beach	33	34	56	56	40	51	29	31	38
Natural Bridges	128	130	141	146	146	138	155	160	123

Site	Summer, 12	Fall, 12	Winter, 13	Spring, 13	Summer, 13	Fall, 13	Winter, 14	Spring, 14
Younger Lagoon	47	20	30	36	37.3	32.1	26.4	36.5
Sand Plant Beach	35	38	31	41	48.1	49.9	45.6	24.2
Natural Bridges	91	75	100	72	88.9	107.3	87.4	83.2

Site	Summer, 14	Fall, 14	Winter, 15	Spring, 15	Summer, 15	Fall, 15	Winter, 16	Spring, 16
Younger Lagoon	21.4	10	26.4	19.5	19.3	20.5	31.4	42.8
Sand Plant Beach	27.5	31	24.5	29.2				
Natural Bridges	74.3	89.4	71	75.8				

Site	Summer, 16	Fall, 16	Winter, 17	Spring, 17	Summer, 17	Fall, 17	Winter, 18	Spring, 18
Younger Lagoon	36.6	46.3	19.5	37.3	22.3	39.3	32	29

Site	Summer, 18	Fall, 18	Winter, 19	Spring, 19	Summer, 19	Fall, 19	Winter, 20	Spring, 20
Younger Lagoon	28	22	23	24.7	38	26	29	27

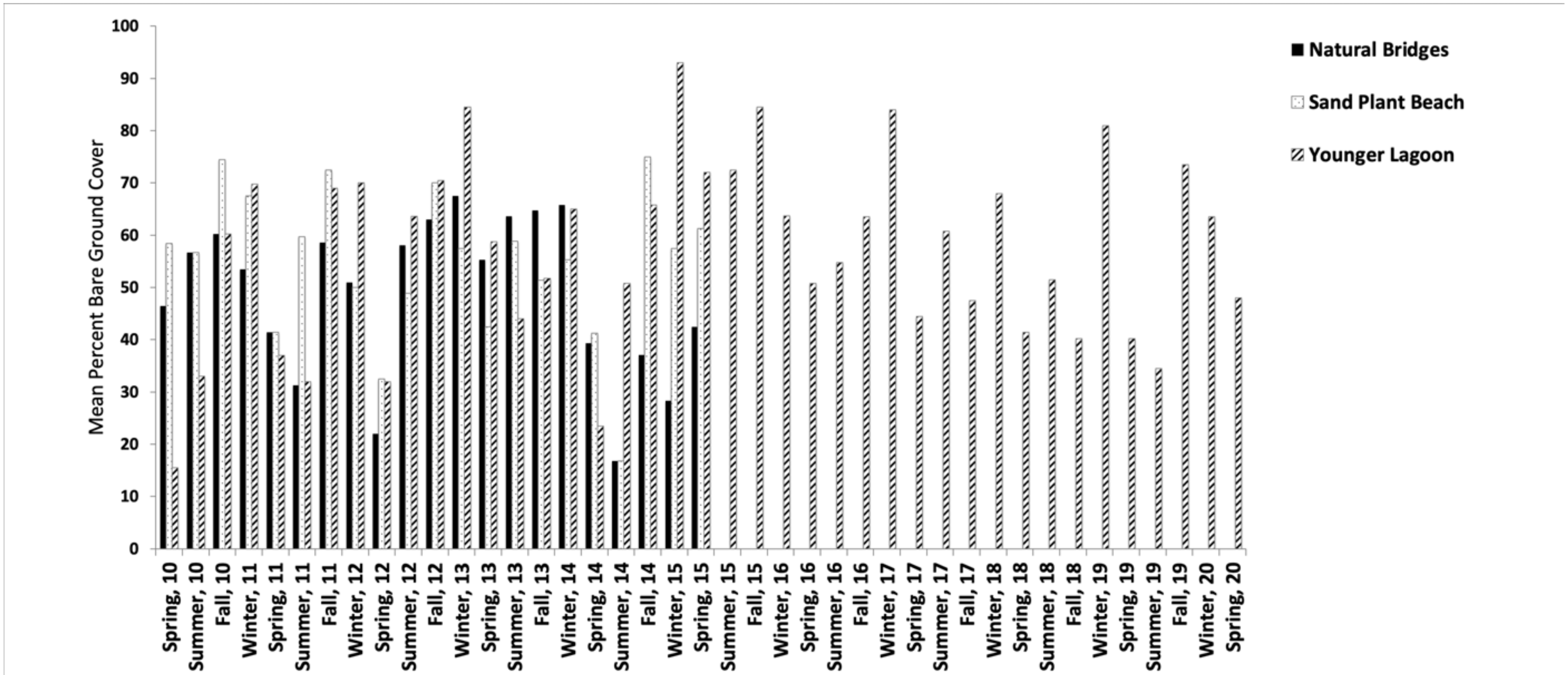

Figure 5. Mean percent bare ground encountered at each site.

Table 6. Number and proportion of native and non-native plant species encountered during surveys. Mean is calculated across all samples.

Site	Spring, 10	Summer, 10	Fall, 10	Winter, 11	Spring, 11	Summer, 11	Fall, 11	Winter, 12	Spring, 12
Natural Bridges									
Native	7 (41%)	8 (44%)	9 (60%)	8 (44%)	9 (43%)	6 (67%)	8 (62%)	9 (47%)	11 (48%)
Non-native	10 (59%)	10 (56%)	5 (40%)	10 (66%)	12 (57%)	9 (33%)	5 (38%)	10 (53%)	12 (52%)
Total	17	18	14	18	21	15	13	19	23
Younger Lagoon									
Native	11 (85%)	11 (85%)	11 (85%)	11 (73%)	12 (80%)	13 (81%)	9 (82%)	6 (50%)	6 (43%)
Non-native	2 (15%)	2 (15%)	2 (15%)	4 (27%)	3 (20%)	3 (19%)	2 (18%)	6 (50%)	8 (57%)
Total	13	13	13	15	15	16	11	12	14
Sand Plant Beach									
Native	7 (88%)	7 (63%)	7 (70%)	8 (80%)	7 (88%)	7 (88%)	9 (82%)	3 (33%)	4 (40%)
Non-native	1 (12%)	2 (37%)	3 (30%)	2 (20%)	1 (12%)	1 (12%)	2 (18%)	6 (67%)	6 (60%)
Total	8	9	10	10	8	8	11	9	10

Site	Summer, 12	Fall, 12	Winter, 13	Spring, 13	Summer, 13	Fall, 13	Winter, 14	Spring, 14
Natural Bridges								
Native	5 (35%)	10 (59%)	7 (88%)	9 (56%)	7 (37%)	6 (35%)	6 (43%)	10 (50%)
Non-native	9 (65%)	7 (41%)	8 (12%)	6 (44%)	12 (63%)	11 (65%)	8 (57%)	10 (50%)
Total	14	17	15	16	19	17	14	20
Younger Lagoon								
Native	12 (67%)	7 (88%)	9 (69%)	12 (75%)	13 (72%)	14 (74%)	10 (83%)	12 (67%)
Non-native	6 (33%)	1 (12%)	4 (31%)	4 (25%)	5 (28%)	5 (26%)	2 (17%)	6 (33%)
Total	18	8	13	16	18	19	12	18
Sand Plant Beach								
Native	2 (40%)	3 (50%)	4 (100%)	4 (67%)	6 (100%)	6 (100%)	5 (100%)	5 (83%)
Non-native	3 (60%)	3 (50%)	0 (0%)	2 (33%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)

Total	5	6	4	6	6	6	5	6

Site	Summer, 14	Fall, 14	Winter, 15	Spring, 15	Summer, 15	Fall, 15	Winter, 16	Spring 16
Natural Bridges								
Native	5 (42%)	5 (45%)	4 (33%)	5 (31%)				
Non-native	7 (58%)	6 (55%)	8 (67%)	11 (69%)				
Total	12	11	12	16				
Younger Lagoon								
Native	9 (69%)	5 (62%	10 (67%)	10 (67%)	11 (73%)	2 (67%)	5 (100%)	10 (83%)
Non-native	4 (31%)	3 (38%)	5 (33%)	5 (33%)	4 (27%)	1 (33%)	0 (0%)	2 (17%)
Total	13	8	15	15	15	3	5	12
Sand Plant Beach								
Native	4 (50%)	4 (40%)	5 (50%)	4 (33%)				
Non-native	4 (50%)	6 (60%)	5 (50%	8 (67%)				
Total	8	10	10	12				

Site	Summer, 16	Fall, 16	Winter, 17	Spring, 17	Summer, 17	Fall, 17	Winter, 18	Spring, 18
Younger Lagoon								
Native	10 (83%)	8 (57%)	3 (60%)	13 (68%)	12 (70%)	13 (76%)	12 (70%)	9 (82%)
Non-native	2 (17%)	6 (43%)	2 (40%)	6 (32%)	5 (30%)	4 (24%)	5 (30%)	2 (18%)
Total	12	14	5	19	17	17	17	11

Site	Summer, 18	Fall, 18	Winter, 19	Spring, 19	Summer, 19	Fall, 19	Winter, 20	Spring, 20
Younger Lagoon								
Native	9 (82%)	8 (80%)	8 (80%)	9 (67%)	8 (67%)	8 (67%)	8 (57%)	9 (53%)
Non-native	2 (18%)	2 (20%)	2 (20%)	3 (33%)	4 (33%)	4 (33%)	6 (43%)	8 (47%)
Total	11	10	10	12	12	14	14	17

Site	Proportion of native and non-native species across all sample periods
Natural Bridges	

Native	**47%**
Non-native	**53%**
Total	
Younger Lagoon	
Native	**73%**
Non-native	**27%**
Total	
Sand Plant Beach	
Native	**68%**
Non-native	**31%**
Total	

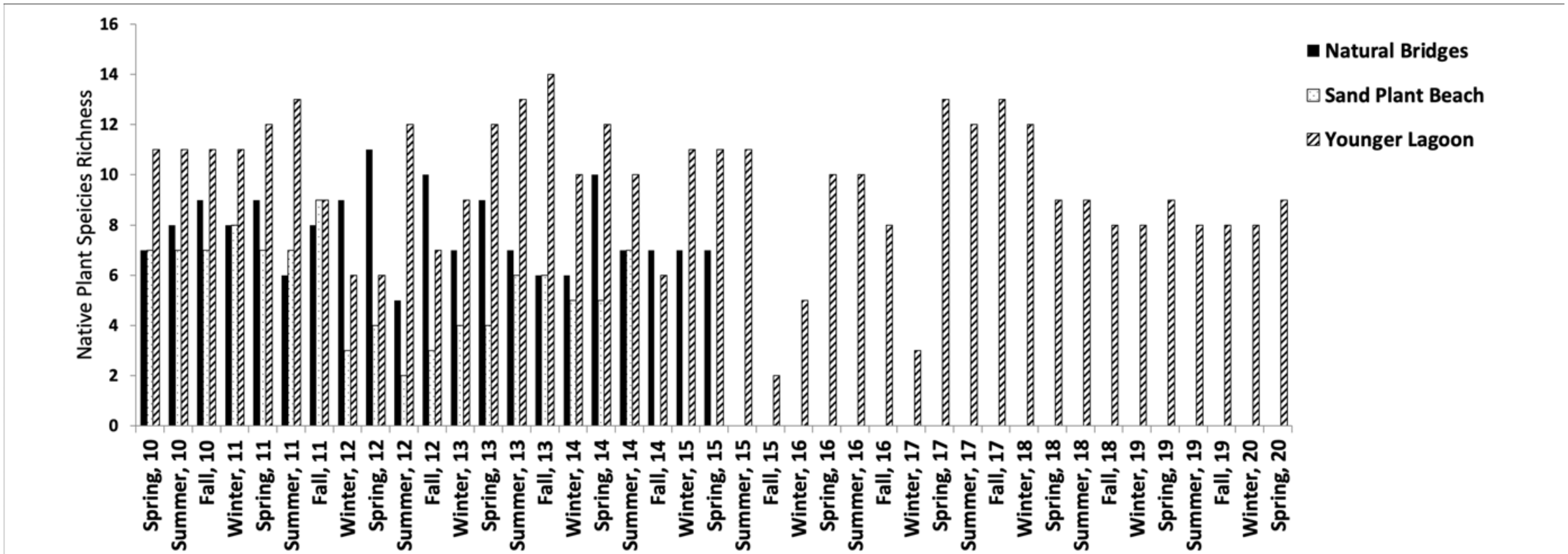

Figure 6. Number of native plant species encountered at each site.

Track Plate Monitoring

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. Native species richness of mammals detected in raked sand plots was across all three sites (n = 8). Ground squirrel were not detected at Natural Bridges and opossum have not been detected in our track surveys at Sand Plant Beach or Younger Lagoon Reserve (Table 7). It is likely that ground squirrels occur at Natural Bridges and opossum are likely using upland habitat at Sand Plant Beach and Younger Lagoon Reserve; however, they were not detected in our survey efforts. Dogs and bicycles were detected at Natural Bridges and Sand Plant Beach and vehicles were detected at Natural Bridges (Table 7). For the first time since sampling began in 2010, no bobcats were detected at Younger Lagoon Reserve in FY2019-2020, while humans were detected during every sampling event. Frequency of detection and species richness for each species is summarized in Table 8.

Table 7. Summary of track plate sampling effort at each site.

	Rodent[1]	**Raccoon**	**Cottontail**	**Bobcat**	**Skunk**	**Squirrel**	**Deer**	**Opossum**	**Coyote**	**Bicycle**	**Vehicle**	**Dog**	**Human**
May 1-2, 2010													
Little Wilder	X			X	X	X			X	X			X
Younger Lagoon	X	X		X	X								X
Natural Bridges	X	X		X	X				X	X	X	X	X
August 11-12, 2010													
Little Wilder		X		X	X							X	X
Younger Lagoon	X	X	X	X		X							
Natural Bridges	X	X	X									X	X
November 17-18, 2010													
Little Wilder	X		X	X					X				X
Younger Lagoon	X	X											X
Natural Bridges	X	X		X							X	X	X
February 8 -9, 2011													
Little Wilder	X			X	X				X	X			X
Younger Lagoon	X	X			X				X				
Natural Bridges		X		X					X		X		X

	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
May 3 - 4, 2011													
Little Wilder	X		X	X									
Younger Lagoon		X	X	X	X				X				
Natural Bridges		X			X				X			X	X
July 22 - 23, 2011													
Little Wilder	X	X			X				X				X
Younger Lagoon	X	X	X	X	X								
Natural Bridges	X	X	X		X							X	X
March 8 - 9, 2012													
Little Wilder	X								X				X
Younger Lagoon				X					X				
Natural Bridges							X				X	X	X
May 15 - 16, 2012													
Little Wilder	X		X	X									X
Younger Lagoon	X	X		X					X				
Natural Bridges	X			X				X				X	X
August 16 - 17, 2012													
Little Wilder	X	X	X	X	X		X		X				X
Younger Lagoon	X	X		X		X	X						
Natural Bridges	X	X	X	X	X		X				X	X	X
October 22 - 23, 2012													
Little Wilder	X						X		X				X
Younger Lagoon		X		X					X				X
Natural Bridges			X		X		X				X		X
January 16 -17, 2013													
Little Wilder	X			X					X				X
Younger Lagoon	X	X		X					X				X
Natural Bridges		X		X	X				X			X	X
May 15 - 16, 2013													
Little Wilder	X			X	X								X

	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
Younger Lagoon	X	X		X					X				X
Natural Bridges	X	X			X							X	X
July 18 - 19, 2013													
Little Wilder	X	X		X					X			X	X
Younger Lagoon	X	X		X					X				
Natural Bridges		X		X	X						X	X	X
October 21- 22, 2013													
Little Wilder		X		X									
Younger Lagoon		X		X					X				X
Natural Bridges	X	X			X				X		X	X	X
February10-11, 2014													
Little Wilder	X	X		X									X
Younger Lagoon									X				X
Natural Bridges		X			X						X		X
April 27-28, 2014													
Little Wilder		X		X					X				X
Younger Lagoon		X							X				
Natural Bridges		X		X	X						X	X	X
July 30-31, 2014													
Little Wilder		X		X					X				X
Younger Lagoon		X		X					X				
Natural Bridges		X			X		X		X		X	X	X
November 4-5, 2014													
Little Wilder				X					X			X	X
Younger Lagoon		X		X					X				
Natural Bridges		X					X				X		X
January 26-27, 2015													
Little Wilder	X								X				X
Younger Lagoon	X	X		X			X						X
Natural Bridges	X				X		X		X		X	X	X

	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
April 14-15, 2015													
Little Wilder	X	X							X				X
Younger Lagoon	X	X		X					X				
Natural Bridges	X				X		X		X		X	X	X
July 8-9, 2015													
Younger Lagoon	X			X	X								
									X				X
October 29-30, 2015													
Younger Lagoon		X		X									
February 2-3, 2016													
Younger Lagoon		X							X				
May3-4, 2016													
Younger Lagoon		X							X				
July 12-13, 2016													
Younger Lagoon		X		X									
November 9-10, 2016													
Younger Lagoon		X		X					X				
March 1-2, 2017													
Younger Lagoon	X	X		X									
April 25-26, 2017													
Younger Lagoon		X					X		X				X
August 2-3, 2017													
Younger Lagoon					X				X				
October 25-26, 2017													
Younger Lagoon		X					X		X	X			X

	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
February 7-8, 2018													
Younger Lagoon	X			X	X								X
May 1-2, 2018													
Younger Lagoon	X								X				
July 12-13, 2018													
Younger Lagoon	X			X					X				X
November 7-8, 2018													
Younger Lagoon	X	X					X		X				X
February 20-21, 2019													
Younger Lagoon	X	X							X				
May 15-16, 2019													
Younger Lagoon	X			X					X				X
July 15-16, 2019													
Younger Lagoon		X											X
October 29-30, 2019													
Younger Lagoon													X
February 11-12, 2020													
Younger Lagoon		X							X				X
May 20-21, 2020													
Younger Lagoon		X											X
	3	3	3	3	3	2	3	1	3	3	1	2	3

[1]Unidentified small rodent.

Table 8. Frequency of occurrence, and native species richness, of animals and human use types through spring 2019 track plate sampling efforts. Actual detections are included parenthetically.

Site	Rodent	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human	[1]Native sp. Richness
Little Wilder	(15) 71%	(10) 48%	(4) 19%	(15) 71%	(6) 29%	(1) 6%	(2) 10%	0%	(15) 71%	(2) 10%	(0) 0%	(3) 14%	(19) 91%	8
Younger Lagoon	(21) 54%	(26) 67%	(2) 5%	(25) 64%	(9) 23%	(2) 5%	(5) 13%	0%	(27) 69%	(1) 3%	(0) 0%	(0) 0%	(19) 49%	8
Natural Bridges	(9) 43%	(15) 71%	(4) 19%	(9) 43%	(13) 62%	0%	(8) 38%	(1) 5%	(9) 43%	(1) 5%	(14) 67%	(16) 76%	(21) 100%	8

[1]Bicycle, vehicle, dog, and human excluded.

Small Mammal Trapping

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. A total of 320 individual small mammals representing four species have been captured during small mammal trapping efforts (Table 9).

Table 9. Summary of Sherman trapping efforts

Site	Pema[1]	Mica[1]	Reme[1]	Rara[1,2]	**TOTAL**
April 24 -25, 2010					
Little Wilder	8	5			**13**
Younger Lagoon	2				**2**
Natural Bridges			3		**3**
August 11-12, 2010					
Little Wilder	5	4			**9**
Younger Lagoon			1		**1**
Natural Bridges					**0**
November 15-16, 2010					
Little Wilder	5	1			**6**
Younger Lagoon				1	**1**
Natural Bridges		3	1		**4**
February 15-16, 2011					
Little Wilder	5				**5**
Younger Lagoon	6	5	0		**11**
Natural Bridges			2		**2**
April 29-30, 2011					
Little Wilder	4				**4**
Younger Lagoon	1				**1**
Natural Bridges					**0**
August 8-9, 2011					
Little Wilder	6	2			**8**
Younger Lagoon	3		3		**6**
Natural Bridges		1	5		**6**

Site	Pema[1]	Mica[1]	Reme[1]	Rara[1,2]	**TOTAL**
March 30, 2012					
Little Wilder	6				**6**
Younger Lagoon	1		1		**2**
Natural Bridges		5	2		**7**
May 15-16, 2012					
Little Wilder	4	1			**5**
Younger Lagoon	3				**3**
Natural Bridges		5			**5**
August 25-26, 2012					
Little Wilder	4				**4**
Younger Lagoon	3				**3**
Natural Bridges		4	2		**6**
November 5-6, 2013					
Little Wilder	2		1		**3**
Younger Lagoon	3				**3**
Natural Bridges		3	1		**4**
January 13-14, 2013					
Little Wilder	2		4		**6**
Younger Lagoon	2				**2**
Natural Bridges		2	1		**3**
May 1-2, 2013					
Little Wilder	1		1		**2**
Younger Lagoon	3		2		**5**
Natural Bridges		5			**5**
July 16-17, 2013					
Little Wilder	3		1		**4**
Younger Lagoon	1				**1**
Natural Bridges			1		**1**
October 22-23, 2013					
Little Wilder	5	1		1	**7**
Younger Lagoon	1				**1**

Site	Pema[1]	Mica[1]	Reme[1]	Rara[1,2]	**TOTAL**
Natural Bridges		1	2		**3**
February 12-13, 2014					
Little Wilder	2	1	1		**4**
Younger Lagoon	1		1		**2**
Natural Bridges		2			**2**
April 28-29, 2014					
Little Wilder	4	1			**5**
Younger Lagoon	3		1		**4**
Natural Bridges	1				**1**
July 30-31, 2014					
Little Wilder	1	1			**2**
Younger Lagoon	2				**2**
Natural Bridges	1		1		**2**
November 4-5, 2014					
Little Wilder	3	1			**4**
Younger Lagoon	4				**4**
Natural Bridges	2	1	3		**6**
January 26-27, 2015					
Little Wilder	3		1		**4**
Younger Lagoon	4		5		**9**
Natural Bridges			3		**3**
April 14-15, 2015					
Little Wilder	2		3		**5**
Younger Lagoon	3				**3**
Natural Bridges					**0**
July 8-9, 2015					
Younger Lagoon	7		1		**8**

October 29-30, 2015				
Younger Lagoon	2	6		**8**
February 2-3, 2016				
Younger Lagoon		6		**6**
May 3-4, 2016				
Younger Lagoon		3	1	**4**
July 12-13, 2016				
Younger Lagoon		4		**4**
November 9-10, 2016				
Younger Lagoon	2	1		**3**
March 1-2, 2017				
Younger Lagoon	2	1		**3**
April 25-26, 2017				
Younger Lagoon		1		**1**
August 2-3, 2017				
Younger Lagoon				**0**
October 25-26, 2017				

Younger Lagoon	1	1	2		**4**
February 8-9, 2018					
Younger Lagoon	2				**2**
May 1-2, 2018					
Younger Lagoon	1		2		**3**
July 12-13, 2018					
Younger Lagoon	6				**6**
November 7-8, 2018					
Younger Lagoon	7		2		**8**
February 20-21, 2019					
Younger Lagoon	5		2	1	**8**
May 14-15, 2019					
Younger Lagoon	4				**4**
July 15-16, 2019					
Younger Lagoon	4				**4**
October 30-31, 2019					
Younger Lagoon	1		1		**2**

Site	Pema[1]	Mica[1]	Reme[1]	Rara[1,2]	**TOTAL**
February 11-12, 2020					
Younger Lagoon	2		1		**3**
May 20-21, 2020					
Younger Lagoon	1		2		**3**
TOTAL	**172**	**56**	**88**	**4**	**320**

[1]Pema = *Peromyscus maniculatus*; Mica = *Microtus californicus*; Rema = *Reithrodontomys megalotis*; Rara = *Rattus norvegicus*. [2]Escaped before positive ID; however, suspected to be Norway Rat.

Invertebrate Monitoring

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. Over all, Younger Lagoon consistently had the greatest number of individuals captured; however, patterns of species richness varied among sampling sessions (Figures 7-8). This may have been at least partially due to trapping methodology and disturbance as raccoons and perhaps coyote disturbed sample cups during some of the sampling efforts. Individuals were identified as distinct taxa; however, at the time of the writing of this report they have not been taxonomically keyed out.

Avian Surveys

Although we are no longer monitoring Natural Bridges and Sand Plant beaches, we continue include results in order to have standalone reports that include all data going forward. Avian species varied among sites and sampling dates (Table 10); however, number of species and abundance were consistently greatest at Natural Bridges and Younger Lagoon.

Figure 7. Species richness of invertebrates across all beaches

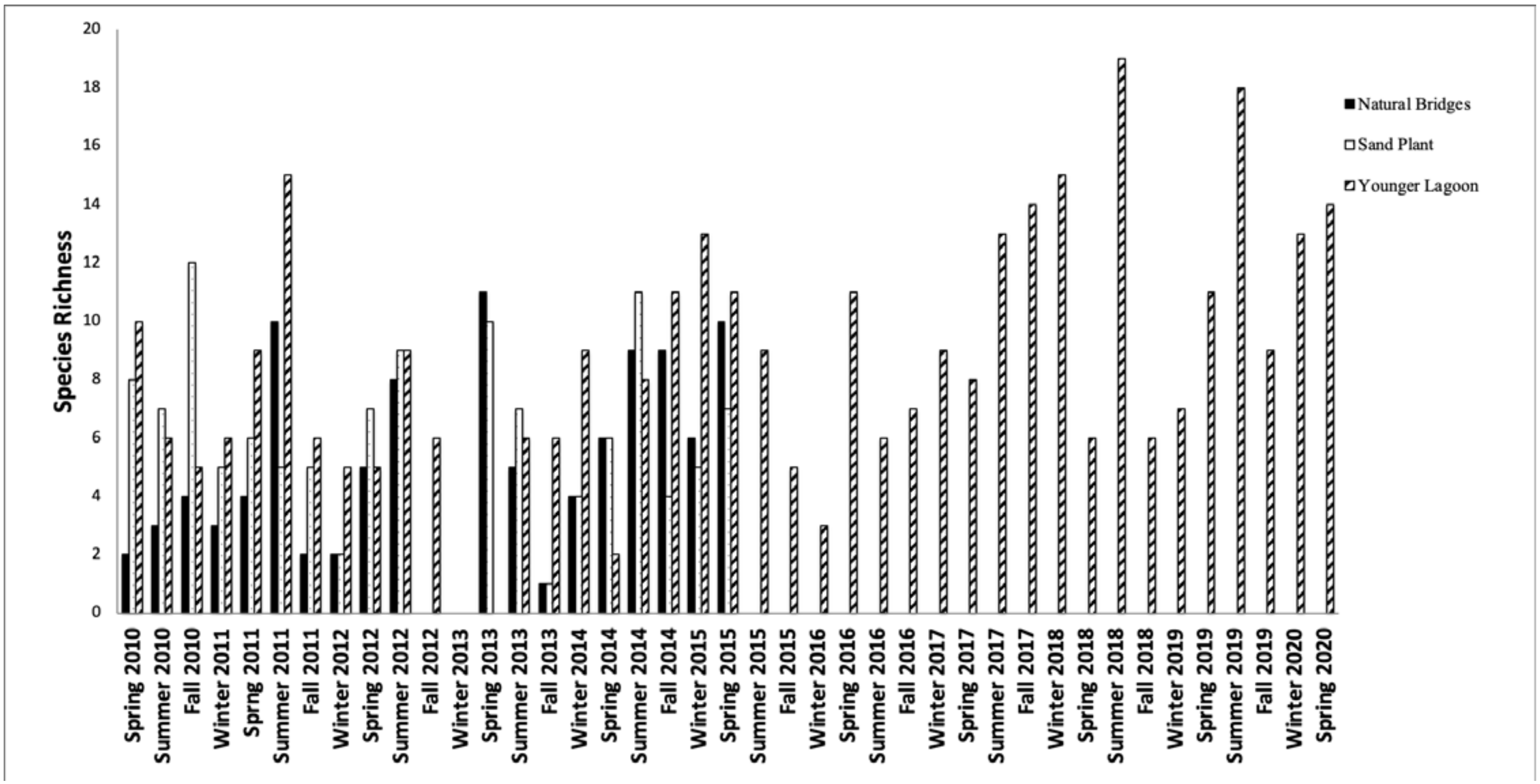

Figure 8. Total abundance of invertebrates at Natural Bridges, Sand Plant Beach, and Younger Lagoon beaches.

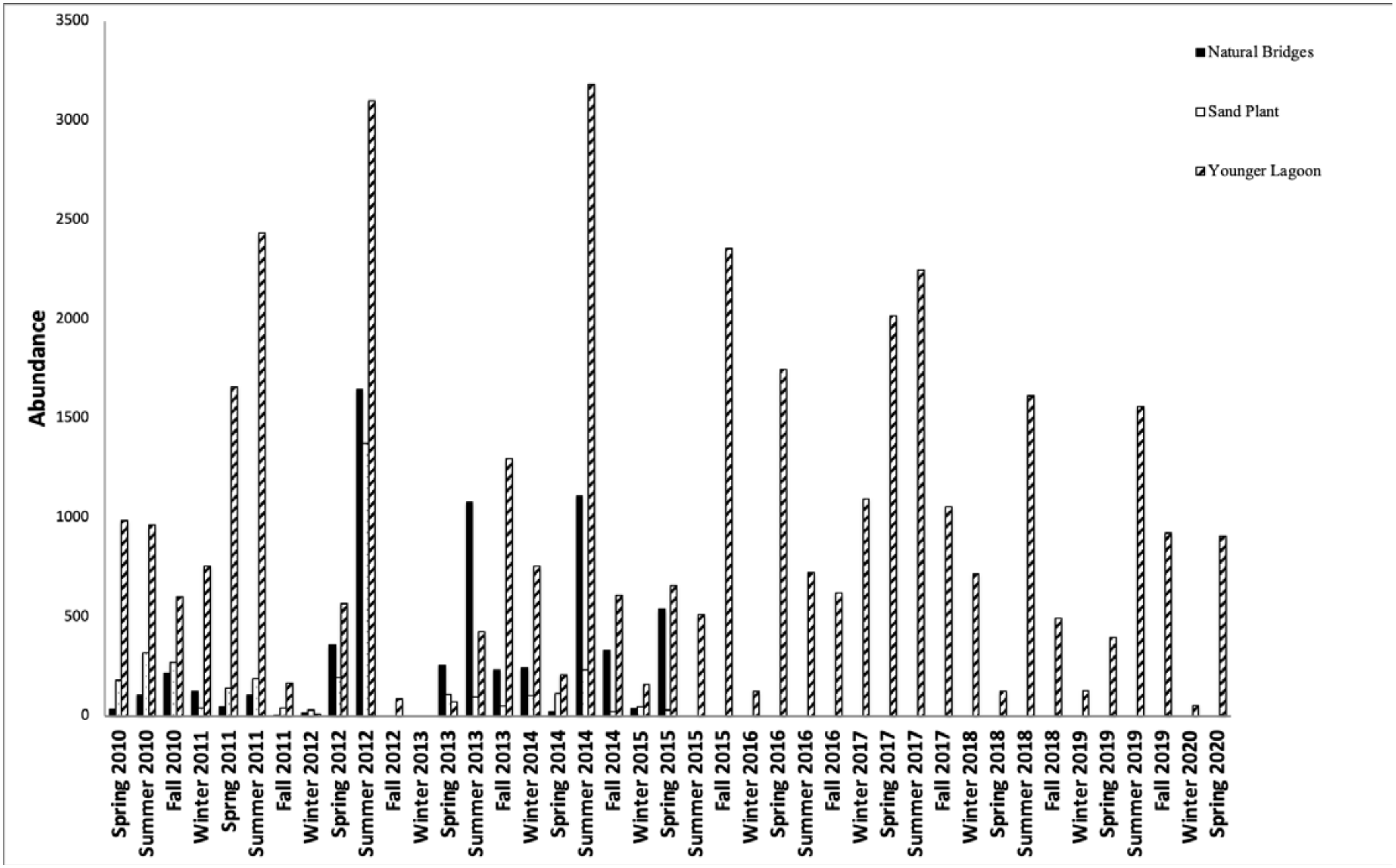

Table 10. Summary of bird surveys at Sand Plant Beach, Younger Lagoon, and Natural Bridges beaches.

Date	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October 29-30, 2015																															
Thurgar Lagoon									1				4				1														
February 2-3, 2016																															
Thurgar Lagoon									1															1							
May 3-4, 2016																															
Thurgar Lagoon							4		3							2														1	
July 27, 2016																															
Thurgar Lagoon							3		1			12					2											1			
November 9-10, 2016																															
Thurgar Lagoon									2				1															1			
March 1-2, 2017																															
Thurgar Lagoon									1								1											1			
April 13-14, 2017																															
Thurgar Lagoon		1																4						3							
August 2-3, 2017																															
Thurgar Lagoon							8	1	3		8																	5		3	
October 25-26, 2017																															
Thurgar Lagoon									1		6		7																		
February 7-8, 2018																															
Thurgar Lagoon									1		3		3													1				4	
May 1-2, 2018																															
Thurgar Lagoon							5	2	7		5	1																			
August 13-14, 2018																															
Thurgar Lagoon							8					1					1											3			
November 7-8, 2018																															
Thurgar Lagoon					2				11		75		40		1											1					
February 10-11, 2019																															
Thurgar Lagoon	4								3						17	4					1										
May 15-16, 2019																															
Thurgar Lagoon							4					2					3	52						1							
July 10-11, 2019																															
Thurgar Lagoon							8		1								4	17	1									1			
October 20-21, 2019																															
Thurgar Lagoon																															
February 10-11, 2020																															
Thurgar Lagoon	2								4					2	5		5								1						2
May 20-21, 2020																															
Thurgar Lagoon							23									3	1	8	1												

Site	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Richness
April 24 & 26, 2010																													
Sand Flats					2																				2				3
Younger Lagoon					2															3					3				3
Natural Bridges		1													3					2									3
August 10-11, 2010																													
Sand Flats																													1
Younger Lagoon		2		1	10															4					22				6
Natural Bridges		1																							8				6
November 15 & 16, 2010																													
Sand Flats																									1				2
Younger Lagoon										15								11				1			4				5
Natural Bridges		4					2											240		1		1			17		2		11
February 15 & 16, 2011																													
Sand Flats					2																				8				2
Younger Lagoon																			1										2
Natural Bridges				3	4					47										50					4		55		10
May 3 & 4, 2011																													
Sand Flats					4				1				8												1		1		7
Younger Lagoon																													2
Natural Bridges		7		4	4	1											1								16		7		12
July 20 & 22, 2011																													
Sand Flats													17							1					5				7
Younger Lagoon																													2
Natural Bridges					8								7				1			1					85		1		13
March 17 & 20, 2012																													
Sand Flats					5																								2
Younger Lagoon		1			8					11										2					10		1		2
Natural Bridges					15	1							1					55		1					10		6		8
May 15 & 16, 2012																													
Sand Flats																									4		1		1
Younger Lagoon		2			2					16			5				1			3					15				10
Natural Bridges					4															3									4
August 25 & 26, 2012																													
Sand Flats		5																											3
Younger Lagoon					4					25					1		1			1					2				10
Natural Bridges		5			1																	1			1	1			7
November 5 & 6, 2012																													
Sand Flats																									1				3
Younger Lagoon		5								16				1			4			1					1		12		5
Natural Bridges		4			3															1		1	1				23		5
January 27 & 28, 2013																													
Sand Flats																													1
Younger Lagoon										2		1						35	1	1									8
Natural Bridges																				1					11				4
May 1 & 2, 2013																													
Sand Flats													8												2				2
Younger Lagoon					7			1		4															11		3		6
Natural Bridges					4																				17		2		5
July 16 & 17, 2013																													
Sand Flats													7																4
Younger Lagoon		8			37					8			1							4									10
Natural Bridges		1																							18				2
October 25-27, 2013																													
Sand Flats																													2
Younger Lagoon		4				1				75										1					150		38		11
Natural Bridges					2															4					120		26		9
February 13-14, 2014																													
Sand Flats					3												1								102				4
Younger Lagoon										1										4					7		35		5
Natural Bridges					2															1					15		34		5
April 8 & 9, 2014																													
Sand Flats					6								4												94		2		1
Younger Lagoon		5			6								6			1									1		3		8
Natural Bridges		3			4																				10		2		10
July 30-31, 2014																													
Sand Flats		14											1												15		2		6
Younger Lagoon		3			3								2							1					16		2		6
Natural Bridges																		7							80		7		4
November 4-5, 2014																													
Sand Flats																1									3				4
Younger Lagoon																		11		1					13		6		2
Natural Bridges		4																20		4		1			16				11
January 26-27, 2015																													
Sand Flats					2																				25				4
Younger Lagoon					4											12									17		1		7
Natural Bridges					3											9				1					190		1		10
April 10 & 11, 2015																													
Sand Flats					3								2												6				1
Younger Lagoon		1														5				2					6				4
Natural Bridges																4				1					23		8		4
July 8-9, 2015																													
Younger Lagoon		8			2								4							2					23				7

Discussion

Data collected indicate that Younger Lagoon Reserve (YLR) supports a wide variety of native flora and fauna, provides habitat for sensitive and threatened species, supports a very unique beach dune community, and is extensively used for research and education.

A parameter that we have mapped, and is evident from visual observation and photo documentation, is the presence of dune hummocks and downed woody material at YLR, both of which are almost entirely absent at Sand Plant Beach and Natural Bridges (Figure 9). It is likely that the hummocks and woody material are absent at Natural Bridges and Little Wilder due to human trampling, collection, and burning. These features provide habitat for plant species such as the succulent plant dudleya, which grow on downed woody material and dune hummocks at YLR, as well as burrowing owls that use burrows in hummocks and seek shelter beneath downed woody material at YLR.

Although Younger Lagoon does experience human use, the intensity and number of users is small. Additionally, authorized users of the YLR beach are educated about the reserve, unique natural features, and are not allowed to collect woody material or trample dune vegetation. It is likely that increased unauthorized overnight human use of the beach is having a negative impact on native mammals such as bobcats. Reserve staff will continue their public outreach and education efforts, continue to partner with UCSC campus police to ensure the security of the reserve and protect sensitive resources and ongoing research, and continue to report back to the Commission on the negative impacts of unauthorized beach use. The relatively natural state of YLR beach and dune vegetation is unique among the three sites and most pocket beaches in Santa Cruz County and likely represents a glimpse into what many of the pocket beaches in the greater Monterey Bay area looked like prior to significant human disturbance.

Open access to the beach would likely result in the loss of the unique ecological characteristics of the site and certainly reduce its effectiveness as a research area for scientific study. Controlled beach access through the free Seymour Center docent led tours, provides an appropriate level of supervised access that enables people to see and learn about the lagoon habitat while limiting impacts to the system. We recommend that this continue.

Figure 9. Younger Lagoon dune map. Survey data and resulting elevation model output shows topographic features on Younger Lagoon Beach.

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Appendix 1. Younger Lagoon Photos.


YLR Beach Photopoint #1 (W). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #1 (NW). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

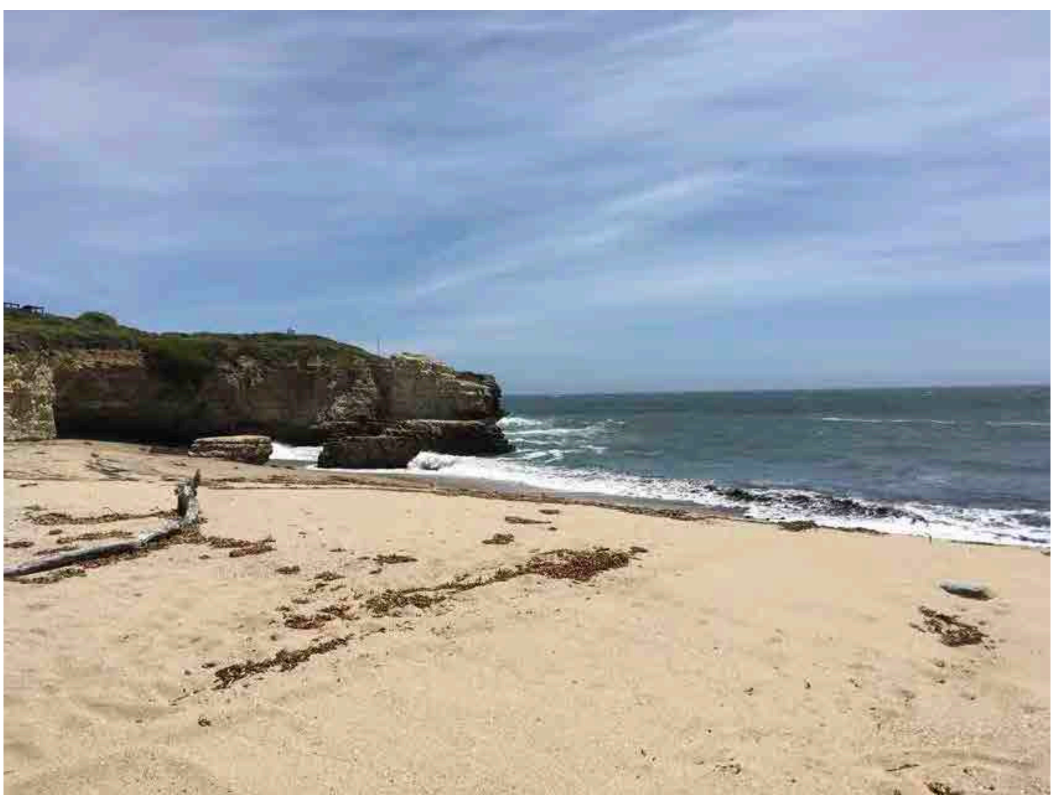
YLR Beach Photopoint #1 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Beach Photopoint #2 (S). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #2 (SW). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #2 (W). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #2 (NW). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #3 (SE). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #3 (E). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #3 (W). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #3 (NW). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #3 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Beach Photopoint #3 (NE). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Beach Photopoint #4 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

Appendix 2. Compliance monitoring report

Compliance Monitoring Report for Coastal Prairie and Coastal Scrub Restoration Sites at Younger Lagoon Reserve – Spring 2020
Justin C. Luong

Introduction

In keeping with the goals of the restoration plans for the Younger Lagoon Reserve Terrace Lands prepared for the California Coastal Commission (UCNRS 2010, UCNRS 2018), reserve employees, interns, and volunteers have continued to perform native plant community restoration activities. This report presents the results of the 2020 monitoring data for 2012, 2014, 2016 and 2018 coastal prairie habitat plantings, along with 2014 coastal scrub plantings and 2016 coastal wetland plantings. Monitoring efforts begin two years post-planting. If a site meets restoration targets, monitoring is then conducted every other year for the first six years post-planting, and then every five years after that. If a site does not meet restoration targets, the site is monitored annually until it reaches restoration targets (UCNRS 2018). The 2012 coastal prairie habitat was monitored this year (normally monitored in even years), pas because it did not meet compliance standards in 2018 or 2019.

Methods

Planting

Seeds for the coastal prairie planting projects were collected from local reference sites in coastal regions of Santa Cruz and San Mateo counties. The seeds were grown in Ray Leach stubby (SC7) conetainers^{TM} for several weeks in the UC Santa Cruz Jean H. Langenheim Greenhouses before being planted at the site. Site preparation prior to planting typically involved the hand removal of large weeds (e.g., *Carpobrotus edulis, Raphanus sativus, Cirsium vulgare,* etc.) and/or the application of herbicide and tarping to reduce non-native species cover. Subsequently, a heavy layer of wood chip mulch (~10-15 cm) was applied to all restoration sites prior to planting to suppress non-native weed emergence. Teams of volunteers, interns, and staff planted the native plugs primarily between December and February using dibblers. Sites received supplemental irrigation during the first year following planting to help improve establishment. After the first year, there was no supplemental irrigation. Follow up management included hand removal and targeted herbicide application for emerging non-native species during the first 18 – 24 months following planting. All sites were mowed twice annually in the years following planting. Fall mowing was intended to reduce thatch, and spring mowing was intended to reduce seed set from nonnative species prior to native perennial species began to reproductively develop. Sites that did not reach compliance goals in the year monitored, received additional follow up management in the subsequent year.

Sampling

To measure cover in coastal prairie and wetland habitats, a 0.25 × 1-m quadrat was placed on alternating sides of a 50-m transect tape every 5 m, for a total of ten quadrats per 50-m transect. For each transect, the quadrat was randomly placed between 1 and 5 m as the starting point. In some areas, 50-m transects did not fit the shape of the restoration area, so transects were slightly shortened or split and divided into sections to better fit the site. Cover was measured using a modified Braun-Blanquet class system within each quadrat, with increases in 5% intervals, starting with 0-5%. The midpoint of each cover class was used for data analysis (e.g. 2.5%, 7.5%, etc.). Richness was measured using a 2-m belt transect on either side of the 50-m transect tape to visually detect any native species not measured in the cover quadrat sampling. To measure cover in scrub habitats, the area of each species and bare ground under the length of the transect was measured. Percent cover was determined from the length covered by a particular speices divided by the total length of the transect. Shrub cover may exceed 100% if multiple species are overlapping on the transect. In some areas, herbaceous cover and scrub were mixed, and both shrub measurements and herbaceous cover quadrats were quantified for these transects. Along shrub transects, herbaceous cover quadrats were only taken within non-scrub dominated areas along the transect, and thus may not be sampled every 5 m.

The 2012 coastal prairie planting area was measured using three transects of 35, 45, and 45 m, for a total of 25 quadrats (Figure 1, 3). The 2014 coastal prairie was measured using two transect of 30 and 35 m, for a total of 13 quadrats (Figure 1, 3). The 2016 coastal prairie area was measured using three transects of 50 m each for a total of 30 quadrats (Figure 1, 3). The 2018 coastal prairie area was measured with two transects of 35 and 50 m, for a total of 17 quadrats (Figure 1, 2). The 2014 mixed coastal scrub and prairie plantings were measured using three transects of 23.6, 25.5, and 44.4 m and 10 total herbaceous cover quadrat measurements (Figure 1, 3). The 2016 coastal wetland plantings were measured using two transects of 30 m, for a total of 12 quadrats (Figure 1, 2). For analysis these measurements were separated into prairie-identified habitats, wetland-identified habitats, and scrub-identified habitats, consistent with analyses from previous years (Lesage, 2015, 2016, 2017, 2018; Luong, 2019). For each planted area, cover was averaged across quadrats within a transect. Species richness for each planted area is a count of all unique taxa found on average per transects and at the site level for restored habitat type by year (Table 1, 2). Sites were all relatively small and around the same acreage, so site level species richness were used to assess compliance targets.

All sites are expected to meet the targets laid out for the California Coastal Commission (UCNRS 2010). The 2012 and 2014 coastal prairie and scrub plantings are expected to meet six-year targets, the 2016 coastal prairie sites should meet four-year targets, and the 2016 wetland and 2018 coastal prairie sites should meet two-year targets. Targets for all habitat types and year-post-planting are available in Appendix 1.

Results

Native species cover targets were met and surpassed in all but the 2012 coastal prairie sites (**Table 1**). The 2012 coastal prairie had a native cover of 8.6 ± 2.6%, which does not meet the requirement of ≥ 25% native cover. The 2014 coastal prairie site had observed cover value of 44.1 ± 10.6% surpassing its post-year-six target of ≥ 25%. The 2016 coastal prairie site had an average native species cover of 44.3 ± 8.5%, exceeding the ≥ 15% native cover target. However, one of the three 2016 transects, only had 15% native cover. The 2018 coastal prairie site had an average native species cover of 76.2 ± 7.0%, which was exceedingly higher than the ≥ 5% year-two target goal. The 2016 wetland restoration site had a native cover of 41.9 ± 12.7%, surpassing the post-year-two goal of ≥ 10% native cover. In the 2014 coastal scrub site, native cover goals of ≥ 40% were also met, with an average shrub cover of 102.0 ± 6.7%. The herbaceous cover at the 2014 scrub site was also above its targets (Table 1).

Native species richness measurements were also at or above defined target levels for all planted areas (Table 2). The 2012 coastal prairie, which did not meet species richness targets in 2018, met its target in 2019 and now continues to exceed its goal. Each transect in the 2012 coastal prairie area had an average native species richness of 6.3 ± 0.3 species, with a total of 14 species across at the site level, which meets the requirement of ≥ 8 species. The 2014 coastal prairie area had an average native species richness of 9.0 ± 4.0 species with a total of 14 native species observed across all transects which meets post-six-years monitoring targets. The 2016 and 2018 coastal prairie sites had observed average transect richness values of 13.7 ± 1.9 and 14.5 ± 3.5 species, and a total of 22 and 20 native species respectively, surpassing their ≥ 6 species richness target. The 2016 wetland restoration site had an average native species richness of 11.5 ± 0.5 species with a total of 17 native species observed across all transects which exceeds its goal of four native species. The 2014 coastal scrub areas met their ≥ 8 species target with an average of 15.3 ± 3.8 native species per transect and 14 total native species.

All planted areas showed evidence of recruitment for multiple native species.

Discussion

Nearly all restoration areas at Younger Lagoon Reserve met or exceeded the restoration targets laid out for the California Coastal Commission for their respective habitats (UCNRS 2010, UCNRS 2018). The 2014, 2016, and 2018 coastal prairie areas, the 2016 wetland area and the 2014 coastal prairie and scrub mix areas all appear to successfully have restored native species cover and richness. Only the 2012 coastal prairie area did not meet its restoration targets for native cover. The 2012 coastal prairie site did not meet the target goal for species richness or native cover in 2017, 2018 or 2019 (Lesage, 2017, Lesage, 2018, Luong, 2019). The 2012 coastal prairie is still maintaining its species richness goals, which was recently achieved in 2019 (Luong, 2019).

The 2012 coastal prairie plantings had a native cover of 8.6 ± 2.6% (target ≥ 25%), and species richness of 14 species (target ≥ 8 species). Low cover values indicate that follow-up invasive plant control and native replanting will be necessary for this location. Ideal candidates to increase native cover are species that commonly persisted at other YLR restoration sites: bunchgrasses such as *Elymus glaucus* and *Hordeum brachyantherum*, and rhizomatous species like *Achillea millefolium*, *Sidalcea malviflora* and *Elymus triticoides*. These transects were dominated by non-native forb species, primarily *Medicago polymorpha*, in 2018 (Lesage, 2018). In 2019, *Geranium dissectum* (non-native annual forb) and *Festuca bromoides* (non-native annual grass) are co-dominant alongside with *Medicago polymorpha* (Luong, 2019). In 2015, native cover was 31.2% (target ≥ 25%; Lesage, 2015), which decreased to 17.0% in 2018, 10.2% and now to 8.6%, demonstrating the difficulty of maintaining native cover at coastal prairie restoration sites without ongoing intensive invasive species maintenance. Species richness has been stable at the 2012 restoration site since 2015, but total species richness increased from 12 to

14 in 2019 (Luong, 2019). However, it is notable that there are only 6.3 species per transect in the 2012 site, which would be below compliance standard at an individual transect level. As such, additional plantings should be completed.

A comparison of monitoring data from 2018 and 2020 shows interesting trends in the coastal prairie and coastal scrub plantings (Lesage, 2018). In 2018, the 2014 coastal prairie plantings had an average native cover of 31.3 ± 5.7%, which was above the target of ≥ 15% native cover. This year, the 2014 coastal prairie had an average of 44.1 ± 10.6% native cover per transect which substantially exceeds the target of ≥ 25% native cover. The increase in cover from 2018 to 2020 indicates non-native species management and supplemental native planting efforts in these areas have been successful. The 2016 coastal prairie area had a cover of 58.5 ± 6.9% in 2018 which decreased to 44.3 ± 8.5% in 2020. Although this far exceeds the goal of ≥ 15% native cover, it demonstrates native species cover in California grasslands may decrease through time without sufficient management. In 2018, the 2014 and 2016 coastal prairie habitat had an average species richness of 8.7 ± 3.2 and 18.0 ± 2.0 species per transect with a total of 17 and 24 unique species, respectively (Lesage, 2018), whereas the 2014 site now has an average of 9.0 ± 4.0 species with a total of 22 unique species and the 2016 site now has 22 unique species with an average of 13.7 ± 1.86. These changes in species richness indicate that supplemental planting has been successful in increasing average species richness, but overall species richness decline may be due to use of unsuitable plant species.

In 2018, the 2016 wetland area (Wetland 6) had an average native cover of 65.4 ± 8.00%, an average species richness of 7.00 ± 2.00 species per transect and a total of 9 unique species in the area. This year native cover in the 2016 wetland prairie declined to 41.9 ± 12.7%, and an average species richness of 11.5 ± 2.0 per transect with a total of 17 unique species. This indicates management actions have been successful in increasing species richness throughout wetland (Wetland 6), but further non-native species control may be needed to prevent further decline in native cover.

For coastal scrub plantings only, the 2014 scrub plantings achieved a native cover of 92.3 ± 2.3% in 2018 which increased in 2020 to 102.0 ± 6.7%. In 2018, species richness for 2014 scrub planting area was on average 12.0 ± 2.0 species per transect with a total of 21 unique species. In 2020, average species richness per transect increased to 15.3 ± 3.8 species per transect and total species richness in the area increased from 21 to 24. This indicates that management in the coastal scrub planting area was sufficient and helping the area far exceed its goal.

Overall, these findings suggest that coastal prairie and wetland habitats may be difficult to maintain into the future without more intensive management, whereas restored coastal scrub sites will not require as intensive methods.

Management Recommendations

Generally, the restoration efforts at Younger Lagoon Reserve are meeting their target goals. Management strategies, such as irrigation during the first year, hand-weeding of sites, and seasonal mowing are maintaining native cover and richness in restored coastal prairie, scrub and wetland areas. Only the 2012 coastal prairie planting continued to not meet its target for native cover. Because the 2012 coastal prairie did not meet its native cover goal, it is recommended that Younger Lagoon staff provide that area more intensive non-native species control. Exceedingly high values in coastal scrub areas (e.g. 102%) indicate that labor could be partially shifted from maintenance of the scrub area to the 2012 coastal prairie. Additional planting of rhizomatous species such as *Achillea millefolium* or *Sidalcea malviflora* may aid in reaching native cover goals, especially as native cover continues to decline each year. Native grasses, such as *Elymus glaucus* and *Bromus carinatus*, occur in nearly every area and could also be used to supplement native cover and richness.

Prior to 2019, species richness goals were assessed at based on average species richness per transect at a site. However, starting 2019 and on, species richness goals were assessed based on total species richness at a particular restoration site. Going forward, I recommend that species richness is assessed at the site level, as sites are all relatively small, roughly the same size and transect sizes are unequal.

Additional non-native species control and supplemental plantings are also recommended for the 2016 coastal prairie site in order to prevent it from falling below compliance standards. Although the 2016 coastal prairie is currently exceeding compliance standards, if more intensive actions or adaptive management actions are not taken, this site may once again fall below compliance in the future, because one of the three transects monitored barely met the performance standard. A decline in the 2016 coastal prairie, but an increase in the 2014 coastal prairie, indicates that management can be effective in improving native cover in coastal prairie.

Previous years have all found that cover post-implementation decreased in the coastal prairies during the fourth year compared to the second year (Lesage, 2018, 2017, 2016, 2015; Luong, 2019). It is recommended that Younger Lagoon Reserve supplement seasonal mowing in these areas with more intensive and targeted hand removal near the native species most at risk from being lost due to competition with undesirable species. Planting in these areas could also increase the likelihood these areas will exceed compliance standards in future years. The observed increase in both native cover and species richness in the 2014 coastal prairie habitats indicates that coastal prairie restoration is feasible with additional management. Although the wetland habitat did not lose native cover as quickly coastal prairies, it did not withstand invasion like coastal scrub, and thus should receive similar management as coastal prairies.

As all scrub planting areas are exceeding target goals, no further management recommendations for scrub sites are needed. Younger Lagoon Reserve may consider shifting some labor dedicated to coastal scrub management to coastal prairie management.

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Tables and Figures

Figure 1. Overview map of locations for compliance monitoring in 2020 which includes the wetland, coastal scrub and prairie transects and planting areas.

Figure 2. Map of locations for northern area in compliance monitoring in 2020.

Figure 3. Map of locations for southern area in compliance monitoring in 2020.

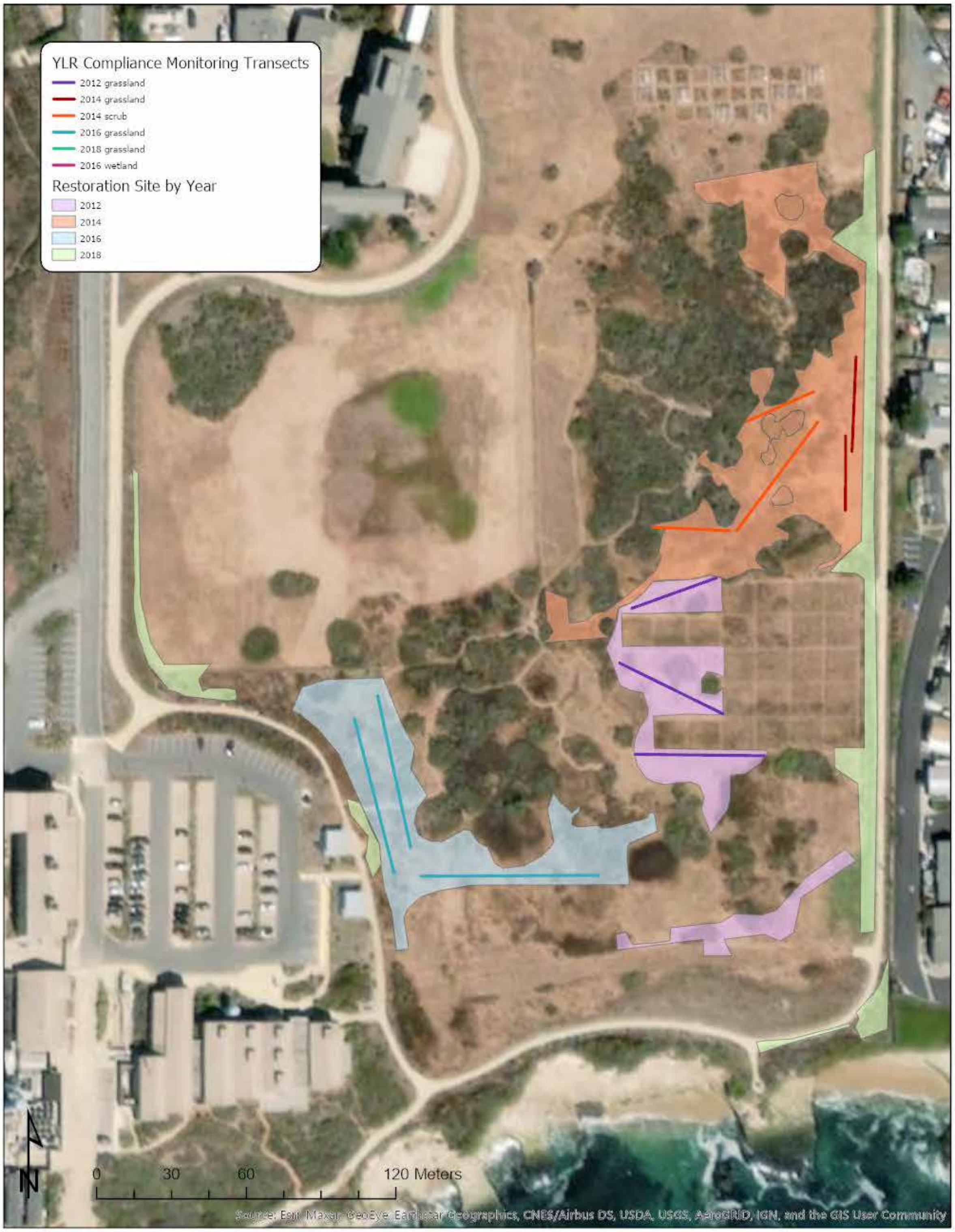

Table 1. Table of native species cover and richness targets and observed values (± SE) in the 2012, 2014, 2016 and 2018 coastal prairie, 2016 wetland, and 2014 coastal scrub restoration areas at Younger Lagoon Reserve. Cover can exceed 100% because multiple plant canopies are accounted for.

Restoration Area	Observed Native Cover (%)	Target Native Cover (%)	Average Native Richness (species/transect)	Observed Native Richness (species/habitat)	Target Native Richness (species/habitat)
2012 Coastal Prairie	8.6 ± 2.6	≥ 25	6.3 ± 0.3	14	≥ 8
2014 Coastal Prairie	44.1 ± 10.6	≥ 25	9.0 ± 4.0	14	≥ 8
2016 Coastal Prairie	44.3 ± 8.5	≥ 15	13.7 ± 1.9	22	≥ 6
2018 Coastal Prairie	76.2 ± 7.0	≥ 5	14.5 ± 3.5	20	≥ 6
2016 Wetland 6	41.9 ± 12.7	≥ 10	11.5 ± 0.5	17	≥ 4
2014 Coastal Scrub					
Shrub Cover	102	≥ 40	15.3 ± 3.8	25	≥ 8
Herb Cover	31.5 ± 12.5	≥ 25			

Table 2. Table of the native species observed in the 2011, 2012, 2013 and 2015 coastal prairie, 2013, 2015 and 2017 coastal scrub restoration areas at Younger Lagoon Reserve. Chart shows species found in at least one transect at each site. Blank cells are species that were observed in previous years. Growth forms abbreviated (AF=Annual Forb, PF=Perennial Forb, PG=Perennial Grass, PGRM=Perennial Graminoid, AGRM = Annual Gramminoid, S=Shrub, T=Tree). Part one contains annual forbs.

Scientific Name	Common name	Growth Form	2014 Coastal Prairie	2012 Coastal Prairie	2016 Coastal Prairie	2018 Coastal Prairie	2016 Wetland	2014 Scrub
Cardamine oligosperma	western bittercress	AF						
Erigeron canadensis	Canadian horseweed	AF						
Epilobium brachycarpum	willowweed	AF						
Epilobium cilatum	willow herb	AF				X	X	
Madia gracilis	coastal tar weed	AF	X		X			X
Pseudognaphalium sp.	Cudweed	AF						

Table 2*, continued*, part two has perennial forbs and trees.

Scientific Name	Common name	Growth Form	2014 Coastal Prairie	2012 Coastal Prairie	2016 Coastal Prairie	2018 Coastal Prairie	2016 Wetland	2014 Scrub
Achillea millefolium	yarrow	PF	X	X	X	X	X	X
Artemisia douglasiana	Western mugwort	PF				X		
Baccharis glutinosa	marsh Baccharis	PF			X			X
Chlorogalum pomeridianum	soaproot	PF			X			X
Clinopodium douglasii	yerba buena	PF						X
Eschscholzia californica	California poppy	PF			X			X
Fragaria chiloensis	beach strawberry	PF						
Grindelia stricta	gumweed	PF				X		
Horkelia californica	California horkelia	PF		X	X		X	X
Marah fabacea	California man-root	PF						
Oenthera elata	Hooker's primrose	PF			X			
Potentilla anserina	Silverweed	PF					X	
Prunella vulgaris	selfheal	PF			X	X	X	
Ranunculus californica	California buttercup	PF		X	X			X
Sanicula crassicaulis	Pacific sanicle	PF						X
Scrophularia californica	California bee plant	PF	X					X
Sidalcea malviflora	checker-bloom	PF				X		X
Sisyrinchium bellum	western blue-eyed grass	PF						X
Symphyotrichum chilense	Pacific aster	PF	X	X	X	X	X	X
Aesculus californica	California Buckeye	T						
Frangula californica	Coffee berry	T						
Salix lasiolepis	Arroyo willow	T					X	

Table 2*, continued*, part three has perennial grasses, graminoids and shrubs.

Scientific Name	**Common name**	**Growth Form**	**2014 Coastal Prairie**	**2012 Coastal Prairie**	**2016 Coastal Prairie**	**2018 Coastal Prairie**	**2016 Wetland**	**2014 Scrub**
Bromus carinatus	California brome	PG	X	X	X	X		X
Danthonia californica	California oatgrass	PG						
Deschampsia cespitosa	Tufted hair grass	PG		X		X	X	
Elymus glaucus	blue wild rye	PG	X	X	X	X		X
Elymus triticoides	creeping wild rye	PG	X	X	X	X	X	
Festca rubra	Red fescue	PG				X		
Hordeum brachyantherum	meadow barley	PG	X	X	X	X	X	X
Stipa pulchra	purple needle grass	PG		X		X		X
Carex hartfordii	Monterey sedge	PGRM		X		X	X	X
Cyperus eragrostis	Nutgrass	PGRM					X	
Juncus mexicanus	Mexican rush	PGRM				X	X	
Juncus patens	spreading rush	PGRM	X	X	X	X	X	X
Juncus occidentalis	Western rush	AGRM						
Juncus bufonius	Toad rush	AGRM					X	
Artemisia californica	California sagebrush	S	X		X			X
Baccharis pilularis	coyote brush	S	X	X	X	X	X	X
Ericameria ericoides	Mock heather	S			X			
Eriophyllum staechadifolium	Seaside golden yarrow	S	X		X			X
Lupinus arboreus	Bush lupine	S			X			
Lupinus variicolor	Many-colored lupine	S				X		
Diplacus aurantiacus	sticky monkey flower	S			X			X
Ribes sanguineum	flowering currant	S	X					

Rosa californica	California wild rose	S	X	X				X
Rubus ursinus	pacific blackberry	S			X	X	X	X
Toxicodendron diversilobum	Poison Oak	S						
Observed Native Species Richness:			14	14	22	20	17	25
Target Native Species Richness:			≥ 8	≥ 8	≥ 8	≥ 6	≥ 4	≥ 8

Table 3. Rainfall for Santa Cruz for rainfall years starting with the 2011-2012 rain year. Rainfall years are measured from October to September of the following year. Data are from the Santa Cruz (130) reporting station at California Department of Water Resources.

Rainfall Year	Total Precipitation
100 Year Average	75.8 cm
2011-2012	52.6 cm
2012-2013	45.8 cm
2013-2014	36.6 cm
2014-2015	55.1 cm
2015-2016	82.7 cm
2016-2017	130.0 cm
2017-2018	49.7cm
2018-2019	92.3 cm
2019-2020	40.1 cm

Appendix 1 – Relevant Compliance Monitoring Standards for YLR Restoration Efforts

Excerpted from: *UCSC Natural Reserves Staff and the Younger Lagoon Reserve Scientific Advisory Committee (UCNRS). 2010. Enhancement and Protection of Terrace Lands at Younger Lagoon Reserve. Plan prepared for the California Coastal Commission.*

Grassland / Coastal Prairie

Performance Standard: 8 native plant species appropriate for habitat established in planted areas to comprise 25% cover.

Years Post Planting	Goal
2 years after planting	6 or more native plant species established comprising > 5% cover and evidence of natural recruitment present
4 years after planting	6 or more native plant species established comprising > 15% cover and evidence of natural recruitment present
6 years after planting and every 5 years after that	8 or more native plant species established comprising > 25% cover and evidence of natural recruitment present

Wetland

Performance Standard: 4 native plant species appropriate for habitat established in planted areas to comprise 25% cover.

Years Post Planting	Goal
2 years after planting	4 or more native plant species established comprising > 10% cover and evidence of natural recruitment present
5 years after planting and every 5 years after that	6 or more native plant species established comprising > 30% cover and evidence of natural recruitment present

Scrub

Performance Standard: 8 native plant species appropriate for habitat established in planted areas to comprise 40% cover.

Years Post Planting	Goal
2 years after planting	6 or more native plant species established comprising > 10% cover and evidence of natural recruitment present
4 years after planting	6 or more native plant species established comprising > 25% cover and evidence of natural recruitment present
6 years after planting and every 5 years after that	8 or more native plant species established comprising > 40 % cover and evidence of natural recruitment present

Appendix 3. Student reports

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

Effect of Soil Moisture and Bird Herbivory on Perennial Grass Survival in Wetlands at Younger Lagoon Reserve

A Senior Thesis submitted in partial satisfaction
of the requirements for the degree of

BACHELOR OF ARTS

in

ENVIRONMENTAL STUDIES

by

Mitchell Westin Kuwahara

June 2020

ADVISOR(S): Karen D. Holl, Environmental Studies

ABSTRACT: Studies on freshwater wet meadow restoration via perennial grass seedlings are limited on the central coast of California. Understanding the relationship of native species, soil moisture, and inundation duration can help the overall success of restoration techniques applied to coastal wetlands in California. I analyzed the survival of four native, perennial grass species transplanted as part of freshwater wetland restoration efforts at Younger Lagoon Reserve. The grass species *Agrostis pallens*, *Deschampsia cespitosa*, *Elymus triticoides*, and *Hordeum brachyantherum* covered a range of elevations to see how each species survived at different inundation levels within the wetland. Results of the five-month study showed that wetland indicator statuses for these grasses were not effective predictors of survival. The overall survival ranged from 45 – 60% for the four species over the first 2.5 months after which time there was minimal mortality. All species had a negative, linear relationship with volumetric water content despite the relatively dry period during the study. Observations suggest that the primary cause of mortality was herbivory by waterfowl when the site was inundated. This implies that some variable that was unaccounted for partially responsible for the survival of these species. Future research can study the role of flooding vs. waterfowl herbivory and utilize structures that limit waterfowl activity to enhance restoration success in these wetlands.

KEYWORDS*: Agrostis pallens*, *Deschampsia cespitosa*, *Elymus triticoides*, *Hordeum brachyantherum*, volumetric water content, survival, waterfowl foraging, Younger Lagoon Reserve

Mitchell Kuwahara

Student signature

June 9, 2020

Date

Effect of Soil Moisture and Bird Herbivory on

Perennial Grass Survival in Wetlands at Younger Lagoon Reserve

Across the world, wetland habitats are being degraded due to a variety of anthropogenic activities (Carrière, 1997; Wójcicki & Woskowicz-Ślęzak, 2015). It is estimated that at least 90% of California wetlands have been destroyed (Matchett & Fleskes, 2017). Filling, draining, land conversion, and the spread of invasive species are some of the numerous forms of human development that have destroyed wetlands (Mašková *et al.,* 2009; Gornish & Ambrozio, 2016). Despite difficulties associated with restoring wetlands, significant interest is placed on their conservation due to their ecological importance.

Wetlands are crucial in protecting endemic species and preserving the hydrology of surrounding systems (Rodriguez & Lougheed, 2010). Healthy, functioning wetlands mitigate soil erosion, improve water quality, and sequester large amounts of carbon (McLaughlin & Cohen, 2013). Additionally, there is large interest in protecting coastal wetlands to combat rising sea levels and frequent large-weather events that are associated with climate change (Dasgupta *et al.,* 2011; Section 404(q) of the Clean Water Act, 33 U.S. C. 1344 (q)).

In fragmented wetlands, there is a focus on restoring the natural hydrology to promote the recovery of species adapted to inundated conditions (Caldwell *et al.,* 2011). There are many variables that impact the hydrology of a wetland such as water withdrawals, the construction of paved roads, and changes in precipitation patterns due to global warming (Taque *et al.,* 2009; Dasgupta *et al.,* 2011). Re-grading land and restoring hydrologic connectivity are among the most common methods of hydrologic restoration. This is a popular method because hydrology has been demonstrated to heavily influence plant species distributions (Gann & Richards, 2015). Once the hydrology is brought back to a pre-disturbance state, restoration tactics focus on improving the habitat and minimizing erosion (Cui *et al.*, 2018). Active restoration is often used to quickly increase vegetation cover which subsequently secures sediment and allows the ecosystem to recover over time (Zhao *et al.*, *2016;* Cui *et al.*, 2018).

The method of reintroducing flora is often determined by available resources such as funding and labor (Wang & Billinton, 2002). Transplanting greenhouse-grown seedlings is an effective method of recreating pre-disturbance conditions in wetlands at faster rates compared to seeding (Zhao *et al.*, 2016; Gornish *et al.*, 2017). Although transplanting seedlings can improve the long-term success of a project, it is an expensive method of ecological restoration (Simenstad *et al.,* 2006; Mitsch & Gosselink, 2007). The biggest risk to this method is wasting resources if outplanted seedlings are unsuccessful. Therefore, the method of species selection for outplanting restoration is critical in determining a project's success.

Choosing the appropriate species to outplant is often determined by their native, regional proximity (Siles *et al.*, 2010, Pfeifer-Mesiter *et al.*, 2012) to ensure that native flora and fauna are reintroduced to a site. In wetland restoration, wetland indicator statuses are used to ensure that outplanted species are adapted to live in soil with low oxygen levels (Verhoeven & Sorrell, 2010; Nakamura & Nakamura, 2016). These wetland indicator statuses – upland, facultative upland, facultative, facultative wetland, and wetland – all indicate the primary habitat association of different species with increasing soil moisture and tolerance of inundation, respectively (USDA, 2020).

Many other abiotic and biotic variables can also impact the survival of these seedlings, such as soil nutrients and animal activity. Waterfowl foraging is a common obstacle when restoring wetlands via transplants in other regions (Randall & Foote, 2005; Rodrigo *et al.*, 2013), but there is scarce literature regarding the relationship between flooded land and waterfowl herbivory along the California central coast.

My research aimed to produce new, regionally specific data to increase transplanting success of some native wetland grass species found in Central Coast wetlands by evaluating the relationship between soil inundation and seedling survival. I predicted a non-linear relationship between soil moisture and plant survival, namely that a species' survival would be dictated by its wetland indicator status. So, for example, I anticipated that survival of facultative wetland species would be higher in flooded plots than would survival of upland species.

Methods

Site Description

I conducted this research at the UC Santa Cruz Younger Lagoon Reserve in Santa Cruz, CA. Younger Lagoon Reserve contains some of the few remaining wet meadow habitats in the Santa Cruz area (Hunt, 2009) and can serve as a model for future wet meadow restoration projects. The approximately 29-hectare property was previously used for agriculture for 70 years, and grazing for approximately 100 years prior, before it was incorporated into the Younger Lagoon Reserve (Hunt, 2009). It is located approximately 7 km south of the main Santa Cruz campus. It has a relatively small temperature range spanning from 12 to 15° Celsius annually and receives an average 62 cm of rainfall annually. The long history of agricultural activity resulted in the degradation of habitat and soil quality which altered the species composition of the region. The University of California Santa Cruz is now mandated by the California Coastal Commission to restore the system back to pre-disturbance conditions through the implementation of various restoration strategies.

Study Species

Four native perennial grass species were grown in the UCSC Thimann Greenhouses and hardened off for two weeks at the Younger Lagoon Reserve. The four species encompass most, but not all, of the wetland indicator statuses (USDA, 2020): *Agrostis pallens* (AGPA) – upland, *Deschampsia cespitosa* (DECE) – facultative wetland, *Elymus triticoides* (ELTR) – facultative, *Hordeum brachyantherum* (HOBR) – facultative wetland. They were planted from November 15 through November 22, 2019. Each species was watered three times per week (Monday, Wednesday, and Friday) until the rainy season began in mid-December after which they were not managed.

Experimental Design

Plants were outplanted in two 57 x 1.8-m transects on an elevation gradient in Wetland 5, which is one of the largest wetlands at Younger Lagoon Reserve (**Figure 1**). Each individual seedling was separated by 0.45 m. The width of each transect (1.8 m) was divided into four 0.45 m-wide segments that housed a different species of plant in each row. There was a 0.5-m buffer on each side of the strip. Within these plots, the 16 total plants were at the same approximate elevation (**Figure 1**). This wetland has an altered hydrology by a road (McAllister Way) that runs on the west side of the wetland.

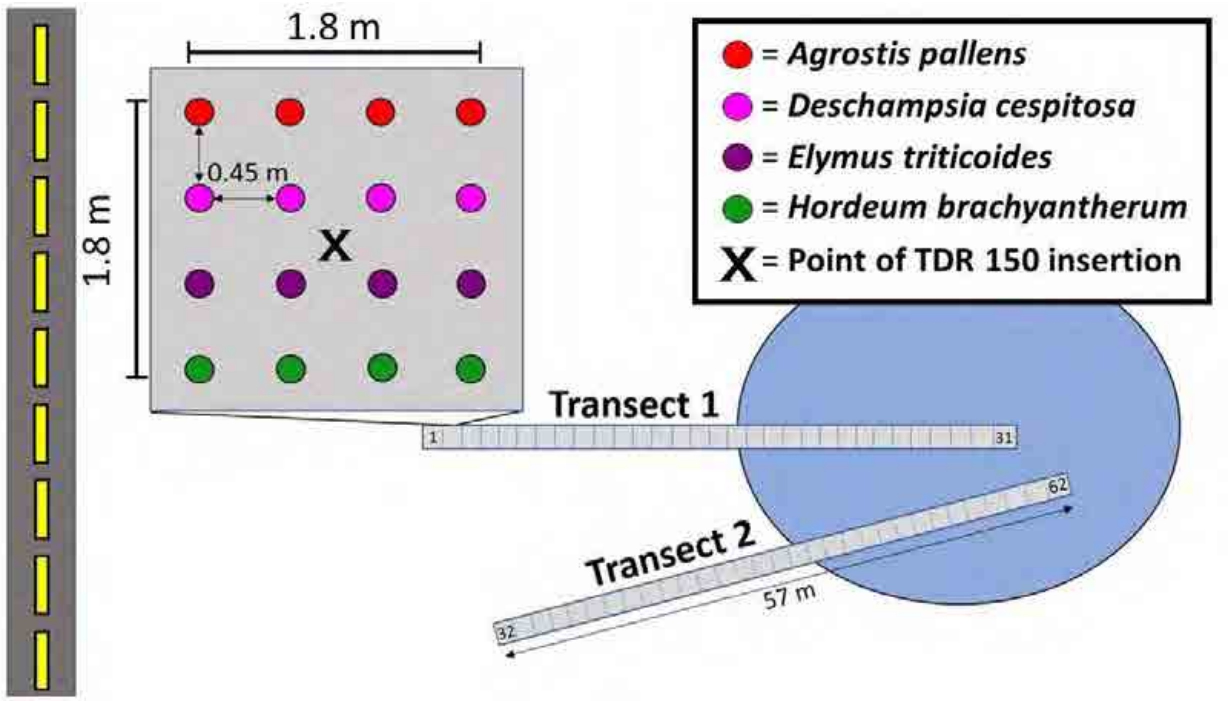

Figure 1. Visual representation of the experimental design. Each transect contained 31 subplots that each had sixteen total seedlings. Approximately half of each transect was in the wetland. It is represented by the blue oval which floods in an average rainfall year.

Data Collection

I measured soil inundation using time-domain reflectometry (TDR) with a FieldScout TDR 150. TDR analyzes the velocity at which electromagnetic waves move through the soil as well as the reflected wave patterns generated. This measures volumetric water content (VWC). VWC data were collected in the center of each plot (**Figure 1**). Where there was visible standing water, I measured water depth as an alternative to VWC.

I measured water depth with a wooden device that I constructed by attaching a wooden stand to the end of a measuring stick (**Figure 2**). For the first few soil moisture data collections, I did not have a standardized method of measuring inundation depth, so I did not collect data in inundated plots.

Figure 2. Water depth tool created with the help of Professor Weixin Cheng. I only used the tool at the top. The larger surface area of the square was designed to stop the yard stick from penetrating into the soil profile while still moving deep enough to determine where the standing water ended and where the soil profile began.

Data Analysis

I recorded survival of each plant in the transects on February 7 and 21. I gathered volumetric water content data on January 17, 24, 31 and February 7 and 21. I was unable to gather any data through March due to COVID-19 restrictions. Vaughan Williams, the Restoration Field Manager at Younger Lagoon Reserve, collected VWC data on April 16 and a third round of survival data on April 20 for me, given the campus restrictions. I also compiled rainfall data from the NRS weather station at Younger Lagoon Reserve.

I calculated percent survival of the four species in each subplot. I then used linear regression to evaluate the relationship between soil moisture and plant survival for each species using subplots as the replicate. I used a t-test to compare the percent survival of plants on February 7 in plots that were flooded vs not flooded plots on January 21. All analyses were conducted using JMP Pro 14.

Results

Only 45-60 percent of individual species survived from the time of planting in late November until early February (**Figure 3**). Over the next two months there was minimal mortality. Volumetric water content had a significant, negative, linear relationship with plant survival (**Figure 4**, **Table 1**). In other words, plant survival was lower in areas with higher soil moisture for all species. Likewise, mean survival of plants in plots flooded on February 7 was significantly lower than those that did not have standing water on them (Flooded: 24 ± 23%, Non-Flooded: 84 ± 7%; $t = 6.65$, $p < .001$). These relationships were consistent for all species planted regardless of their wetland indicator status. Rainfall from October 2019 – April 2020 was lower than during the same time period in the four previous years (**Figure 5**).

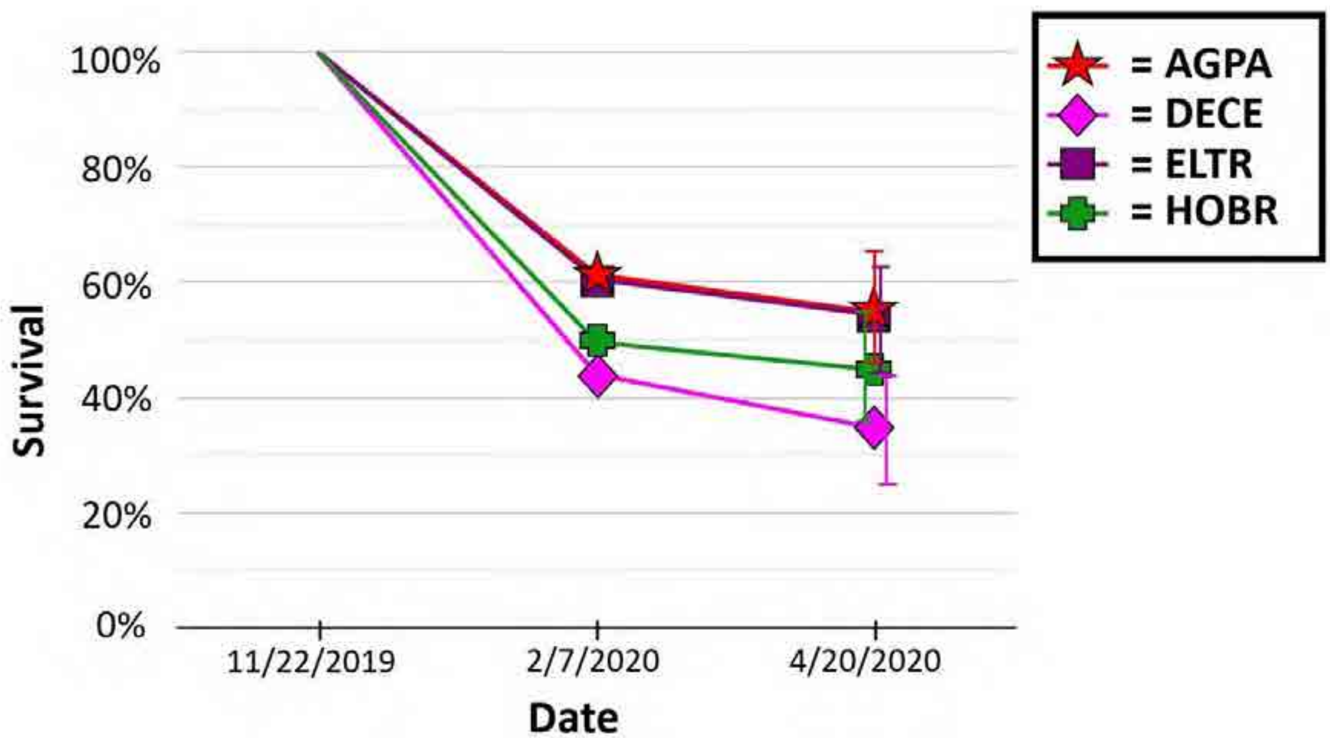

Figure 3. Percent survival of each species. Values are means ± 1 SE for n = 62 subplots.

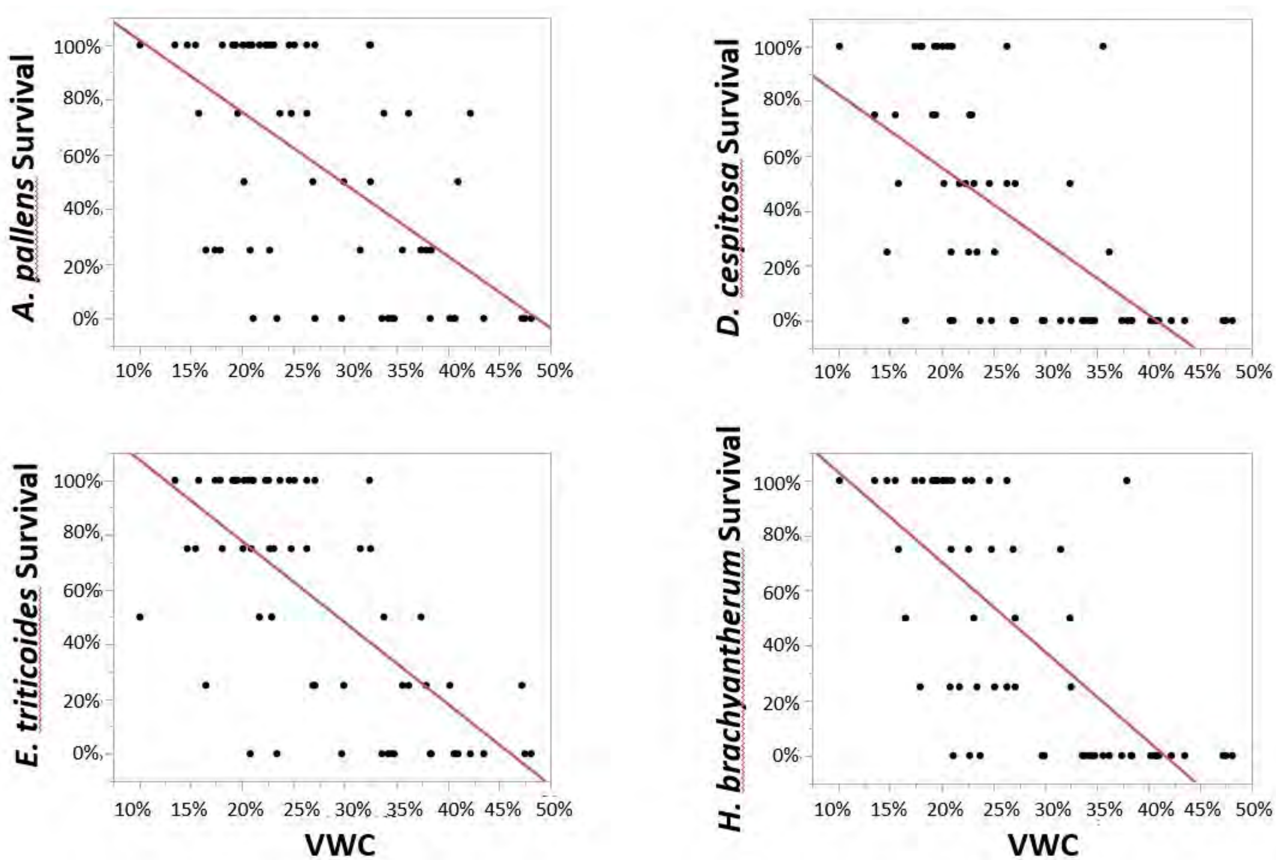

Figure 4. Percent survival of planted grass species on April 20, 2020 as a function of volumetric water content on April 16, 2020. Measurements were collected in the direct center of every plot with a TDR-150 (see Figure 1).

Table 1. Results from the linear regression analysis of plant survival as a function of volumetric water content. The regression for species on 2/7/2020 uses survival and VWC data from the same day. The second regression for each species on uses VWC data from 4/16/2020 and survival data from 4/20/2020.

Species	Date	Mean Survival + Std. Error (%)	R-Squared w/ VWC	P-Value w/ VWC
AGPA	2/7/2020	61.3 ± 0.06	0.48	< 0.001
	4/16/2020 - 4/20/2020	54.8 ± 0.05	0.35	< 0.001
DECE	2/7/2020	44.0 ± 0.06	0.65	< 0.001
	4/16/2020 - 4/20/2020	34.7 ± 0.05	0.41	< 0.001
ELTR	2/7/2020	60.5 ± 0.05	0.61	< 0.001
	4/16/2020 - 4/20/2020	54.4 ± 0.05	0.47	< 0.001
HOBR	2/7/2020	49.6 ± 0.06	0.56	< 0.001
	4/16/2020 - 4/20/2020	44.8 ± 0.06	0.50	< 0.001

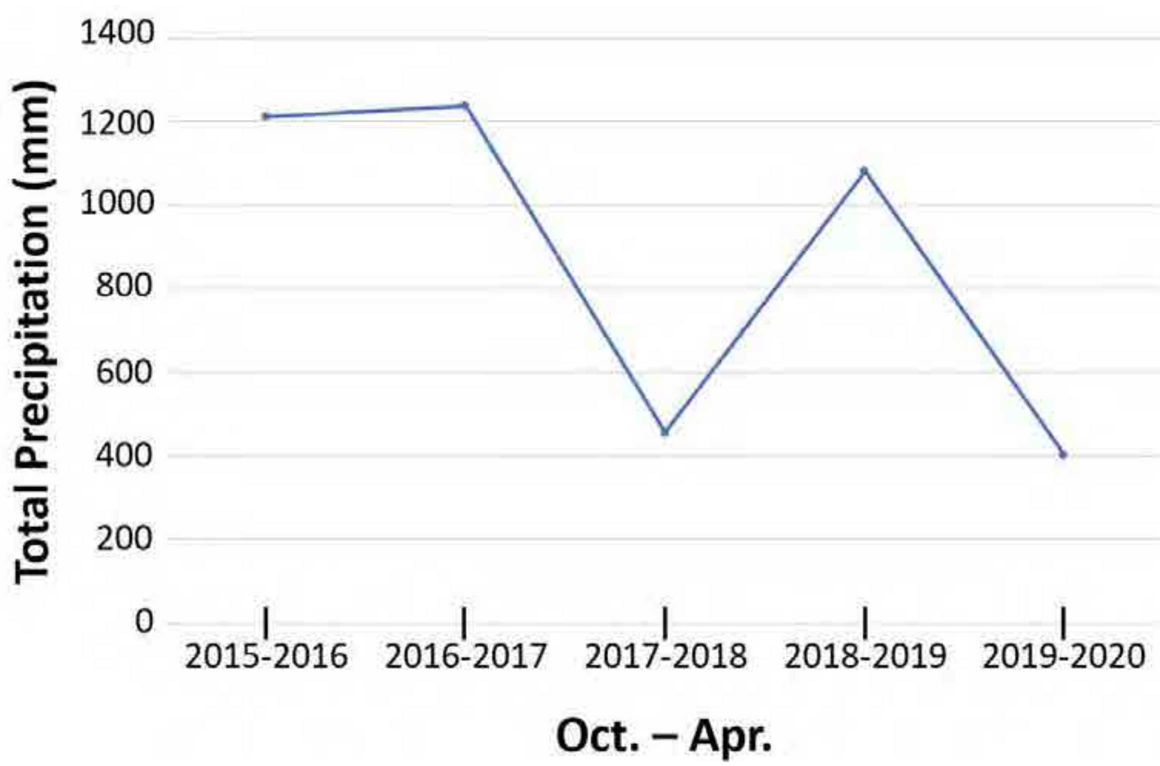

Figure 5. Total precipitation spanning Oct. – Apr. from 2015-2020. Data were compiled from the NRS Younger Lagoon weather station.

Discussion

All species had lower survival in wetter areas. The two species most adapted to survive in wet areas (DECE and HOBR) had the lowest survival rates which contradicts literature that classifies species by wetland indicator status. For example, one would assume that *Deschampsia cespitosa*, a facultative wetland species, would be more successful in wet areas of the transects and that *Agrostis pallens*, an upland species, would survive better in dry regions. The consistent mortality of all species suggests that an additional factor influenced the survival rates of these species more than their respective wetland indicator statuses (Ervin *et al.*, 2006; Johns *et al.*, 2015; McCoy *et al.*, 2017). The analyses show that plant survival in the flooded plots was significantly lower than in unflooded plots for each plant species, which helps infer that some quality of flooded plots influenced the survival of all species planted.

During the winter break period, which is relatively inactive for Younger Lagoon, restoration field managers observed extremely high levels of waterfowl activity in the research transects. This was most likely caused by large amounts of standing water that resulted from a week of heavy precipitation. Additionally, newly planted grasses provide habitat for waterfowl prey including invertebrates like amphipods and insect larvae (Kaminski & Prince, 1981; Batzer *et al.*, 1993). Informal observations suggest that waterfowl foraging potentially had more influence on survival than soil moisture. The year was relatively dry compared to previous precipitation levels which also make the sharp die off rates perplexing. The sharp die off and the relatively dry season suggests that waterfowl herbivory reduced seedling survival. The relationship between flooded plots and lower survival levels of all species suggests that these preferred habitats for foraging waterfowl (Batt, 1992; Asamoah *et al.*, 2011) have a stronger influence on plant survival compared to volumetric water content.

Although the observations suggest that waterfowl were the primary cause of seedling mortality, further research is needed to prove that waterfowl foraging directly reduced survival of these species. In future restoration efforts I suggest using waterfowl cages (Bowers, 1995; Figuerola & Green, 2004) that have been demonstrated to discourage waterfowl activity. Twine can also be used to limit the open water that ducks and other birds need to land and take off (Bowers, 1995). Twine can be a less resource-intensive method of limiting waterfowl activity compared to cages.

For future research, I suggest using the aforementioned waterfowl cages to create control groups within wetland experiments. These cages can aid analyses of waterfowl interactions and their impact on plant survival. I also suggest using a range of wetland plants that includes obligate wetland species to test whether wetland indicator statuses predict survival as a function of soil moisture. I also recommend further research that examines how variance in species-level functional traits can vary across wetland indicator statuses (McCoy-Sulentic *et al.*, 2017). This research can potentially explain the homogenous mortality rates of all species in this study regardless of their respective wetland indicator status. It is possible that they have species-level traits that are not bound to their specific indicator status. Lastly, I recommend incorporating remote sensing into future wetland experiments. Indices can be created using thermal imaging to determine soil moisture which can dramatically reduce time collecting data (Ahmed *et al.*, 2011; Chew *et al.*, 2016) and provide measurements for the entire wetland rather than one measurement bound by transect/data point design.

Conclusion

The scale of wetland destruction in California necessitates the improvement of wetland restoration strategies to increase the success of future reestablishment projects. This study suggests that future restoration projects need to consider more variables than just wetland indicator statuses and predicted soil moisture levels when determining the species and location for outplanting zones. Further research is required to determine the impact that other variables, such as waterfowl foraging, have on the survival of outplanted species. This information can have profound implications for subsequent freshwater wetland management. Future strategical improvements that increase the effectiveness of outplanting in wetlands can save these extremely productive ecosystems from further degradation.

Author Note

I would like to thank Karen Holl for advising my paper and helping me amidst a global pandemic with considerable patience. I would also like to thank Vaughan Williams and Becca Fenwick for their mentorship at Younger Lagoon Reserve and Weixin Cheng for his help in constructing my soil measurement tool. Finally, I would like to thank the wonderful interns at Younger Lagoon Reserve who helped me outplant nearly 1000 seedlings in Wetland 5. This work was performed (in part) at the University of California Natural Reserve System Younger Lagoon.

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Appendix 4. Photo monitoring


YLR Beach Photopoint #1 (W). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Beach Photopoint #1 (NW). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


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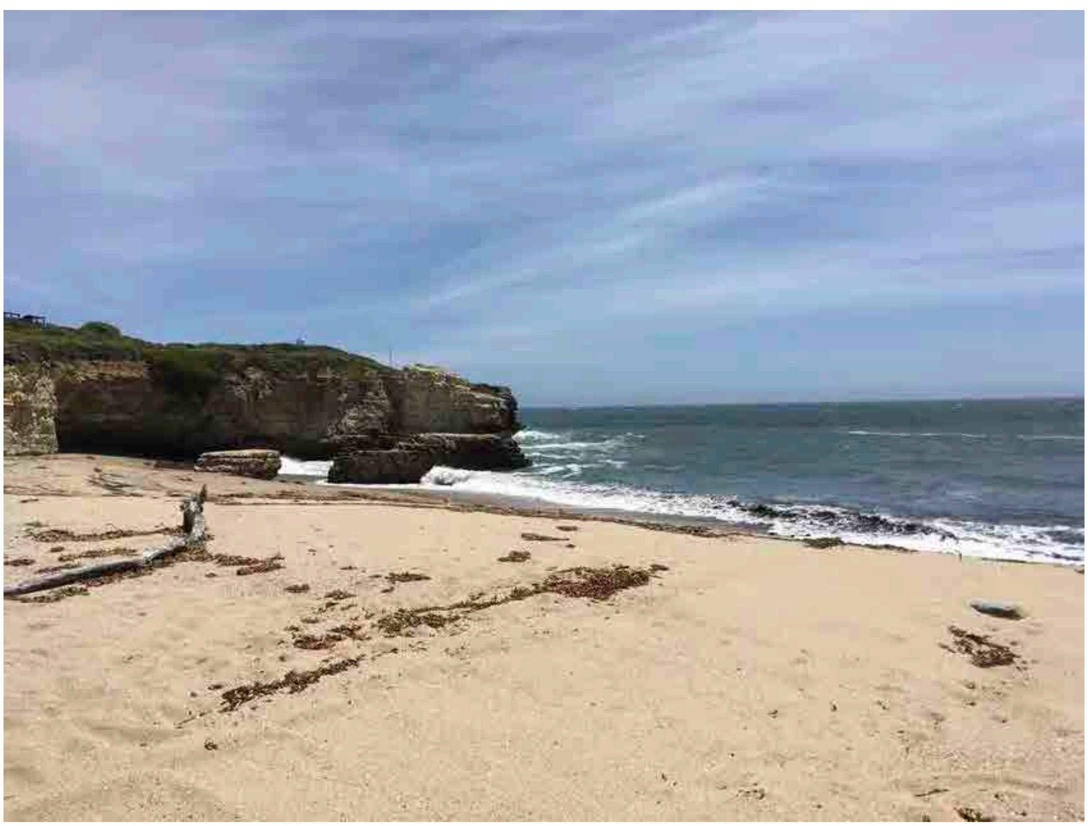

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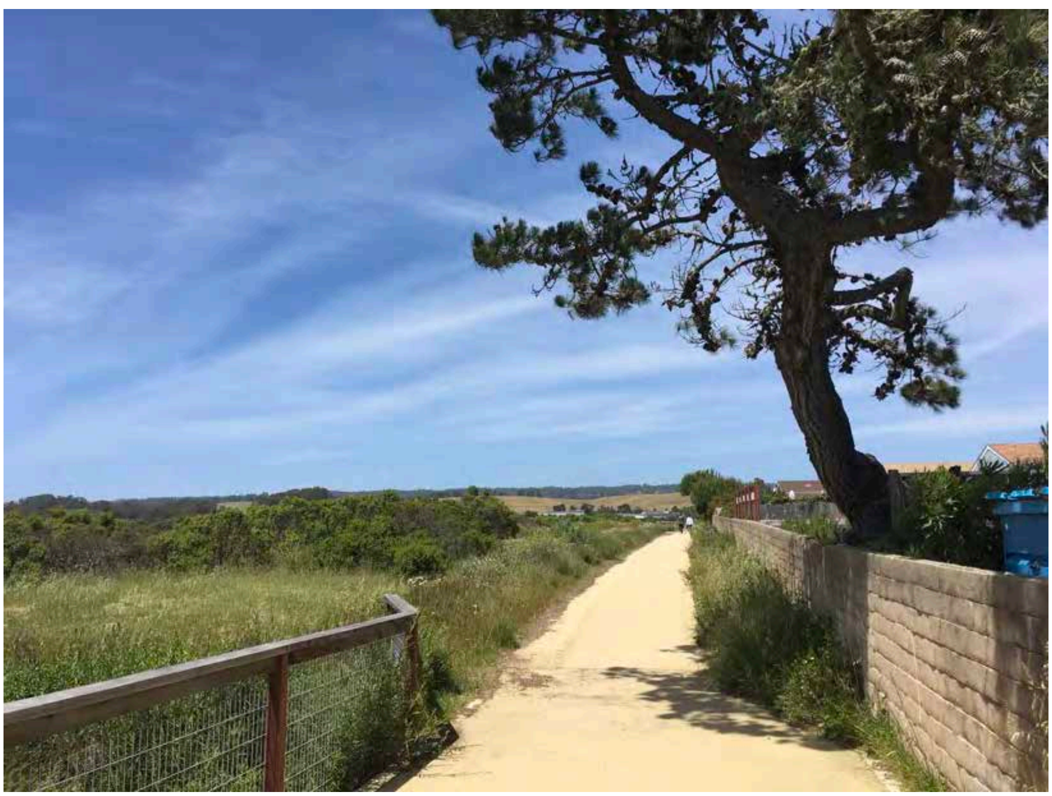
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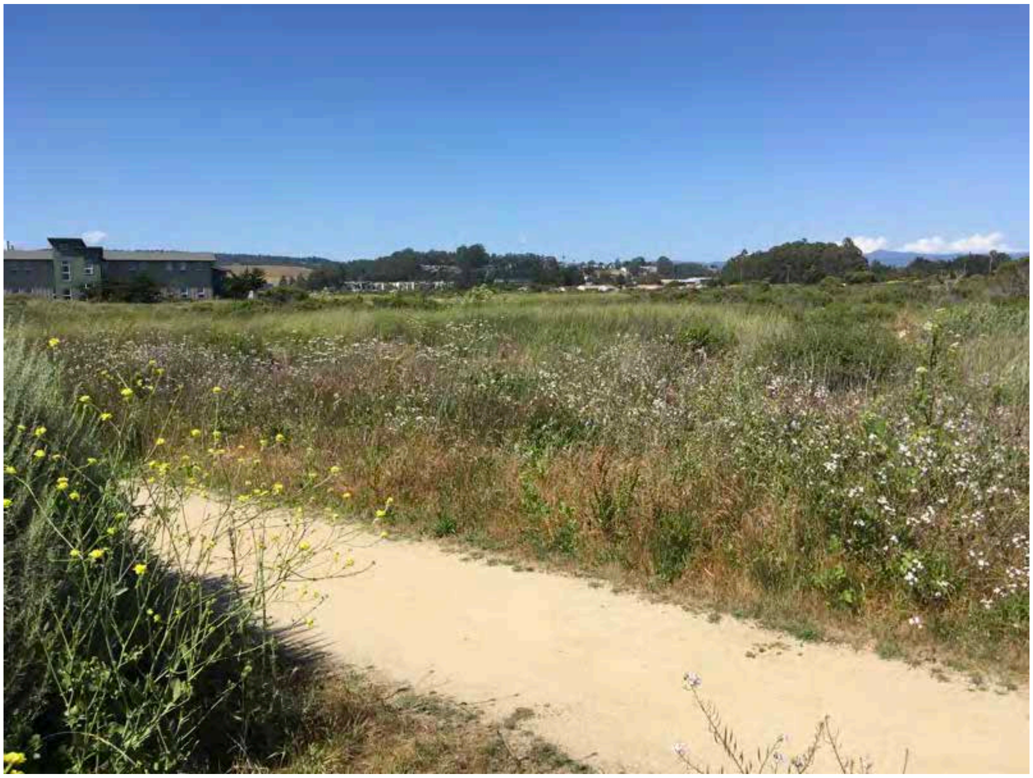
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YLR Terrace Photopoint #7 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Terrace Photopoint #8 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Terrace Photopoint #8 (NE). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Terrace Photopoint #8 (SE). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

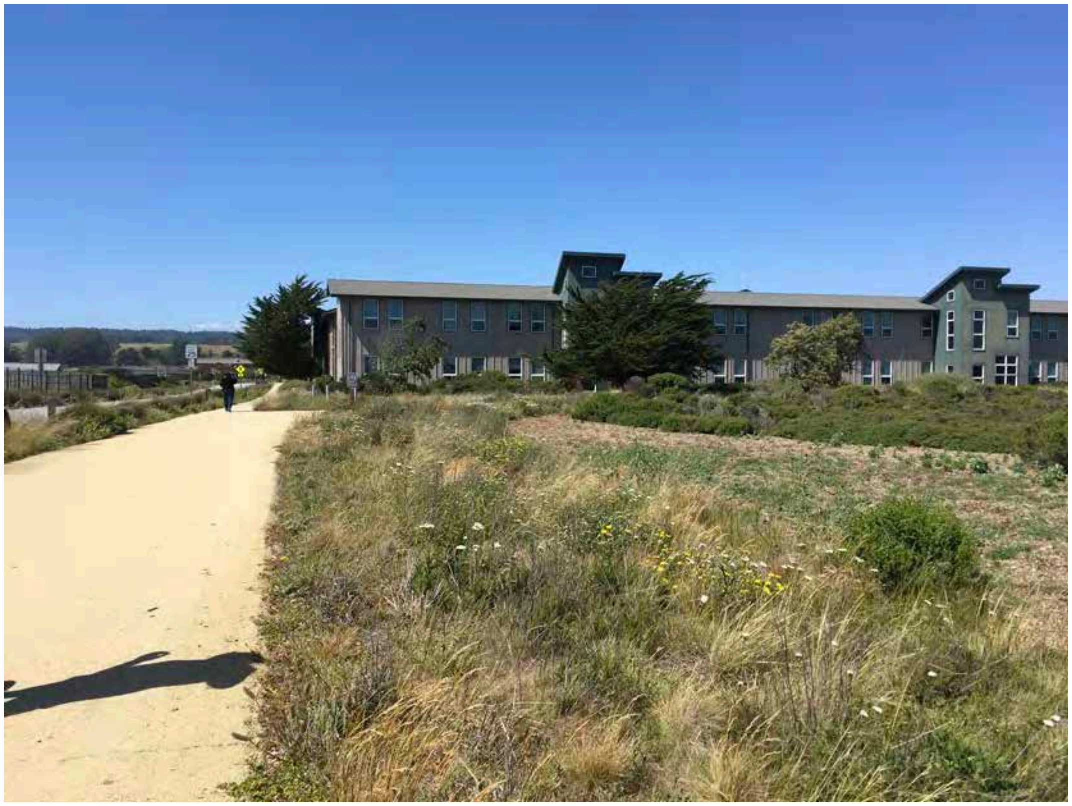

YLR Terrace Photopoint #8 (S). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Terrace Photopoint #9 (S). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Terrace Photopoint #9 (SE). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Terrace Photopoint #9 (E). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Terrace Photopoint #9 (NE). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).



YLR Terrace Photopoint #9 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

YLR Terrace Photopoint #10 (W). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Terrace Photopoint #10 (NW). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).


YLR Terrace Photopoint #10 (N). May 22, 2020. Photographer: Kyla Roessler. Camera: Apple iPad Pro 9.7 (12 MP, 29mm).

Appendix 5. NOID 9 (18-1) Special Conditions Implementation Reports, NOID 12 (20-1), and NOID 12 (20-1) Special Conditions Implementation Plan

UC Santa Cruz NOID 9 (18-1)
Special Conditions Implementation Report 2
January 1, 2019 – December 31, 2019

Burrowing owl on the Younger Lagoon Reserve Beach Dunes

UC Santa Cruz NOID 9 (18-1)
Special Conditions Implementation Report 2

Overview and Executive Summary

On September 13, 2018, the California Coastal Commission approved UCSC's NOID 9 (18-1) as consistent with UCSC's approved Coastal Long Range Development Plan with the addition of five staff-recommended special conditions. These included 1) Free Beach Tours, 2) Beach Tour Outreach Plan, 3) Beach Tour Signs, 4) Beach Tour Availability and Monitoring, and 5) Beach Access Management Plan Duration. Within 30 days of the approval (i.e., by October 13, 2018), UCSC was required to submit a plan for implementation of the special conditions to the Executive Director of the California Coastal Commission. The plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on October 15, 2018. UCSC received feedback from Coastal Commission staff on the plan, and a revised plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on December 15, 2018. The revised plan for implementation of the special conditions was approved by the Executive Director on January 30, 2019. Special condition 4 requires that at least every six months (i.e., by June 30th and December 31st each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval. UCSC's report on the implementation of these special conditions for the period of January 1, 2019 through December 31, 2019 is detailed below.

UC Santa Cruz has successfully implemented all five special conditions. A summary of UC Santa Cruz's compliance with the five special conditions is below.

Special Condition	Status	Notes
1) Free Beach Tours	Completed	All beach tours are now offered for free without admission to the Seymour Center.
2) Beach Tour Outreach Plan	Completed & Ongoing	UCSC's Beach Tour Outreach Plan was approved by the executive director in January 2019 and all beach tour outreach materials now clearly state that the beach tour is free. UCSC's ongoing outreach efforts include regular social media postings and calendar listings, including listings in Spanish and publications that serve inland communities.
3) Beach Tour Signs	Completed	UCSC's Beach Tour Signage Plan was approved by the executive director in

		January 2019 and "Free Beach Tour" signs have been installed at all of the required locations.
4) Beach Tour Availability and Monitoring	Completed & Ongoing	Free beach tours are now offered per the required schedule – a minimum of 38 times a year on weekends and weekdays, and all of the required data on tour attendees has been and continues to be collected. UCSC submitted their first and second biannual reports on the beach tours on-time (June 2019) and this report. The next report is due by June 31, 2020.
5) Beach Access Management Plan Duration	In Progress	NOID 9 (18-1) is effective through December 31, 2020. UC Santa Cruz is required to submit their next Beach Access Management Plan NOID by July 1, 2020.

Implementation of the special conditions resulted in an approximately 18% increase in overall tour participation and more than 900% increase in walk-in/day-of tour participants in 2019 compared to 2018.

A summary of the free beach tour user data for 2018 (pre special conditions) and 2019 (post special conditions) is below:

Year	Dates	Total Tours Offered	Total Participants	Total # of Walk-in / Day-of Participants	Total # of Participants with a Reservation
2018	January 1- December 31	38	224	5	219
2019	January 1- December 31	38	265	46	219

Condition 1.

FREE BEACH TOURS

All beach tours shall be offered for free, and UCSC shall not require that beach tour users pay any separate admission fee to any other facility in order to take the beach tour. This condition shall not be construed as affecting existing already allowed admission fees for UCSC's Seymour Marine Discovery Center. Beach tour signups may be provided online (e.g., at UCSC Marine Science Campus and Seymour Marine Discovery Center websites) but shall at a minimum be made available by phone and at the Seymour Marine Discovery Center front desk. UCSC shall also identify and implement a mechanism for tracking the number of tour requests that are denied due to lack of tour availability or because tours are fully booked. All UCSC materials referencing the beach at Younger Lagoon and/or beach tours shall be required to be modified as necessary to clearly identify that access to the beach is available for free via beach tours. Within 30 days of this approval (i.e., by October 13, 2018), UCSC shall provide evidence to the Executive Director identifying the manner in which (1) free beach tour signups are made available, (2) tour request denials are quantified and recorded, and (3) UCSC materials have been modified to reflect that beach access is available for free via beach tours, all consistent with this condition.

Implementation Report

All beach tours are now offered for free (without admission fee). Beach tour sign-ups are available by phone and at the Seymour Marine Discovery Center (Seymour Center) public admissions counter. Seymour Center staff track any tour requests that are denied due to lack of tour availability or because tours are fully booked as part of their ongoing monitoring of all visitor programs. Seymour Center staff record the number of participants that were denied, the number of participants that were wait listed, as well as the date of the request and the date of the tour being requested (see Appendix 1). The Younger Lagoon Reserve and the Seymour Marine Discovery Center websites have been modified to clearly identify that access to the beach is available for free via beach tours.

https://youngerlagoonreserve.ucsc.edu/about-us/index.html
https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html
https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/

<u>Condition 2.</u>

BEACH TOUR OUTREACH PLAN

Within 30 days of this approval (i.e., by October 13, 2018), UCSC shall submit two copies of an Outreach Plan for Executive Director review and approval, where such Plan shall identify all measures and venues to be used to advertise and increase awareness of the free beach tours (e.g., UCSC Marine Science Campus and Seymour Marine Discovery Center websites, press releases, calendar listings with UCSC Events and local media (e.g., Good Times newspaper), ads on radio (e.g., public radio station KAZU), print ads, social media (including Facebook, Twitter, and Instagram), etc.). The Plan shall identify the language to be used in describing the free beach tours (where said language shall be required to be consistent with the terms and conditions of this approval), and shall provide a schedule for each type of outreach, with the goal being to reach as many potential free beach tour audiences as possible, including audiences that might not normally be reached through traditional and local means (e.g., inland communities). UCSC shall implement the approved Outreach Plan as directed by the Executive Director.

Implementation Report

Outreach was conducted according to the following plan during the reporting period:

Venue	Language	Schedule
Seymour Center Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Permanent webpage: https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/
YLR Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Permanent webpages: https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html
Seymour Center Social Media o Facebook o Twitter o Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Facebook—Monthly Twitter, Instagram ---Once a quarter
YLR Social Media o Facebook o Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Once a quarter
Calendar Listings o UCSC Events o Good Times Newspaper (Santa Cruz) o KAZU public radio (Santa Cruz) o Register Pajaronian Newspaper (Watsonville) o The Californian Newspaper (Salinas) o La Network Campesina Radio 107.9 (Salinas)	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**. For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 14 participantes. Llame al **831-459-3800**.	Submitted monthly (calendar listings appear at the discretion of the media outlet.) Submitted monthly (calendar listings appear at the discretion of the media outlet.)

Condition 3.

BEACH TOUR SIGNS

Within 30 days of this approval (i.e., by October 13, 2018), UCSC shall submit two copies of a Beach Tour Sign Plan for Executive Director review and approval, where such Plan shall provide for installation of signage outside of the Seymour Marine Discovery Center and inside at its front desk, at Campus overlooks, and at other appropriate public access locations on the Marine Science Campus that describe free beach tour availability, including "day of" signs for each day beach tours are offered to ensure maximum notice is provided. All such signs shall be sited and designed to be visually compatible with the area, shall be consistent with the Campus sign program (and CLRDP sign requirements), and shall provide clear information in a way that minimizes public view impacts. UCSC shall implement the approved Beach Tour Sign Plan as directed by the Executive Director.

Implementation Report

UCSC's Beach Tour Sign Plan was reviewed and approved as part of the NOID 9 Special Conditions Implementation Plan on January 30, 2019. Per the approved sign plan, information on the free beach tours is currently displayed "day of" on a large sign in the front window of the Seymour Center and at the public admissions counter. The Seymour Center has also purchased and installed a large colorful monitor in the front window that displays "day-of" information on the free beach tours. "Day of" signage includes the brown and white footprints on wave logo, and the following language "Free Younger Lagoon Reserve Beach Tours Today" (Figures 1, 4, and 5). Signage has been added to the information kiosk outside of the Seymour Center (Figure 3) and to Overlooks A-F (Figures 6-12). Overlooks and kiosk signage include the brown and white footprints on wave logo and include the following language "Free Younger Lagoon Reserve Beach Tours, Call (831) 459-3800" (Figure 2).

Figure 1. “Day of” sign design.

Figure 2. Overlooks and kiosk sign design.

Figure 3. Signage installed at Seymour Center information kiosk.

Figure 4. Signage installed at Seymour Center front window.

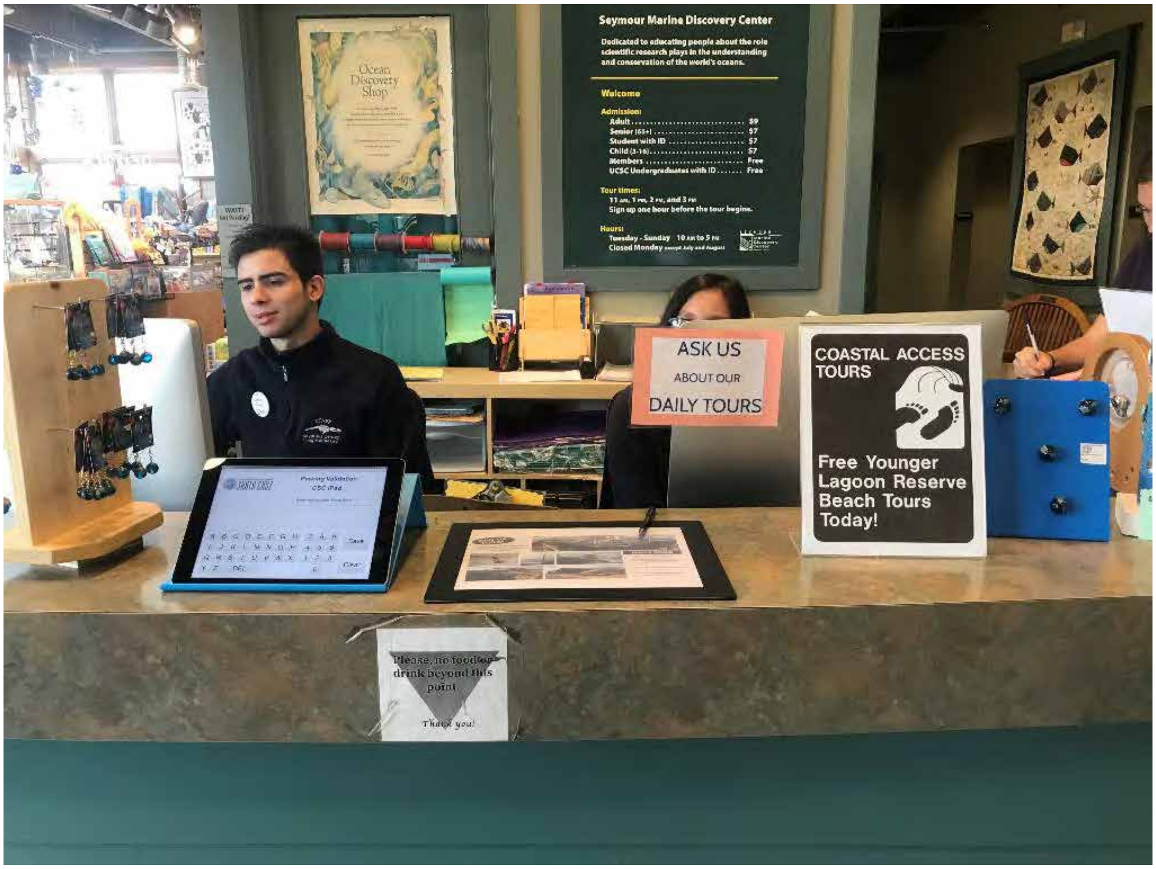


Figure 5. Signage installed at the Seymour Center admissions desk.

Figure 6. Signage installed at Overlook A.

<u>Figure 7.</u> Signage installed at Overlook A (close-up).

<u>Figure 8.</u> Signage installed at Overlook B.

Figure 9. Signage installed at Overlook C.

Figure 10. Signage installed at Overlook D.

Figure 11. Signage installed at Overlook E.

Figure 12. Signage installed at Overlook F.

Condition 4.

BEACH TOUR AVAILABILITY

Beach Tour Availability and Monitoring. UCSC shall offer at least four beach tours per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th each year, and shall provide at least two beach tours per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (a minimum of 38 total beach tours per year). UCSC may limit the number of beach tour participants to 14 persons per tour, but this number may be exceeded per tour on a case by case basis, and beach tours shall not require any minimum number of participants to be provided (i.e., if at least one person signs up, the tour shall be provided). UCSC shall document the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also ***Condition 1****).*

At least every six months (i.e., by June 30th and December 31st each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the Report shall at a minimum provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved Beach Tour Outreach Plan (see ***Condition 2****), as well as the required information described in the previous paragraph. Each such Monitoring Report shall include a section that identifies recommendations about whether user data suggests that beach tours should be increased in terms of frequency of tours and/or number of tour attendees, or otherwise modified to better respond to user demand, including the potential to offer a more limited beach area tour (e.g., designed to allow participants to access just the sandy beach area itself in a shorter amount of time) as a means of offsetting demand. UCSC shall implement any Executive Director-approved recommendations from each Beach Tour Monitoring Report.*

Implementation Report

Free beach tours are offered at least four times per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th, and at least two times per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (a minimum of 38 total beach tours per year). During 2019 free beach tours were offered twice a month in January and February, four times per month in March, April, May, June, July, August, and September, and twice a month in October, November, and December. A total of 38 free beach tours were offered this calendar year (See Appendix 1). In 2019, beach tour participants were limited to 14 persons per tour on all but two tours. On June 6, 2019, the number of beach tour participants was increased to 16 persons (the maximum number the docent felt comfortable leading), and another two persons were denied a beach tour and instead offered a Seymour Center daily tour, which included vistas of the lagoon and beach. On July 14, 2019, the number of beach tour participants was increased to 17 persons and no one was denied a beach tour. On August 4, 2019, the number of beach tour participants was kept at 14 persons (the maximum number the docent felt comfortable leading), and another six persons were denied a beach tour and instead offered a Seymour Center daily tour, which included vistas of the lagoon and beach. Beach tours do not require any minimum number of participants to be provided (i.e., if at least one person signs up, the tour will be provided). UCSC has documented the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also Condition 1, and Appendix 1).

At least every six months (i.e., by June 30th and December 31st each year), UCSC will submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the Report will at a minimum provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved Beach Tour Outreach Plan (see Condition 2), as well as the required information described in the previous paragraph and Condition 4 above. The first such report was submitted by June 30, 2019.

UCSC offered 38 beach tours (265 participants) during 2019 (Appendix 1). All but one of these tours had at least one participant. Only one tour did not go out due to lack of sign-ups. Sixteen of the tours that went out included walk-in / "day-of" participants. Two tours were overbooked in 2019.

In comparison, UCSC offered 38 beach tours (224 participants) during 2018 (Appendix 2). Six tours did not go out due to lack of sign-ups, and one tour was canceled due to weather. Four of the tours that went out included walk-in / "day-of" participants. No tours were overbooked during 2018.

Although not required by the special conditions, in addition to tracking user data, UCSC also collected data on the biological impacts of the tours. Beginning on April 14, 2019, Younger Lagoon Reserve staff accompanied tours, and documented impacts to avian wildlife on the beach. Staff observed birds flushing from the wet sandy beach, beach dunes, coastal stack, and lagoon in response to all but one of the tours they attended (see Appendix 3).

Recommendations

Although only in place for a year, the beach tours as specified by UCSC's NOID 9 special conditions appear to be meeting user demand. The number of tour participants served increased approximately 18% compared to the same time period during the previous year. Over the last year, eight participants were denied a tour due to overdemand. The documented biological impacts to avian wildlife described above, along with ongoing quarterly beach monitoring efforts indicate that open access to the beach would result in the loss of the unique ecological characteristics of the site, reduce its effectiveness as a research area for scientific study, and likely have a negative impact on sensitive and protected species (See 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, and 2017-2018 Annual Reports). We recommend continuing the tours as outlined in the special conditions for the next six months.

Condition 5.

BEACH ACCESS MANAGEMENT PLAN DURATION

This approval for UCSC's public beach access management plan at Younger Lagoon Beach shall be effective through December 31, 2020. UCSC shall submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2021 to December 31, 2025) no later than July 1, 2020. Such complete NOID shall at a minimum summarize the results of the Beach Tour Monitoring Reports (see Condition 4), and shall identify the manner in which UCSC's proposed management plan responds to such data, including with respect to opportunities to increase public access to the beach area (when considered in light of potential impacts to UCSC research and coastal resources). If such complete NOID has not been submitted by July 1,2020, then UCSC shall allow supervised (via beach and trail monitors only) general public access to Younger Lagoon Beach during daylight hours (i.e., one hour-before sunrise to one hour after sunset) until such NOID has been submitted.

Implementation Report

UCSC will submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2021 to December 31, 2025) no later than July 1, 2020.

Appendix 1. Tour Data January 1, 2019 – June 30, 2019

Tour Date	Day	Participants	Walk in	Reservation	No Show	Denial / Wait list
1/3/19	Thursday	2	2	0	0	0
1/13/19	Sunday	7	0	7	0	0
2/7/19	Thursday	3	0	3	0	0
2/10/19	Sunday	6	1	5	0	0
3/3/19	Sunday	10	3	7	0	0
3/719	Thursday	3	0	4	1	0
3/1019	Sunday	9	6	3	0	0
3/2119	Thursday	3	0	4	1	0
4/4/19	Thursday	10	6	4	0	0
4/7/19	Sunday	9	4	5	0	0
4/14/19	Sunday	9	2	11	4	0
4/18/19	Thursday	5	1	5	1	0
5/2/19	Thursday	1	0	1	0	0
5/5/19*	Sunday	0	0	0	0	0
5/12/19	Sunday	2	0	2	0	0
5/16/19	Thursday	1	0	1	0	0
6/2/19	Sunday	3	0	3	0	0
6/6/19	Thursday	1	1	0	0	0
6/9/19**	Sunday	16	4	14	0	2
6/20/19	Thursday	3	1	2	0	0

*5/5/19 - No tour; no participants.

**6/9/19 - Denial due to overdemand; participants accommodated on a Seymour Center daily tour, which included vistas of the lagoon and beach, later that day.

Appendix 1 (cont.). Tour Data July 1, 2019 – December 31, 2019

Tour Date	Day	Participants	Walk in	Reservation	No Show	Denial / Wait list
7/7/19	Sunday	14	4	13	3	0
7/11/19	Thursday	14	2	12	0	0
7/14/19	Thursday	17	5	18	6	0
7/18/19	Thursday	12	2	13	3	0
8/1/19	Thursday	10	0	18	8	0
8/4/19*	Sunday	14	0	21	1	6
8/11/19	Sunday	10	0	10	0	0
8/15/19	Thursday	5	0	5	0	0
9/1/19	Sunday	13	0	14	1	0
9/5/19	Thursday	6	0	6	0	0
9/8/19	Sunday	4	0	4	0	0
9/19/19	Thursday	2	0	2	0	0
10/3/19	Thursday	7	2	5	0	0
10/13/19	Sunday	9	0	9	0	0
11/7/19	Thursday	6	0	6	0	0
11/10/19	Sunday	8	0	13	5	0
12/1/19	Sunday	2	0	11	9	0
12/9/19	Thursday	9	0	9	0	0
TOTAL	**-**	**265**	**46**	**270**	**43**	**8**

*8/4/19 - Denial due to overdemand. Participants offered a Seymour Center daily tour, which includes vistas of the lagoon and beach.

Appendix 2. Tour Data January 1, 2018 – June 30, 2018

Tour Date	Day	Participants	Walk in	Reservation	No Show
1/4/18	Thursday	3	1	2	0
1/14/18	Sunday	3	0	3	0
2/1/18	Thursday	6	0	6	0
2/11/18	Sunday	2	1	1	0
3/1/18*	Thursday	1	0	1	0
3/4/18	Sunday	2	0	2	0
3/11/18	Sunday	6	1	5	0
3/15/18	Thursday	2	2	0	0
4/5/18	Thursday	11	0	11	0
4/8/18	Sunday	2	0	2	0
4/19/18	Thursday	8	0	8	0
4/22/18	Sunday	2	0	3	1
5/3/18	Thursday	11	0	11	0
5/6/18	Sunday	7	0	7	0
5/13/18	Sunday	2	0	2	0
5/17/18**	Thursday	0	0	0	0
6/3/18	Sunday	0	0	0	0
6/7/18	Thursday	10	0	11	1
6/10/18	Sunday	7	0	7	0
6/21/18	Thursday	10	0	13	3

*3/1/18 – Canceled due to weather.
**5/17/18 – Canceled; no sign-ups.
***6/3/18 – Canceled; no sign-ups.

Appendix 2 (cont.). Tour Data July 1, 2018 – December 31, 2018

Tour Date	Day	Participants	Walk in	Reservation	No Show
7/1/18	Sunday	9	0	11	2
7/5/18	Thursday	13	0	13	0
7/8/18	Sunday	9	0	10	1
7/19/18*	Sunday	0	0	0	0
8/2/18**	Thursday	0	0	0	0
8/5/18	Sunday	13	0	15	2
8/12/18	Sunday	2	0	2	0
8/16/18	Thursday	9	0	9	0
9/2/18	Sunday	18	0	18	0
9/6/18	Thursday	6	0	6	0
9/9/18	Sunday	5	0	5	0
9/27/28	Thursday	14	0	15	1
10/4/18	Thursday	10	0	12	2
10/14/18	Sunday	8	0	8	0
11/1/18***	Thursday	0	0	0	0
11/11/18	Sunday	7	0	7	0
12/2/18	Sunday	6	0	8	2
12/6/18****	Thursday	0	0	0	0
TOTAL	**-**	**224**	**5**	**234**	**15**

*7/19/18 – Canceled; no sign-ups.
**8/2/18 – Canceled; no sign-ups.
***11/1/18– Canceled; no sign-ups.
****12/6/18– Canceled; no sign-ups.

Appendix 3. Avian Wildlife Impact Data, April 14, 2019 – June 30, 2019

Tour Date	Day	Species Present	Species Flushed
4/14/19	Sunday	AMCO, BLOY, BRAC, CCGO, GREG, MALL, SNEG, WEGU	BLOY, CCGO, MALL
4/18/19	Thursday	BLOY, BRAC, MALL, SNEG, SOSP, WEGU	BLOY, MALL, SNEG
5/2/19	Thursday	CCGO, BRBL, GREG, KILL, MALL, RSHA, WEGU	BRBL, CAGO, GREG, MALL, WEGU
5/5/19*	Sunday	No tour	No tour
5/12/19	Sunday	MALL, NOMO RNPH, WEGU, WESA	WESA
5/16/19	Thursday	BLPH, BRAC, GREG, KILL, MALL, RNPH, WEGU	MALL
6/2/19	Sunday	BARS, BLPH, MALL, PIGU, WEGU, WESA	BLPH, MALL WESA
6/6/19	Thursday	AMRO, BARS, BLPH, BRAC, BRBL, CAGO, CLSW, GREG, MALL, PECO, PIGU, WEGU	CAGO, GREG, PIGU, WEGU
6/9/19	Sunday	BARS, BLPH, BRAC, KILL, PIGU, RWBL, SOSP, WEGU	BARS, BLPH, PIGU, RWBB
6/20/19	Thursday	AMCR, BARS, BLPH, BRAC, PIGU, WEGU	BLPH, PIGU, WEGU

*5/5/19 - No tour; no participants

AMCO – American coot, **AMCR** – American crow, **AMRO** – American robin, **AMWI** – American whimbrel, **BARS** – Barn swallow, **BHCO** – Brown-headed cowbird, **BLOY** – Black oystercatcher, **BLPH** – Black phoebe, **BRAC** – Brand’s cormorant, **BRAN** – Brant, **BRBL** – Brewer’s blackbird, **BRPE** – Brown pelican, **CAGU** – California Gull, **CCGO** – Canada goose, **CLSW** – Cliff swallow, **CORA** – Common raven, **GBHE** – Great blue heron, **GREG** – Great egret, **GRHE** – Green heron, **KILL** – Killdeer, **MALL** – Mallard, **NOHA** – Northern harrier, **NOMO** – Northern mockingbird, **PECO** – Pelagic cormorant, **PIGU** – Pigeon guillemot, **RNPH** – Red-necked phalarope, **RSHA** – Red-shouldered hawk, **RWBL** – Red-winged blackbird, **SAND** – Sanderling, **SAPH** – Say’s phoebe, **SNEG** – Snowy Egret, **SOSP** – Song sparrow, **TUVU** – Turkey vulture, **WEGU** – Western gull, **WESA** – Western sandpiper

Appendix 3 (cont). Avian Wildlife Impact Data, July 1, 2019 – December 31, 2019

Tour Date	Day	Species Present	Species Flushed
7/7/19	Sunday	BARS, BHCO, BRPE, GREG, WEGU	GREG, WEGU
7/11/19	Thursday	CAGU, CORA, NOHA, PECO, PIGU, WEGU	PECO
7/14/19	Thursday	AMCR, CAGU, PECO, WEGU	WEGU
7/18/19	Thursday	AMCO, BARS, CLSW, WEGU	WEGU
8/1/19	Thursday	CORA, MALL, PECO, RNPH, SNEG	MALL, RNPH
8/4/19	Sunday	GBHE, PIGU, SNEG, WEGU	GBHE, SNEG
8/11/19	Sunday	GBHE, GREG, PECO, RNPH, SNEG, WESA	GREG, WESA
8/15/19	Thursday	BARS, GBHE, GREG, PECO, WESA	GBHE, GREG
9/1/19	Sunday	CAGU, PECO, SNEG	SNEG
9/5/19	Thursday	BLPH, GREG, PECO, SNEG, WEGU	GREG, SNEG
9/8/19	Sunday	NOHA, PECO, SAND, WEGU, WHIM	NOHA
9/19/19	Thursday	GREG, GRHE, PECO, RNPH, RTHA, SAND, WEGU	GRHE, PECO, RTHA
10/3/19	Thursday	BLPH, BRPE, CAGU, KILL, PECO, SAPH, SNEG, WHIM	BLPH, CAGU, SAPH, SNEG
10/13/19	Sunday	BLPH, NOHA, PECO, SOSH, WEGU	NOHA
11/7/19	Thursday	AMWI, BLPH, BRAN, PECO, RTHA, SAPH, WEGU	BLPH, RTHA
11/10/19*	Sunday	CLSW, PECO, TUVU	-
12/1/19**	Sunday	-	-
12/9/19	Thursday	AMWI, BLPH, BRPE, PECO, SNEG, WEGU	BLPH

* 11/10/19 – No birds flushed.
*12/1/19 – No biological data collected.

AMCO – American coot, **AMCR** – American crow, **AMRO** – American robin, **AMWI** – American whimbrel, **BARS** – Barn swallow, **BHCO** – Brown-headed cowbird, **BLOY** – Black oystercatcher, **BLPH** – Black phoebe, **BRAC** – Brand's cormorant, **BRAN** – Brant, **BRBL** – Brewer's blackbird, **BRPE** – Brown pelican, **CAGU** – California Gull, **CCGO** – Canada goose, **CLSW** – Cliff swallow, **CORA** – Common raven, **GBHE** – Great blue heron, **GREG** – Great egret, **GRHE** – Green heron, **KILL** – Killdeer, **MALL** – Mallard, **NOHA** – Northern harrier, **NOMO** – Northern mockingbird, **PECO** – Pelagic cormorant, **PIGU** – Pigeon guillemot, **RNPH** – Red-necked phalarope, **RSHA** – Red-shouldered hawk, **RWBL** – Red-winged blackbird, **SAND** – Sanderling, **SAPH** – Say's phoebe, **SNEG** – Snowy Egret, **SOSP** – Song sparrow, **TUVU** – Turkey vulture, **WEGU** – Western gull, **WESA** – Western sandpiper

UC Santa Cruz NOID 9 (18-1)
Special Conditions Implementation Report #3
January 1, 2020 – June 30, 2020

Burrowing owl on the Younger Lagoon Reserve Beach Dunes

UC Santa Cruz NOID 9 (18-1)
Special Conditions Implementation Report 3

Overview and Executive Summary

On September 13, 2018, the California Coastal Commission approved UCSC's NOID 9 (18-1) as consistent with UCSC's approved Coastal Long Range Development Plan with the addition of five staff-recommended special conditions. These included 1) Free Beach Tours, 2) Beach Tour Outreach Plan, 3) Beach Tour Signs, 4) Beach Tour Availability and Monitoring, and 5) Beach Access Management Plan Duration. Within 30 days of the approval (i.e., by October 13, 2018), UCSC was required to submit a plan for implementation of the special conditions to the Executive Director of the California Coastal Commission. The plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on October 15, 2018. UCSC received feedback from Coastal Commission staff on the plan, and a revised plan for implementation of the special conditions was submitted to the Executive Director of the California Coastal Commission on December 15, 2018. The revised plan for implementation of the special conditions was approved by the Executive Director on January 30, 2019. Special condition 4 requires that at least every six months (i.e., by June 30th and December 31st each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval. UCSC's report on the implementation of these special conditions for the period of January 1, 2020 through June 30, 2020 is detailed below. UCSC has included information from the previous two reporting periods and one-year prior, to provide historical and cumulative reference data.

UC Santa Cruz has successfully implemented all five special conditions. A summary of UC Santa Cruz's compliance with the five special conditions is below. Note that due to COVID-19 precautions, the Seymour Center was temporarily closed, and the free beach tour program temporarily suspended in early March 2020. The University will restart the free beach tour program when the Seymour Center reopens (see UC Santa Cruz's Pub. Res. Code section 30611 notification letter to the Commission).

Special Condition	Status	Notes
1) Free Beach Tours	Completed	All beach tours are now offered for free without admission to the Seymour Center.
2) Beach Tour Outreach Plan	Completed & Ongoing	UCSC's Beach Tour Outreach Plan was approved by the executive director in

		January 2019 and all beach tour outreach materials now clearly state that the beach tour is free. UCSC's ongoing outreach efforts include regular social media postings and calendar listings, including listings in Spanish and publications that serve inland communities.
3) Beach Tour Signs	Completed	UCSC's Beach Tour Signage Plan was approved by the executive director in January 2019 and "Free Beach Tour" signs have been installed at all of the required locations.
4) Beach Tour Availability and Monitoring	Completed & Ongoing	Free beach tours are now offered per the required schedule – a minimum of 38 times a year on weekends and weekdays, and all of the required data on tour attendees has been and continues to be collected. UCSC has submitted all of the required biannual reports on the beach tours on-time. The next report is due by December 31, 2020.
5) Beach Access Management Plan Duration	In Progress	NOID 9 (18-1) is effective through December 31, 2020. UC Santa Cruz is required to submit their next Beach Access Management Plan NOID by July 1, 2020.

Implementation of the special conditions resulted in an approximately 18% increase in overall tour participation and more than 900% increase in walk-in/day-of tour participants in 2019 (first full year post special conditions) compared to 2018 (pre special conditions).

A summary of the free beach tour user data for 2018 (pre special conditions) and 2019 (first full year post special conditions) is below:

Year	Dates	Total Tours Offered	Total Participants	Total # of Walk-in / Day-of Participants	Total # of Participants with a Reservation
2018	January 1-December 31	38	224	5	219
2019	January 1-December 31	38	265	46	219

Although only six tours were offered before the Seymour Center was temporarily closed and the free beach tour program temporarily suspended in early March 2020 due to COVID-19 precautions, total tour attendance for the 2020 tours that were offered was more than 100% higher than tour attendance during the same time period in 2019 and more than 350% higher than tour attendance during the same time period in 2018. A summary of the free beach tour user data for the first six tours in 2018 (pre special conditions), 2019 (first full year post special conditions), and 2020 is below:

Year	Dates	Total Tours Offered	Total Participants	Total # of Walk-in / Day-of Participants	Total # of Participants with a Reservation
2018	January 1-March 7	6	17	2	15
2019	January 1-March 4	6	31	6	25
2020	January 1-March 8	6	60	5	55

Condition 1.

FREE BEACH TOURS

All beach tours shall be offered for free, and UCSC shall not require that beach tour users pay any separate admission fee to any other facility in order to take the beach tour. This condition shall not be construed as affecting existing already allowed admission fees for UCSC's Seymour Marine Discovery Center. Beach tour signups may be provided online (e.g., at UCSC Marine Science Campus and Seymour Marine Discovery Center websites) but shall at a minimum be made available by phone and at the Seymour Marine Discovery Center front desk. UCSC shall also identify and implement a mechanism for tracking the number of tour requests that are denied due to lack of tour availability or because tours are fully booked. All UCSC materials referencing the beach at Younger Lagoon and/or beach tours shall be required to be modified as necessary to clearly identify that access to the beach is available for free via beach tours. Within 30 days of this approval (i.e., by October 13, 2018), UCSC shall provide evidence to the Executive Director identifying the manner in which (1) free beach tour signups are made available, (2) tour request denials are quantified and recorded, and (3) UCSC materials have been modified to reflect that beach access is available for free via beach tours, all consistent with this condition.

Implementation Report

All beach tours are now offered for free (without admission fee). Beach tour sign-ups are available by phone and at the Seymour Marine Discovery Center (Seymour Center) public admissions counter. Seymour Center staff track any tour requests that are denied due to lack of tour availability or because tours are fully booked as part of their ongoing monitoring of all visitor programs. Seymour Center staff record the number of participants that were denied, the number of participants that were wait listed, as well as the date of the request and the date of the tour being requested (see Appendix 1). The Younger Lagoon Reserve and the Seymour Marine Discovery Center websites have been modified to clearly identify that access to the beach is available for free via beach tours. Notice of the temporary closure of the Seymour Center and temporary cessation of the free beach tours due to COVID-19 has been posted to the Younger Lagoon Reserve and the Seymour Marine Discovery Center websites.

https://youngerlagoonreserve.ucsc.edu/about-us/index.html
https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html

https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/

Condition 2.

BEACH TOUR OUTREACH PLAN

Within 30 days of this approval (i.e., by October 13, 2018), UCSC shall submit two copies of an Outreach Plan for Executive Director review and approval, where such Plan shall identify all measures and venues to be used to advertise and increase awareness of the free beach tours (e.g., UCSC Marine Science Campus and Seymour Marine Discovery Center websites, press releases, calendar listings with UCSC Events and local media (e.g., Good Times newspaper), ads on radio (e.g., public radio station KAZU), print ads, social media (including Facebook, Twitter, and Instagram), etc.). The Plan shall identify the language to be used in describing the free beach tours (where said language shall be required to be consistent with the terms and conditions of this approval), and shall provide a schedule for each type of outreach, with the goal being to reach as many potential free beach tour audiences as possible, including audiences that might not normally be reached through traditional and local means (e.g., inland communities). UCSC shall implement the approved Outreach Plan as directed by the Executive Director.

Implementation Report

Outreach was conducted according to the following plan during the reporting period prior to the temporary closure of the Seymour Center and temporary cessation of the free beach tours due to COVID-19:

Venue	Language	Schedule
Seymour Center Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Permanent webpage: https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/
YLR Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Permanent webpages: https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html
Seymour Center Social Media	Younger Lagoon Reserve tours are free and open to	Facebook—Monthly Twitter, Instagram ---Once a quarter

- Facebook - Twitter - Instagram	the public. Space is limited to 14 participants. Call **831-459-3800**.	
YLR Social Media - Facebook - Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Once a quarter
Calendar Listings - UCSC Events - Good Times Newspaper (Santa Cruz) - KAZU public radio (Santa Cruz) - Register Pajaronian Newspaper (Watsonville) - The Californian Newspaper (Salinas) - La Network Campesina Radio 107.9 (Salinas)	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**. For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 14 participantes. Llame al **831-459-3800**.	Submitted monthly (calendar listings appear at the discretion of the media outlet.) Submitted monthly (calendar listings appear at the discretion of the media outlet.)

Condition 3.

BEACH TOUR SIGNS

Within 30 days of this approval (i.e., by October 13, 2018), UCSC shall submit two copies of a Beach Tour Sign Plan for Executive Director review and approval, where such Plan shall provide for installation of signage outside of the Seymour Marine Discovery Center and inside at its front desk, at Campus overlooks, and at other appropriate public access locations on the Marine Science Campus that describe free beach tour availability, including "day of" signs for each day beach tours are offered to ensure maximum notice is provided. All such signs shall be sited and designed to be visually compatible with the area, shall be consistent with the Campus sign program (and CLRDP sign requirements), and shall provide clear information in a way that minimizes public view impacts. UCSC shall implement the approved Beach Tour Sign Plan as directed by the Executive Director.

Implementation Report

UCSC's Beach Tour Sign Plan was reviewed and approved as part of the NOID 9 Special Conditions Implementation Plan on January 30, 2019. Per the approved sign plan, information on the free beach tours is currently displayed "day of" on a large sign in the front window of the Seymour Center and at the public admissions counter. The Seymour Center has also purchased and installed a large colorful monitor in the front window that displays "day-of" information on the free beach tours. "Day of" signage includes the brown and white footprints on wave logo, and the following language "Free Younger Lagoon Reserve Beach Tours Today" (Figures 1, 4, and 5). Signage has been added to the information kiosk outside of the Seymour Center (Figure 3) and to Overlooks A-F (Figures 6-12). Overlooks and kiosk signage include the brown and white footprints on wave logo and include the following language "Free Younger Lagoon Reserve Beach Tours, Call (831) 459-3800" (Figure 2).

Figure 1. "Day of" sign design.

Figure 2. Overlooks and kiosk sign design.

Figure 3. Signage installed at Seymour Center information kiosk.

Figure 4. Signage installed at Seymour Center front window.

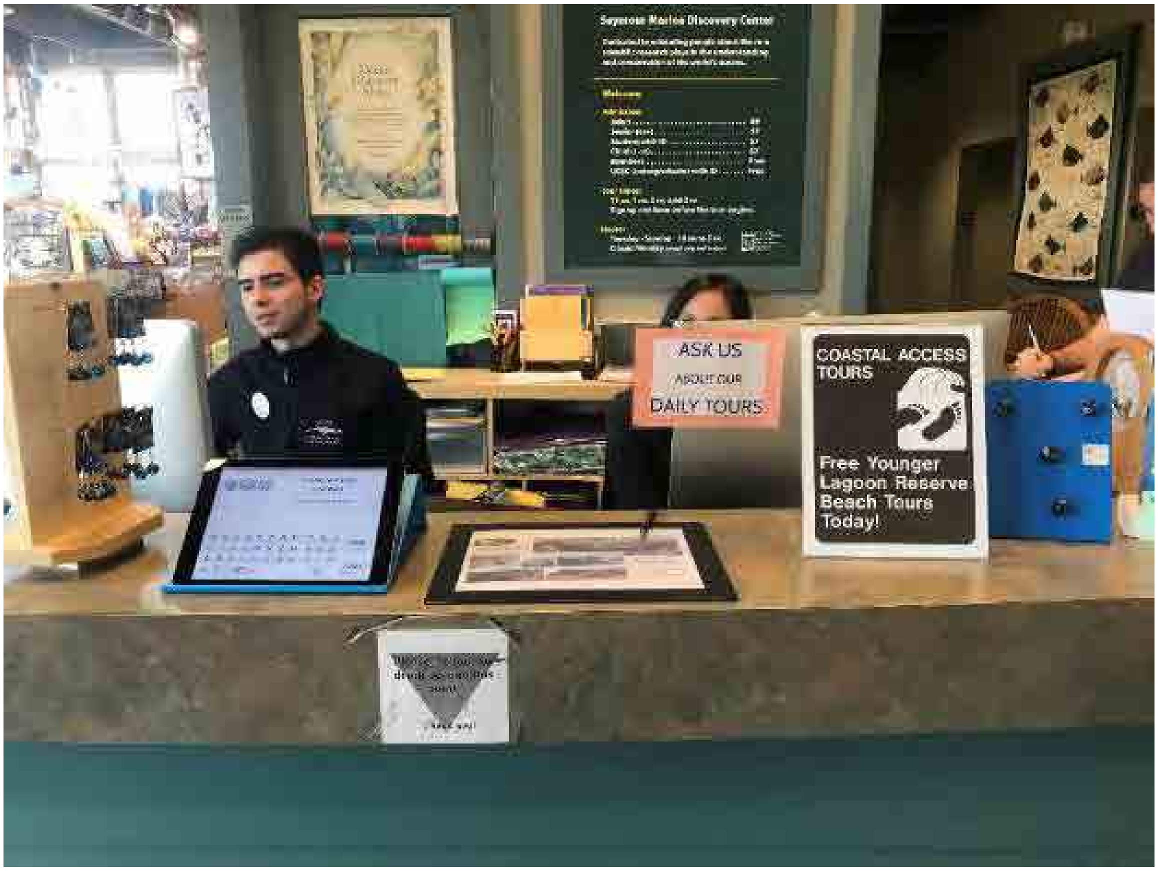


Figure 5. Signage installed at the Seymour Center admissions desk.

Figure 6. Signage installed at Overlook A.

Figure 7. Signage installed at Overlook A (close-up).

Figure 8. Signage installed at Overlook B (Terrace Point).

Figure 9. Signage installed at Overlook C.

Figure 10. Signage installed at Overlook D.

Figure 11. Signage installed at Overlook E.

Figure 12. Signage installed at Overlook F.

Condition 4.

BEACH TOUR AVAILABILITY

Beach Tour Availability and Monitoring. UCSC shall offer at least four beach tours per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th each year, and shall provide at least two beach tours per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (a minimum of 38 total beach tours per year). UCSC may limit the number of beach tour participants to 14 persons per tour, but this number may be exceeded per tour on a case by case basis, and beach tours shall not require any minimum number of participants to be provided (i.e., if at least one person signs up, the tour shall be provided). UCSC shall document the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also ***Condition 1****).*

At least every six months (i.e., by June 30th and December 31st each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the Report shall at a minimum provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved Beach Tour Outreach Plan (see ***Condition 2****), as well as the required information described in the previous paragraph. Each such Monitoring Report shall include a section that identifies recommendations about whether user data suggests that beach tours should be increased in terms of frequency of tours and/or number of tour attendees, or otherwise modified to better respond to user demand, including the potential to offer a more limited beach area tour (e.g., designed to allow participants to access just the sandy beach area itself in a shorter amount of time) as a means of offsetting demand. UCSC shall implement any Executive Director-approved recommendations from each Beach Tour Monitoring Report.*

Implementation Report

Prior to the temporary closure of the Seymour Center and temporary cessation of the free beach tours due to COVID-19, free beach tours were offered at least four times per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th, and at least two times per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (a minimum of 38 total beach tours per year).

During 2020 free beach tours were scheduled to be offered twice a month in January and February, four times per month in March, April, May, June, July, August, and September, and twice a month in October, November, and December (38 total tours). Due to COVID-19 impacts, a total of six free beach tours have been offered thus far in 2020 (See Appendix 1). In 2020, beach tour participants were limited to 14 persons per tour on all but one tour. On January 2, 2020, the number of beach tour participants was increased to 15 persons to accommodate all persons who desired to take the beach tour that day. UCSC has documented the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also Condition 1, and Appendix 1).

At least every six months (i.e., by June 30th and December 31st each year), UCSC will submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the Report will at a minimum provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved Beach Tour Outreach Plan (see Condition 2), as well as the required information described in the previous paragraph and Condition 4 above. The first such report was submitted by June 30, 2019 and the second by December 31, 2019.

UCSC offered 38 beach tours (265 participants) during 2019 (Appendix 1). All but one of these tours had at least one participant. Only one tour did not go out due to lack of sign-ups. Sixteen of the tours that went out included walk-in / "day-of" participants. Two tours were overbooked in 2019.

In comparison, UCSC offered 38 beach tours (224 participants) during 2018 (Appendix 2). Six tours did not go out due to lack of sign-ups, and one tour was canceled due to weather. Four of the tours that went out included walk-in / "day-of" participants. No tours were overbooked during 2018.

Although not required by the special conditions, in addition to tracking user data, UCSC also collected data on the biological impacts of the tours. Beginning on April 14, 2019, Younger Lagoon Reserve staff accompanied tours, and documented impacts to avian wildlife on the beach. Staff observed birds flushing from the wet sandy beach, beach dunes, coastal stack, and lagoon in response to all but three of the tours they attended (see Appendix 3).

Recommendations

Although only in place for 18 months and currently paused due to COVID-19 impacts, the beach tours as specified by UCSC's NOID 9 special conditions appear to be meeting user demand. Total tour attendance for the 2020 tours that were offered was more than 100% higher than tour attendance during the same time period in 2019 (first full year post special conditions) and more than 350% higher than tour attendance during the same time period in 2018 (pre special conditions). Over the last 18 months, eight participants were denied a tour due to overdemand. The documented biological impacts to avian wildlife described above, along with ongoing quarterly beach monitoring efforts indicate that open access to the beach would result in the loss of the unique ecological characteristics of the site, reduce its effectiveness as a research area for scientific study, and likely have a negative impact on sensitive and protected species (See 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, and 2018-2019 Annual Reports). Our monitoring reports suggest that although Younger Lagoon is a relatively small area, amidst agriculture and development, this relic habitat is still functioning at a level beyond most developed beaches and lagoons in the region. We recommend continuing the tours as outlined in the special conditions for the next six months.

Condition 5.

BEACH ACCESS MANAGEMENT PLAN DURATION

This approval for UCSC's public beach access management plan at Younger Lagoon Beach shall be effective through December 31, 2020. UCSC shall submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2021 to December 31, 2025) no later than July 1, 2020. Such complete NOID shall at a minimum summarize the results of the Beach Tour Monitoring Reports (see Condition 4), and shall identify the manner in which UCSC's proposed management plan responds to such data, including with respect to opportunities to increase public access to the beach area (when considered in light of potential impacts to UCSC research and coastal resources). If such complete NOID has not been submitted by July 1,2020, then UCSC shall allow supervised (via beach and trail monitors only) general public access to Younger Lagoon Beach during daylight hours (i.e., one hour-before sunrise to one hour after sunset) until such NOID has been submitted.

Implementation Report

UCSC will submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2021 to December 31, 2025) no later than July 1, 2020.

Appendix 1. Tour Data January 1, 2020 – June 30, 2020

Tour Date	Day	Participants	Walk in	Reservation	No Show	Denial / Wait list
1/2/20	Thursday	15	4	20	9	0
1/12/20	Sunday	13	1	18	6	0
2/6/20	Thursday	9	0	18	9	0
2/9/20	Sunday	4	0	5	1	0
3/5/20	Thursday	8	0	8	0	0
3/8/20	Sunday	11	0	14	3	0
3/19/20*	Thursday	-	-	-	-	-
3/22/20*	Sunday	-	-	-	-	-
4/2/20*	Thursday	-	-	-	-	-
4/5/20*	Sunday	-	-	-	-	-
4/16/20*	Thursday	-	-	-	-	-
4/26/20*	Sunday	-	-	-	-	-
5/7/20*	Thursday	-	-	-	-	-
5/10/20*	Sunday	-	-	-	-	-
5/21/20*	Thursday	-	-	-	-	-
5/24/20*	Sunday	-	-	-	-	-
6/4/20*	Thursday	-	-	-	-	-
6/14/20*	Sunday	-	-	-	-	-
6/18/20*	Thursday	-	-	-	-	-
6/28/20*	Sunday	-	-	-	-	-
2020 TOTAL	**-**	**60**	**5**	**83**	**28**	**0**

*3/19 - 6/28 – Canceled due to COVID-19 impacts.

Appendix 1 (cont.). Tour Data January 1, 2019 – June 30, 2019

Tour Date	Day	Participants	Walk in	Reservation	No Show	Denial / Wait list
1/3/19	Thursday	2	2	0	0	0
1/13/19	Sunday	7	0	7	0	0
2/7/19	Thursday	3	0	3	0	0
2/10/19	Sunday	6	1	5	0	0
3/3/19	Sunday	10	3	7	0	0
3/719	Thursday	3	0	4	1	0
3/1019	Sunday	9	6	3	0	0
3/2119	Thursday	3	0	4	1	0
4/4/19	Thursday	10	6	4	0	0
4/7/19	Sunday	9	4	5	0	0
4/14/19	Sunday	9	2	11	4	0
4/18/19	Thursday	5	1	5	1	0
5/2/19	Thursday	1	0	1	0	0
5/5/19*	Sunday	0	0	0	0	0
5/12/19	Sunday	2	0	2	0	0
5/16/19	Thursday	1	0	1	0	0
6/2/19	Sunday	3	0	3	0	0
6/6/19	Thursday	1	1	0	0	0
6/9/19**	Sunday	16	4	14	0	2
6/20/19	Thursday	3	1	2	0	0

*5/5/19 - No tour; no participants.

**6/9/19 - Denial due to overdemand; participants accommodated on a Seymour Center daily tour, which included vistas of the lagoon and beach, later that day.

Appendix 1 (cont.). Tour Data July 1, 2019 – December 31, 2019

Tour Date	Day	Participants	Walk in	Reservation	No Show	Denial / Wait list
7/7/19	Sunday	14	4	13	3	0
7/11/19	Thursday	14	2	12	0	0
7/14/19	Thursday	17	5	18	6	0
7/18/19	Thursday	12	2	13	3	0
8/1/19	Thursday	10	0	18	8	0
8/4/19*	Sunday	14	0	21	1	6
8/11/19	Sunday	10	0	10	0	0
8/15/19	Thursday	5	0	5	0	0
9/1/19	Sunday	13	0	14	1	0
9/5/19	Thursday	6	0	6	0	0
9/8/19	Sunday	4	0	4	0	0
9/19/19	Thursday	2	0	2	0	0
10/3/19	Thursday	7	2	5	0	0
10/13/19	Sunday	9	0	9	0	0
11/7/19	Thursday	6	0	6	0	0
11/10/19	Sunday	8	0	13	5	0
12/1/19	Sunday	2	0	11	9	0
12/9/19	Thursday	9	0	9	0	0
2019 TOTAL	**-**	**265**	**46**	**270**	**43**	**8**
GRAND TOTAL	**-**	**325**	**51**	**353**	**71**	**8**

*8/4/19 - Denial due to overdemand. Participants offered a Seymour Center daily tour, which includes vistas of the lagoon and beach.

Appendix 2. Tour Data January 1, 2018 – June 30, 2018 (pre special conditions)

Tour Date	Day	Participants	Walk in	Reservation	No Show
1/4/18	Thursday	3	1	2	0
1/14/18	Sunday	3	0	3	0
2/1/18	Thursday	6	0	6	0
2/11/18	Sunday	2	1	1	0
3/1/18*	Thursday	1	0	1	0
3/4/18	Sunday	2	0	2	0
3/11/18	Sunday	6	1	5	0
3/15/18	Thursday	2	2	0	0
4/5/18	Thursday	11	0	11	0
4/8/18	Sunday	2	0	2	0
4/19/18	Thursday	8	0	8	0
4/22/18	Sunday	2	0	3	1
5/3/18	Thursday	11	0	11	0
5/6/18	Sunday	7	0	7	0
5/13/18	Sunday	2	0	2	0
5/17/18**	Thursday	0	0	0	0
6/3/18	Sunday	0	0	0	0
6/7/18	Thursday	10	0	11	1
6/10/18	Sunday	7	0	7	0
6/21/18	Thursday	10	0	13	3

*3/1/18 – Canceled due to weather.
**5/17/18 – Canceled; no sign-ups.
***6/3/18 – Canceled; no sign-ups.

Appendix 2 (cont.). Tour Data July 1, 2018 – December 31, 2018 (pre special conditions)

Tour Date	Day	Participants	Walk in	Reservation	No Show
7/1/18	Sunday	9	0	11	2
7/5/18	Thursday	13	0	13	0
7/8/18	Sunday	9	0	10	1
7/19/18*	Sunday	0	0	0	0
8/2/18**	Thursday	0	0	0	0
8/5/18	Sunday	13	0	15	2
8/12/18	Sunday	2	0	2	0
8/16/18	Thursday	9	0	9	0
9/2/18	Sunday	18	0	18	0
9/6/18	Thursday	6	0	6	0
9/9/18	Sunday	5	0	5	0
9/27/28	Thursday	14	0	15	1
10/4/18	Thursday	10	0	12	2
10/14/18	Sunday	8	0	8	0
11/1/18***	Thursday	0	0	0	0
11/11/18	Sunday	7	0	7	0
12/2/18	Sunday	6	0	8	2
12/6/18****	Thursday	0	0	0	0
2018 TOTAL	**-**	**224**	**5**	**234**	**15**

*7/19/18 – Canceled; no sign-ups.
**8/2/18 – Canceled; no sign-ups.
***11/1/18– Canceled; no sign-ups.
****12/6/18– Canceled; no sign-ups.

Appendix 3. Avian Wildlife Impact Data, January 1, 2020 – June 30, 2020

Tour Date	Day	Species Present	Species Flushed
1/2/20	Thursday	AMCO, AUWA, BLPH, BRCO, GCSP, MALL, NOHA, PIGU, SAPH, WEGU	BLPH, AUWA
1/12/20*	Sunday	AMCO, BLPH, BRCO, CAGO, COHA, GREG, MALL, PECO, SAPH, SNEG, WEGU	-
2/6/20	Thursday	BRCO, SNEG, WEGU	SNEG
2/9/20*	Sunday	BRCO, GREG, WEGU	-
3/5/20	Thursday	CAGO, GREG, MALL, PECO	MALL
3/8/20	Sunday	AMCO, BRCO, CAGO, CITE, MALL, SNEG, WHIM	BRCO, CITE, MALL, SNEG
3/19/20**	Thursday	-	-
3/22/20**	Sunday	-	-
4/2/20**	Thursday	-	-
4/5/20**	Sunday	-	-
4/16/20**	Thursday	-	-
4/26/20**	Sunday	-	-
5/7/20**	Thursday	-	-
5/10/20**	Sunday	-	-
5/21/20**	Thursday	-	-
5/24/20**	Sunday	-	-
6/4/20**	Thursday	-	-
6/14/20**	Sunday	-	-

* 1/12/20 and 2/9/20 - No birds flushed.

**3/19 - 6/28 – Tours canceled due to COVID-19 impacts. No biological data collected.

AMCO – American coot, **AMCR** – American crow, **AMRO** – American robin, **AMWI** – American whimbrel, **BARS** – Barn swallow, **BHCO** – Brown-headed cowbird, **BLOY** – Black oystercatcher, **BLPH** – Black phoebe, **BRAC** – Brand's cormorant, **BRAN** – Brant, **BRBL** – Brewer's blackbird, **BRPE** – Brown pelican, **CAGU** – California Gull, **CCGO** – Canada goose, **CLSW** – Cliff swallow, **CORA** – Common raven, **GBHE** – Great blue heron, **GREG** – Great egret, **GRHE** – Green heron, **KILL** – Killdeer, **MALL** – Mallard, **NOHA** – Northern harrier, **NOMO** – Northern mockingbird, **PECO** – Pelagic cormorant, **PIGU** – Pigeon guillemot, **RNPH** – Red-necked phalarope, **RSHA** – Red-shouldered hawk,

RWBL – Red-winged blackbird, **SAND** – Sanderling, **SAPH** – Say's phoebe, **SNEG** – Snowy Egret, **SOSP** – Song sparrow, **TUVU** – Turkey vulture, **WEGU** – Western gull, **WESA** – Western sandpiper

Appendix 3 (cont.). Avian Wildlife Impact Data, April 14, 2019 – June 30, 2019

Tour Date	Day	Species Present	Species Flushed
4/14/19	Sunday	AMCO, BLOY, BRAC, CCGO, GREG, MALL, SNEG, WEGU	BLOY, CCGO, MALL
4/18/19	Thursday	BLOY, BRAC, MALL, SNEG, SOSP, WEGU	BLOY, MALL, SNEG
5/2/19	Thursday	CCGO, BRBL, GREG, KILL, MALL, RSHA, WEGU	BRBL, CAGO, GREG, MALL, WEGU
5/5/19*	Sunday	No tour	No tour
5/12/19	Sunday	MALL, NOMO RNPH, WEGU, WESA	WESA
5/16/19	Thursday	BLPH, BRAC, GREG, KILL, MALL, RNPH, WEGU	MALL
6/2/19	Sunday	BARS, BLPH, MALL, PIGU, WEGU, WESA	BLPH, MALL WESA
6/6/19	Thursday	AMRO, BARS, BLPH, BRAC, BRBL, CAGO, CLSW, GREG, MALL, PECO, PIGU, WEGU	CAGO, GREG, PIGU, WEGU
6/9/19	Sunday	BARS, BLPH, BRAC, KILL, PIGU, RWBL, SOSP, WEGU	BARS, BLPH, PIGU, RWBB
6/20/19	Thursday	AMCR, BARS, BLPH, BRAC, PIGU, WEGU	BLPH, PIGU, WEGU

*5/5/19 - No tour; no participants

AMCO – American coot, **AMCR** – American crow, **AMRO** – American robin, **AMWI** – American whimbrel, **BARS** – Barn swallow, **BHCO** – Brown-headed cowbird, **BLOY** – Black oystercatcher, **BLPH** – Black phoebe, **BRAC** – Brand's cormorant, **BRAN** – Brant, **BRBL** – Brewer's blackbird, **BRPE** – Brown pelican, **CAGU** – California Gull, **CCGO** – Canada goose, **CLSW** – Cliff swallow, **CORA** – Common raven, **GBHE** – Great blue heron, **GREG** – Great egret, **GRHE** – Green heron, **KILL** – Killdeer, **MALL** – Mallard, **NOHA** – Northern harrier, **NOMO** – Northern mockingbird, **PECO** – Pelagic cormorant, **PIGU** – Pigeon guillemot, **RNPH** – Red-necked phalarope, **RSHA** – Red-shouldered hawk, **RWBL** – Red-winged blackbird, **SAND** – Sanderling, **SAPH** – Say's phoebe, **SNEG** – Snowy Egret, **SOSP** – Song sparrow, **TUVU** – Turkey vulture, **WEGU** – Western gull, **WESA** – Western sandpiper

Appendix 3 (cont.). Avian Wildlife Impact Data, July 1, 2019 – December 31, 2019

Tour Date	Day	Species Present	Species Flushed
7/7/19	Sunday	BARS, BHCO, BRPE, GREG, WEGU	GREG, WEGU
7/11/19	Thursday	CAGU, CORA, NOHA, PECO, PIGU, WEGU	PECO
7/14/19	Thursday	AMCR, CAGU, PECO, WEGU	WEGU
7/18/19	Thursday	AMCO, BARS, CLSW, WEGU	WEGU
8/1/19	Thursday	CORA, MALL, PECO, RNPH, SNEG	MALL, RNPH
8/4/19	Sunday	GBHE, PIGU, SNEG, WEGU	GBHE, SNEG
8/11/19	Sunday	GBHE, GREG, PECO, RNPH, SNEG, WESA	GREG, WESA
8/15/19	Thursday	BARS, GBHE, GREG, PECO, WESA	GBHE, GREG
9/1/19	Sunday	CAGU, PECO, SNEG	SNEG
9/5/19	Thursday	BLPH, GREG, PECO, SNEG, WEGU	GREG, SNEG
9/8/19	Sunday	NOHA, PECO, SAND, WEGU, WHIM	NOHA
9/19/19	Thursday	GREG, GRHE, PECO, RNPH, RTHA, SAND, WEGU	GRHE, PECO, RTHA
10/3/19	Thursday	BLPH, BRPE, CAGU, KILL, PECO, SAPH, SNEG, WHIM	BLPH, CAGU, SAPH, SNEG
10/13/19	Sunday	BLPH, NOHA, PECO, SOSH, WEGU	NOHA
11/7/19	Thursday	AMWI, BLPH, BRAN, PECO, RTHA, SAPH, WEGU	BLPH, RTHA
11/10/19*	Sunday	CLSW, PECO, TUVU	-
12/1/19**	Sunday	-	-
12/9/19	Thursday	AMWI, BLPH, BRPE, PECO, SNEG, WEGU	BLPH

* 11/10/19 – No birds flushed.
*12/1/19 – No biological data collected.

AMCO – American coot, **AMCR** – American crow, **AMRO** – American robin, **AMWI** – American whimbrel, **BARS** – Barn swallow, **BHCO** – Brown-headed cowbird, **BLOY** – Black oystercatcher, **BLPH** – Black phoebe, **BRAC** – Brand's cormorant, **BRAN** – Brant, **BRBL** – Brewer's blackbird, **BRPE** – Brown pelican, **CAGU** – California Gull, **CCGO** – Canada goose, **CLSW** – Cliff swallow, **CORA** – Common raven, **GBHE** – Great blue heron, **GREG** – Great egret, **GRHE** – Green heron, **KILL** – Killdeer, **MALL** – Mallard, **NOHA** – Northern harrier, **NOMO** – Northern mockingbird, **PECO** – Pelagic cormorant, **PIGU** – Pigeon guillemot, **RNPH** – Red-necked phalarope, **RSHA** – Red-shouldered hawk,

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Prepared September 18, 2020 (for October 8, 2020 hearing)

To: Coastal Commissioners and Interested Persons

From: Susan Craig, Central Coast District Manager
Colin Bowser, Coastal Planner

Subject: University of California at Santa Cruz Coastal Long-Range Development Plan Notice of Impending Development Number 11 (SCZ-NOID-0004-20) – Younger Lagoon Beach Access Management Plan

SUMMARY OF STAFF RECOMMENDATION

The University of California at Santa Cruz's (UCSC's) Coastal Science Campus (the Campus) Coastal Long-Range Development Plan (CLRDP) was certified by the Commission on January 7, 2009. UCSC is now pursuing its eleventh project pursuant to the CLRDP, has submitted the above-referenced notice of impending development (NOID) to the Commission, and requests that the Commission concur that the proposed project is consistent with the certified CLRDP.

This NOID affects Younger Lagoon Reserve and its beach, which consists of a relatively small pocket beach with a back-beach lagoon system within which UCSC's coastal research and resource protective efforts are focused (through the UC Reserve System's Younger Lagoon Reserve program). Although historically a popular beach for general public access, Younger Lagoon Beach has been off-limits to general public use since 1981. At that time, the Commission authorized a CDP for a temporary beach closure to protect UCSC's Long Marine Lab research program in the lagoon area inland of the sandy beach itself, as well as threatened coastal resources in the overall lagoon-beach area. That original beach closure was only allowed by the Commission based on a required periodic reevaluation, which ultimately occurred in 2001 when the Commission again allowed the beach to remain closed for similar reasons. The periodic beach access reevaluation tool was codified into the certified CLRDP in 2009. Consequently, the CLRDP requires that the amount and intensity of beach access be revaluated every five years via authorization of a Younger Lagoon Beach Public Access Management Plan through the NOID process. That reauthorization process is designed to allow UCSC and the Commission to reassess the context and conditions associated with the level of public beach access at Younger Lagoon Reserve and its beach, consistent with ensuring resource protection at the same time and to potentially make changes in the degree of public beach access provided to the beach area (i.e., to increase it, decrease it, or leave it as is) for the next five years.

CLRDP Implementation Measure (IM) 3.6.3 requires that the public have "supervised access" to Younger Lagoon Beach but does not specify the level of supervision. Rather, this question is subject to the periodic reevaluation identified above. IM 3.6.3 also requires that a monitoring program be implemented to document the condition of native flora and fauna in Younger Lagoon and the back-beach area at five-year intervals. In addition, it requires that UCSC prepare a report at the end of each five-year period that presents the results of the monitoring program and discusses the potential effects of sandy beach public access on Younger Lagoon resources, and whether beach access changes should be implemented. At the end of each five-year period, UCSC must submit a NOID to the Commission to implement a beach access plan for the next five years.

In March 2010, the Commission approved UCSC's NOID ("NOID 2")[1] to implement a beach access management plan through 2015 that allowed supervised access to Younger Lagoon Beach through a docent-led beach tour program and also implemented a five-year monitoring program, as required by IM 3.6.3. UCSC began implementing the beach access plan and monitoring program in the spring of 2010 and submitted the report on the results of the monitoring to the Commission in February of 2016. In 2017, UCSC submitted the required beach access NOID (to cover the period between 2015 and 2020), which described a plan to continue the beach access program that had been in place under NOID 2 for the next five-year period (i.e., through 2020). The Commission approved that NOID ("NOID 9") with conditions in September 2018. Specifically, the 2018-approved Younger Lagoon Beach access management plan kept the beach closed to general public access and continued the docent-led beach tour program, with some changes (relative to the previous program) designed to provide additional opportunities for the public to access the beach consistent with ensuring resource protection at the same time . As conditioned, NOID 9 required UCSC to offer free[2] public beach tours four times a month during the spring and summer season (March through September), and twice monthly during other times of the year (for a minimum of 38 tours per year), thus increasing the number of beach tours offered during the summer season compared to the twice per month beach tours provided year-round under the previous program. To further comply with the conditions of NOID 9, UCSC increased the number of participants allowed on each beach tour from 12 to 14 and also identified a suite of English and Spanish language advertising outlets to promote the tours (including in inland areas), including press releases, local papers and event calendars, social media, and new and existing interpretive signage on Campus. UCSC also continued to monitor the reserve for potential coastal resource and research

[1] UCSC's NOIDs have been numbered sequentially since CLRDP certification (e.g., as discussed above, this is NOID 11), but are also coded with a Commission reference number (here SCZ-NOID-0004-20). While different, they both refer to the same item, namely the NOID in this case that is before the Commission.

[2] Prior to NOID 9, those aged 16 and over were required to pay a fee to take a Younger Lagoon Beach tour.

impacts as required by, and described in, IM 3.6.3.

NOID 11, which is the subject of this staff report, incorporates all the public access requirements of NOID 9, but UCSC will increase the maximum number of participants per tour from 14 to 18 and will offer a virtual tour instead of in-person tours during the COVID-19 pandemic. The virtual tours will continue even after COVID-19 restrictions ease and in-person tours resume. NOID 11 covers the period through December 31, 2025, and another NOID will be required prior to that time to cover the period past that date.

UCSC's monitoring data shows that tour participation increased in 2019 after NOID 9 went into effect. Further, until COVID-19 conditions forced in-person tours to end in March 2020, tour participation was on pace to exceed that of 2019. The supposition is that eliminating the previously required tour participation fees, actively promoting tours through a variety of media, and allowing day-of in-person tour sign-ups all helped increase tour participation and public access. In terms of the required biological monitoring, UCSC reports that the tours are not adversely impacting the lagoon and beach ecosystems.

Staff believes that the proposed Beach Access Management Plan, as conditioned to mirror the requirements of NOID 9 but with more specific reporting requirements included, can be found consistent with the CLRDP. Staff continues to believe that the balance being struck between research and resource protection at this unique site on the one hand, and general beach public access through the docent-led beach tour program on the other, is appropriate.

That said, the beach access situation at Younger Lagoon Beach is an anomaly in coastal California, including inasmuch as public beach access is critically important, and ensuring that it is maximized and provided to all is a critical component of the Commission's coastal program under the Coastal Act. It is only because of the historical context at this location, namely the Commission's involvement in setting access limits for this particular pocket beach as part of UCSC's research program dating back to 1981, that limitations on general public beach access here to address resource and research issues can be found appropriate. It remains incumbent on UCSC to recognize that same dynamic as it provides an access program to the general beachgoing public in return for the Commission's concession on behalf of those beachgoers. Staff believes that the previous suite of beach access parameters are still relevant to the current setting and necessary to maintain the balance of ongoing coastal science research, resource protection, and public access at an unusual site like Younger Lagoon. At the same time staff notes that public beach access is the cornerstone of the Commission's access program, that regulations on its use are not to be taken lightly, and must be assessed and applied in light of the facts and evidence regarding the effect of such access on resources. Toward that end, Commission and UCSC staff will continue to evaluate the Beach Access Management Plan and its implementation, and take steps to adapt it appropriately over time in ways that ensure meaningful public access at the same time as resource/research protection.

Staff therefore recommends that the Commission determine that the NOID project, as conditioned, is consistent with the certified CLRDP. The necessary motion and resolution to find the proposed development consistent with the certified CLRDP are found on page 6 below.

Staff Note - NOID Action Deadline: This NOID was filed as complete on August 14, 2020. The 30-working-day hearing deadline was September 28, 2020. On August 31, UCSC agreed to extend the hearing deadline (as allowed by CLRDP Section 8.4.2[3]) to December 28, 2020. Thus, the Commission must act on the NOID by December 28, 2020 or it will be deemed consistent with the CLRDP.

[3] CLRDP Section 8.4.2 provides that the hearing deadline may be extended if, on or before the deadline, the Director of Campus Planning waives UCSC's right to a hearing within 30 working days and agrees to an extension to a date certain that is no later than three months from the hearing deadline (in this case, no later than December 28, 2020).

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EXHIBITS

I. MOTION AND RESOLUTION

Staff recommends a YES vote on the following motion. Passage of this motion will result in a determination that the development described in UCSC NOID Number 11 (SCZ-NOID-0004-20), as conditioned, is consistent with the certified UCSC CLRDP, and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of the Commissioners present.

> ***Motion:*** *I move that Commission determine that the development described in UCSC Notice of Impending Development Number 11, as conditioned, is consistent with the certified UCSC CLRDP, and I recommend a yes vote.*

> ***Resolution:*** *The Commission hereby determines that the development described in UCSC Notice of Impending Development Number 11, as conditioned, is consistent with the certified UCSC CLRDP for the reasons discussed in the findings herein.*

II. CONDITIONS

1. **Free Beach Tours.** All beach tours shall be offered for free, and UCSC shall not require that beach tour users pay any separate admission fee to any other facility in order to take the beach tour. This condition shall not be construed as affecting existing, already-allowed admission fees for UCSC's Seymour Marine Discovery Center. At a minimum, beach tour sign-ups shall be provided online (e.g., at UCSC Marine Science Campus and Seymour Marine Discovery Center websites), by phone ,and at the Seymour Marine Discovery Center front desk. UCSC shall also identify and implement a mechanism for tracking the number of tour requests that are denied due to lack of tour availability or because tours are fully booked. All UCSC materials referencing the beach at Younger Lagoon and/or beach tours shall be required to be modified as necessary to clearly identify that access to the beach is available for free via beach tours.

2. **Beach Tour Outreach Plan.** Within 30 days of this approval (i.e., by November 7, 2020), UCSC shall submit two copies of an updated Outreach Plan for Executive Director review and approval, where such Plan shall identify all measures and venues to be used to advertise and increase awareness of the beach tours, including the online virtual tours. Promotional methods shall include, but are expected to not be limited to: UCSC Marine Science Campus and Seymour Marine Discovery Center websites, press releases, calendar listings with UCSC Events and local media (e.g., Good Times newspaper, Santa Cruz Sentinel, The Register-Pajaronian, The Half Moon Bay Review, The Monterey Herald, etc.), ads on radio (e.g., local radio stations KAZU, KRML, and others), print ads, social media (including Facebook, Twitter, and Instagram), and contacts with influential organizations in local environmental and community advocacy groups who may facilitate promotional opportunities. The Plan shall identify the language to be used in describing the virtual and free in-person beach tours (where said language shall be required to be consistent with the terms and conditions of this approval), and shall provide a schedule for each type of outreach, with the goal being to reach as many potential online viewers and potential beach tour participants as possible,

including audiences beyond Santa Cruz that might not normally be reached through traditional and local means (e.g., inland communities). The Plan shall describe how UCSC will monitor and track the Outreach Plan's execution so that UCSC and the Coastal Commission can note the effectiveness of the plan and make changes as needed. UCSC shall implement the updated approved Outreach Plan.

3. **Beach Tour Signs.** UCSC will continue to implement the Beach Tour Sign Plan that was previously-approved by the Executive Director under NOID 9 where such Plan has provided for installation of signage outside of the Seymour Marine Discovery Center and inside at its front desk, at Campus overlooks, and at other appropriate public access locations on the Marine Science Campus that describe free beach tour availability, including "day of" signs for each day beach tours are offered to ensure maximum notice is provided. All such signs shall continue to be sited and designed to be visually compatible with the area, consistent with the Campus sign program (and CLRDP sign requirements) and continue to provide clear information in a way that minimizes public view impacts. UCSC shall continue to implement the approved Beach Tour Sign Plan from NOID 9.

4. **Beach Tour Availability and Monitoring.** UCSC shall offer at least four beach tours per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th each year and shall provide at least two beach tours per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (totaling a minimum of 38 total beach tours per year). UCSC may limit the number of beach tour participants to 18 persons per tour, but this number may be exceeded per tour on a case-by-case basis, and beach tours shall not require any minimum number of participants to be provided (i.e., if at least one person signs up, the tour shall be provided). UCSC shall document the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also **Condition 1**).

   At least every six months (i.e., by June 30 and December 31 of each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the Report shall, at a minimum, provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved updated Beach Tour Outreach Plan (see **Condition 2**) and which shall include specific information regarding the dates that each advertisement for beach tours was placed in each venue/media/social media outlet, as well as the required information described in the previous paragraph. Each such Monitoring Report shall include a section that identifies recommendations about whether user data suggests that beach tours should be increased in terms of frequency of tours and/or number of tour attendees, or otherwise modified to better respond to user demand, including the potential to offer a more limited beach area tour (e.g., designed to allow participants to access just the sandy beach area itself in a shorter amount of time) as a means of offsetting demand. Each Monitoring Report shall also include a section that describes how the beach-lagoon ecosystem has responded to beach tours. This assessment will include data and analysis useful for assessing whether the ecosystem shows any impacts from beach tours. This assessment will be used to help determine if larger tours have any impacts on the YLR ecosystem, its environmental quality, and UCSC research opportunities at the site. UCSC shall implement any Executive Director-approved recommendations from each Beach Tour Monitoring Report.

5. **Beach Access Management Plan Duration.** This approval for UCSC's public beach access management plan at Younger Lagoon Beach shall be effective through December 31, 2025. UCSC shall submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2026 to December 31, 2030) no later than July 1, 2025. Such a complete NOID shall, at a minimum, summarize the results of the Beach Tour Monitoring Reports (see **Condition 4**), and shall identify the manner in which UCSC's proposed management plan responds to such data, including with respect to opportunities to increase public access to the beach area when considered in light of potential impacts to UCSC research and coastal resources. If such a complete NOID has not been submitted by July 1, 2025, then UCSC shall allow supervised (via beach and trail monitors only) general public access to Younger Lagoon Beach during daylight hours (i.e., one hour-before sunrise to one-hour after sunset) until such NOID has been submitted.

III. FINDINGS AND DECLARATIONS

A. UCSC CLRDP

General UCSC CLRDP Background

As an alternative to project-by-project coastal permit review, Coastal Act Section 30605 allows universities to develop long-range development plans for Coastal Commission certification. Once certified, the university becomes the primary entity responsible for ensuring that future development on the site is consistent with the certified long-range development plan, subject to ongoing Commission oversight. UCSC's Marine Science Campus CLRDP was certified by the Coastal Commission on January 7, 2009.

UCSC's Coastal Science Campus

UCSC's Coastal Science Campus site is located directly adjacent to the Monterey Bay National Marine Sanctuary (MBNMS) just within the western border of the City of Santa Cruz in Santa Cruz County (see **Exhibit 1** for a location map and for an aerial photo of the Campus site). The Campus site has been known locally for many years as Terrace Point. The main UCSC campus is located roughly two miles inland of the Campus in the rolling foothills northwest of downtown Santa Cruz. The Coastal Science Campus is located at the outskirts of the city, seaward of Highway One, at the transitional boundary between the urbanized city area to the east (downcoast) and the rural north coast of the unincorporated county to the west (upcoast). The Santa Cruz County north coast area is well-known to the Commission for its sweeping vistas of both coastal agricultural fields and natural landscapes framed by the undulating coastal range. Much of this area is in extensive State Park and other rural public land holdings, and all of it is traversed by a rural stretch of Highway 1. Although there are some limited residential enclaves (e.g., Davenport along the coast, and Bonny Doon in the mountains) in these mostly pastoral areas, this north coast area is part of the stretch of largely agricultural and undeveloped coastal lands extending nearly 50 miles to Half Moon Bay upcoast. The Campus site is located at the southern end of this stretch of coast as one travels north and upcoast from the City of Santa Cruz and, by extension, out of the urbanized portion of northern Monterey Bay.

The Campus site is primarily made up of a relatively flat terrace area (roughly 73 acres) sloping gently from north to south (to the ocean) with the remainder occupied by a large arroyo feature (roughly 25 acres) on the west side of the site, at the base of which lies Younger Lagoon, an estuarine lagoon that occasionally connects to the ocean. A sandy beach area fronts Younger Lagoon below the terrace. The lagoon, the beach, the arroyo, and a portion of the terrace make up Younger Lagoon Reserve. The terrace portion of the site includes within it a 2.5-acre federally owned parcel that is surrounded by UCSC property. Altogether, the Campus (including the federal in-holding and the Younger Lagoon Reserve) covers about 100 acres.

In the general Campus vicinity, agricultural land extends to the west along the coast beyond the Younger Lagoon Reserve and the western Campus boundary. To the north are Union Pacific Railroad tracks, a light industrial facility, and Highway 1. To the south lies the MBNMS and the Pacific Ocean, and to the east is Antonelli Pond (north of Delaware Avenue) and the densely packed De Anza Mobile Home Park (south of Delaware Avenue), beyond which is Natural Bridges State Park, and past that, West Cliff Drive in the City of Santa Cruz.

UCSC'S Coastal Science Campus CLRDP

UCSC's Coastal Science Campus CLRDP was certified by the Coastal Commission on January 7, 2009. The CLRDP provides a blueprint for future development of the site, including a maximum increase of about 600,000 square feet of new Campus facilities, mostly within four distinct development zones (occupying about one-third of the terrace area – see page 1 of Exhibit 2) for an expanded Marine Science Campus. The CLRDP provides for roughly 340,000 gross square feet of potential new facilities within the four development zones in new one- and two-story buildings up to 36 feet tall, with the remainder in outdoor research and support areas. The CLRDP also accounts for additional areas of roads and some natural drainage ponds outside of the four development nodes. Overall, and at full buildout, the CLRDP allows the Campus to grow by about three times its size at certification. In addition to the building program, the CLRDP also provides for an expanded public access trail system and natural habitat restoration in the wetland and open space areas on the terrace that are not part of the proposed development zones (roughly 47 acres) that, per the CLRDP, were previously added to Younger Lagoon Reserve.

B. UCSC NOID 11

Notices of Impending Development

Under a certified CLRDP, University development of specific projects contained in the CLRDP can proceed without a coastal permit, provided the University sends a Notice of Impending Development (or a "NOID") to the Commission prior to undertaking development, and either the Commission deems the identified development project consistent with the CLRDP (with or without conditions to make it so) or does not respond in a timely manner to the NOID.[4] Pursuant to Coastal Act Sections 30605 and 30606, the Commission may impose conditions on such development project proposals only if it finds them inconsistent with the certified CLRDP.

Younger Lagoon Beach Access

Younger Lagoon Beach is similar to other sandy pocket beaches along the northern Santa Cruz County coast that include inland lagoon and brackish features, and it was a popular and well-used area for general beach activities for many years before UCSC acquired the property in the 1970s. The beach was closed to general public access on a temporary basis in 1981 in order to protect UCSC research as well as Younger Lagoon and related habitat resources, and to provide security to the UCSC marine lab more generally.[5] Although some unauthorized access continued to occur (i.e., occasional vandalism and surfing and skim-boarding across the wet sandy fore-beach), the general beach access closure remained in effect, limiting beach access to UCSC researchers and personnel only between 1981 to 2010. As indicated, the initial closure in 1981 was conditioned by the Commission's CDP to require periodic reevaluation, and that reevaluation mechanism was ultimately built into the CLRDP when it was certified in 2009. The CLRDP Younger Lagoon Beach Access Management Plan is structured to be reevaluated every five years, and the reauthorization process is designed to allow UCSC and the Commission to reassess the context and conditions associated with the level of public beach access at Younger Lagoon Beach, and to potentially make changes in the degree of public beach access provided to the beach area (i.e., to increase, decrease, or leave access as is) for the next five years.

NOID 11 – Younger Lagoon Reserve Beach Public Access Management Plan

[4] Coastal Act Section 30606 requires that the University provide notice of an impending development at least 30 working days prior to pursuing it. California Code of Regulations (CCR) Section 13549 provides that a NOID is only filed following Executive Director review of the NOID and any supporting materials to ensure there is sufficient information for making the consistency determination. The filing review must be completed within five working days after receiving the NOID submittal. CCR Section 13548 requires that the Commission act on the notice within 30 working days of filing of the NOID. In sum, if the Commission does not act within 30 working days of filing of the NOID, the identified development project is deemed consistent and can proceed. In the case of the UCSC CLRDP, the action deadline may be extended by UCSC for up to 3 months.

[5] This general public beach access closure was only allowed by the Commission on a temporary basis in 1981, and that approval required periodic reevaluation, which ultimately occurred in 2001 when the Commission again allowed for continued beach closure for similar reasons. The temporary nature of the closure was based on the premise that the Commission would continue to reevaluate the beach access issue on a regular basis in order to ensure that the balance being struck and the trade-offs (i.e., between research and resource protection on the one hand, and general beach public access on the other) remained appropriate under the Coastal Act.

In March 2010, the Commission approved UCSC's NOID 2 to implement a beach access management plan through 2015 that allowed supervised access to Younger Lagoon Beach through a docent-led beach tour program6 and also implemented a five-year monitoring program, as required by CLRDP Implementation Measure (IM) 3.6.3. UCSC began implementing the beach access plan and monitoring program in the spring of 2010 and submitted the report on the results of the monitoring program to the Commission in February of 2016.

In 2017, UCSC submitted the required beach access plan NOID (to cover the period between 2015 and 2020), which described a plan to continue the beach access program that had been in place under NOID 2 for the next five-year period (i.e., through 2020). That NOID (NOID 9) was presented to the Commission at its July 2017 meeting, but UCSC withdrew it prior to any Commission action in order to consider and incorporate feedback from Commissioners on the adequacy of its proposed public access parameters. For example, Commissioners were concerned about the adequacy of UCSC's public access offerings, including with respect to the number of days per year the tours were offered, how many people could go on each tour, that tourgoers aged 16 and over needed to pay for admission to the Seymour Marine Discovery Center (SMDC) to go on the tour, and how UCSC was advertising the tour program to the broader community. Commissioners were particularly concerned with how UCSC was advertising to lower-income residents who do not live near the campus and may be unfamiliar with the site.

To address Commissioner concerns, UCSC revised its beach access management plan and resubmitted it to the Commission. The Commission approved the revised NOID 9 with conditions in September 2018. Specifically, that approval allowed the beach to remain closed to general public access and continued the docent-led beach tour program, with some changes (relative to the previous program) designed to provide additional opportunities for the public to access the beach while ensuring natural resource protection at the same time . As conditioned, NOID 9 required UCSC to offer free public beach tours four times a month during the spring and summer season (March through September), and twice monthly during other times of the year (for a minimum of 38 tours per year), thus increasing the number of beach tours offered during the spring and summer seasons compared to the twice-per-month beach tours provided year-round under the previous program. To further comply with the conditions of NOID 9, UCSC also increased the number of participants allowed on each beach tour from 12 to 14 and identified a suite of English and Spanish language advertising outlets to promote the tours (including in inland areas), including press releases, local papers and event calendars, social media, and new and existing interpretive signage on Campus. UCSC also continued to monitor the reserve for potential coastal resource and research impacts as required by, and described in, IM 3.6.3.

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[6] Typically, tours are led by docents from the Seymour Marine Discovery Center where tours begin. The tours include a narrative history of the UC Natural Reserve System, a discussion of the lagoon and its habitats, a walk through a restored coastal scrub habitat, with opportunities to view the rear dune, and culminate with a walk on the sand at Younger Lagoon Beach.

NOID 11 proposes to reauthorize the public access program for another five years through 2025[7] and incorporates all the previous requirements of NOID 9 with a few changes, including a proposed increase in the maximum number of participants per tour from 14 to 18, as well as a new "virtual tour" (instead of in-person tours) to continue to provide for public access (of sorts) during the COVID-19 pandemic. The virtual tours will also be continued after COVID-19 restrictions ease and in-person tours resume.

More specifically, UCSC again proposes to keep the beach closed to general public access, and to continue the existing docent-led beach tour program as the allowed form of public beach access through 2025 in a similar fashion as was approved in NOID 9. The beach tours are designed to provide an interpretive experience for visitors. They are led by SMDC docents trained in the natural history and ecology of Younger Lagoon and its fronting beach. While walking to the beach, participants are provided with a narrative history of the University of California Natural Reserve System (UCNRS) and a discussion of the lagoon and its habitats. The tour proceeds through restored coastal scrub habitat and participants are given opportunities to view the rear dune. The tour culminates with a walk on the sandy beach, but the extent of the accessible beach area varies depending on tidal conditions and the extent of dune plants because foot traffic is only permitted seaward of the dune vegetation. Thus, the exact beach access area may vary slightly from the areas depicted in Figure 1 of the NOID based on on-the-ground conditions (see Exhibit 3, p.16, and Exhibit 4 (CLRDP Figures 3-11 and 5-6)).

NOID 11 includes all the requirements of NOID 9 (e.g., no fees for tours, community outreach to inform the public about the tours, beach tour informational signage at the SMDC and throughout the campus, maintaining the same frequency of tours, and regular submission of beach tour monitoring reports, etc.). In addition, UCSC is proposing two changes to increase the maximum number of persons allowed per beach tour from 14 to 18, and to implement a virtual online YLR tour that would be a substitute for in-person tours during the COVIDCOVID-19 pandemic and then, once in-person tours resume, would continue to be available as a supplement to (but not as a replacement for) in-person tours.

See Exhibit 1 for a location map and a site plan; see Exhibit 2 for photos of the Campus, including Younger Lagoon Beach; and see Exhibit 3 for the complete NOID and supporting materials.

C. CLRDP Consistency Analysis

Applicable CLRDP Provisions

The CLRDP includes multiple provisions that regulate Younger Lagoon Reserve (YLR) in general, as well as public beach access specifically. IM 3.6.3 governs public beach access within the YLR and provides as follows:

[7] A new NOID must be submitted and approved for the 2026 to 2030 period to meet the CLRDP requirement that the beach access parameters and a Beach Access Plan be reviewed and authorized every five years.

Implementation Measure 3.6.3 - Public Beach Access within YLR.
Supervised beach access to Younger Lagoon beach shall be provided to the general public consistent with and pursuant to a management plan for such access that is based on the best possible assessment of the capacity of the beach area to sustain use and the level of intensity of such use when considered in light of the fragility of the beach area and adjacent resources and ongoing research. Within six months of CLRDP certification, and at five-year intervals post-certification after that, the University shall submit a Notice of Impending Development to the Coastal Commission with all necessary supporting information for a development project to implement such a beach access management plan for the next five years. Each such management plan shall at a minimum include:

- *A regular schedule of guided, educational tours to the beach area that is coordinated with and similar to other Marine Science Campus education and docent programs and designed to introduce visitors to the special aspects of beach ecology without causing deterioration of that ecology or loss of opportunity for feeding or breeding of beach dependent species. These tours may be weekly weather permitting but shall be offered a minimum of two times per month.*
- *Identification of all parameters for beach access, including a clear depiction of the area within which such access is allowed, and a clear description of all related implementing measures (e.g., trail alignments, trail design, barriers/fencing, signage, timing restrictions, supervision requirements, etc.). Access shall be by way of controlled access trails shown on Figure 5.6. Trails shall be maintained, marked, and signed for safety and interpretation of YLR ecology.*
- *A monitoring program that evaluates trends in beach area conditions, where at a minimum such program shall include: user data (including identification of all user types and specific data on size and composition of beach tour groups); a selected set of repeatable photo points to be taken seasonally to show all major areas of the beach; presence/absence of tidewater goby and evidence of breeding activity; species composition and coverage of beach dune vegetation from the lowest (nearest to the mean high tide line) occurring terrestrial plant to 10 meters inland into the strand vegetation; evidence of seed production by beach strand species in this zone; species composition and abundance of animal tracks (vertebrate and invertebrate) on the beach and adjacent beach dune area; and regular counts of feeding shorebirds on the beach.*
- *An assessment of beach area resources and the effect of beach area use and activities (including authorized and unauthorized uses, research use, YLR activities, etc.) on such resources in the time since the last five-year review and overall in the time since at least CLRDP certification;*

- *A description of existing public access opportunities on the Campus, and the way in which such opportunities relate to the amount and type of supervised access provided to the beach area.*

Policy 6.1 and IM 6.1.1 provide for maximum and free public access to the campus, respectively:

> ***Policy 6.1 Public Access to the Marine Science Campus***
> *Maximum public access to the coastal resources of the Marine Science Campus and the adjacent shoreline and coastal area shall be provided consistent with public safety, fragile coastal resources, implementation of the educational and research missions of the Campus, and security of sensitive facilities and research activities on the site.*
>
> ***Implementation Measure 6.1.1 – Free Public Access for Visitors***
> *Free public visitor access to the Marine Science Campus shall be provided during at least daylight hours (i.e., one hour before sunrise until one-hour after sunset). Modest fees may be charged only for access to the Seymour Marine Discovery Center and similar University facilities with developed educational and/or visitor-oriented programs.*

Consistency Analysis

UCSC proposes to continue to keep the beach closed to general public access and to continue the docent-led beach tour program (once COVID-19 restrictions are lifted) as the allowed form of public beach access through 2025, with some changes relative to the prior program (i.e., to allow up to 18 persons per tour and create and promote a virtual online tour). No changes are proposed for the substance of the in-person tours; they would still be led by SMDC docents, and would include a narrative history of the UCNRS, a discussion of the lagoon and its habitats, a walk through a restored coastal scrub habitat with opportunities to view the rear dune and would conclude on the sandy beach itself. Additionally, UCSC would continue to submit information regularly regarding the methods and media used to promote the beach tour program, including in inland areas.

Per the requirements of NOID 9, in January 2019, UCSC increased the overall number of annual tours from 24 to 38. Tours were promoted through posted signs on campus and through a variety of media outlets including newspapers, local radio stations, and on UCSC websites and event calendars. Tour reservations could be made in-person the day of the tour instead of requiring reservations to made in advance by phone. Based on the monitoring reports that UCSC submitted pursuant to Condition 4 of NOID 9, tours at Younger Lagoon Reserve have grown more popular and visitor counts have increased. Compared to calendar year 2018, tour participation in 2019 grew by 18%, from 224 to 265 participants. And for the first three months of 2020 before tours stopped because of COVID-19 public health precautions, tour participation almost doubled that of the first three months of 2019 and was over three times higher than the first three months of 2018 (i.e., 60 participants from January through March of 2020 vs. 31 during these three months in 2019 and 17 during these three months in 2018). Most tour participants reserved tours by phone instead of booking tours in person at the SMDC, and usually less than 10% of participants made walk-up reservations at the SMDC. In the period from January 1, 2018 through March 8, 2020, the number of participants on each tour varied from one to 18, with seven tours cancelled for no participants and four tours going with greater than the typical maximum capacity of 14 participants (with a maximum of 18 participants).[8] Data on the number of people who were denied a tour or did not show up for a reserved tour were gathered only in 2019 and early-2020 (i.e., before COVID-19 restrictions began) and show that two tours turned away a total of eight people because tours were full, and 71 people made reservations for a tour but did not show up to take the tour.

In addition to the analysis regarding visitation levels, UCSC has provided biological monitoring information regarding Younger Lagoon Beach and the lagoon area. UCSC found that the beach and surrounding uplands contain 225 species of birds, 19 species of mammals (including occasional bobcats, mountain lions, coyotes, and grey fox), 209 species of plants, 20 species of reptiles, three species of amphibians, and three species of fish. UCSC considers this diversity of species to indicate the value of having a small, controlled human footprint at Younger Lagoon Beach and the lagoon area, and notes that fewer species were observed at nearby Sand Plant Beach, Little Wilder Beach, and Natural Bridges State Beach during the 2010-2015 period in which UCSC compared species diversity at the four sites. Thus, even with the increase in the number of tour participants since NOID 9, habitat conditions remained healthy and able to support a large range of species for such a relatively small area, and it is clear that the tours themselves are not adversely impacting the habitat and/or UCSC research activities.

The above analysis demonstrates the effectiveness of NOID 9's conditions in terms of increasing public access to the beach while still providing needed scientific research and habitat protection. NOID 9's conditions have been effective in balancing these sometimes-competing objectives, and the increase in visitation can be attributed, at least in part, to the elimination of tour fees, tour capacity increases, and tours being proactively promoted through informational tour signage at SMDC and in a number of locations throughout the campus, announcements on UCSC and SMDC websites, and through an array of bilingual print, radio, and social media. NOID 11 would build upon the success of NOID 9, would allow for increased tour capacity consistent with natural resource protections and would add a virtual way for the public to experience the beach here, even after the COVID-19 restrictions are lifted.

To codify UCSC's proposal, this NOID retains all the conditions of NOID 9, which shall ensure that beach tours remain free (Condition 1); that UCSC will submit a more detailed outreach plan that explains all measures and venues undertaken to advertise and increase awareness of the online virtual tour and in-person tours when they resume after COVID-19 restrictions are lifted (Condition 2); and that beach tour signage at the SMDC and at various locations throughout the campus will be maintained (Condition 3). Condition 4 will continue to require a minimum of 38 tours per year, with the majority of

[8] Tour docents may increase the maximum tour size to greater 18 people if they choose, based on conditions at the time. See NOID 9 Special Conditions Implementation Report #3 for tour participation statistics

tours taking place during warmer-weather months. This condition also requires that weekday and weekend beach tours are offered each month, while also ensuring that at least half of all beach tours are offered on weekend days when more people may be available to take them.

UCSC also proposes to increase the maximum number of persons per beach tour from 14 to 18, which is reflected in Condition 4. Subject to the following discussion, these changes are generally appropriate in light of the information gathered from the Monitoring Report for 2019 and, together with online tours, should increase beach access availability in two forms while ensuring adequate protection of coastal resources consistent with the CLRDP.

Next, with respect to outreach, UCSC proposes to continue to raise awareness of the beach tour program via press releases, calendar listings with UCSC Events and the Good Times newspaper (a local weekly periodical for the Santa Cruz area), ads on local radio stations, Spanish language radio stations in the local area, print ads, and on popular social media platforms. UCSC indicates that the tours will also be advertised on a “Behind-the-Scenes Tours” page on the SMDC website and on interpretive signage in public areas on Campus, consistent with how they have been promoted in those venues in the past, but done more broadly through more promotional outlets, and done more frequently.

UCSC proposes to continue this approach to outreach, in part furthered by the Commission’s conditions of NOID 9, although the proposed plan does not include enough specificity to show how often the tour program would be promoted on each platform. To ensure that these measures are adequately used to inform the public, Condition 4 is modified from the previous version to require that specific data on the exact dates that each advertisement for the tours was placed in each venue, media, or social media outlet, be collected, and that this data be included in the required monitoring reports. The monitoring reports are required to be submitted at least every six months and will provide information regarding UCSC’s activities under the approved Beach Tour Outreach Plan (Condition 2), as well as tour participation data, outreach activities, number of beach tours offered, the number of people who sign up for each beach tour, and the number of people turned away for lack of available spaces.[9] The report must also contain recommendations based on user data on whether beach tours should be increased (in terms of frequency of tours and/or number of tour attendees) or otherwise modified to better respond to user demand, and consider the potential to offer a more limited beach area tour (e.g., designed to allow participants to access just the sandy beach area itself in a shorter amount of time) as a means of offsetting demand. Finally, Monitoring Reports will show, as data and observations allow, whether and how larger tour groups enabled by the provisions of this NOID (increasing tour size from 14 to 18 or more) affect the beach and lagoon area environmental quality and its effectiveness as a setting for UCSC’s research. UCSC will be required to implement any such recommendations in the approved Monitoring Report, where the intent is to adapt

[9] Condition 1 requires UCSC to develop and implement a mechanism for gathering use data so that unmet demand for tours can be quantified and addressed.

to changing information and context while seeking to maximize public access opportunities.

Lastly, in order to ensure that UCSC meets the CLRDP requirement for five-year review of beach access at Younger Lagoon Beach on the original time schedule required by the Commission through the CLRDP IM 3.6.3, Condition 5 states that this NOID is effective through December 31, 2025 only, and requires UCSC to submit a NOID for the January 1, 2026 to December 31, 2030 period by July 1, 2025.

In addition to the beach tour components, UCSC proposes to continue to provide visual access into the lagoon area and the beach via CLRDP-required overlooks. Specifically, the Commission required three overlooks to provide such access into Younger Lagoon and the beach as part of the offsetting mitigation package built into the CLRDP to address UCSC building program impacts. Overlook C is the main campus overlook that provides views into the Campus' marine mammal pools (on the one side) and Younger Lagoon and the sandy beach (on the other). This overlook is elevated atop the Younger Lagoon protective berm and it provides the best view to the beach area from the terrace portion of the Campus. Overlook C is accessible only through docent-led tours, and it is the main overlook visited on such tours through the SMDC. Overlook D is located further inland and just north of the Campus Ocean Health Building on the Younger Lagoon side of the protective berm and is developed with a partially enclosed observation blind that gives a more inland view of Younger Lagoon, including a more distant view of the beach and ocean. As with Overlook C, Overlook D can only be accessed via docent-led tours. Finally, Overlook E is located even further inland and provides a view of the more interior parts of Younger Lagoon from a partially enclosed smaller space near the protective berm. Overlook E is open to the general public and requires no participation in a tour to access the site. The updated Beach Access Management Plan includes continuing visual beach access through these overlook offerings, which is appropriate, as views are required to be made available in these ways per the CLRDP.

UCSC also notes that it has complementary public programs that help offset the lack of general access to the Younger Lagoon Beach. For example, UCSC again hosted its annual "Bioblitz" in 2019, which is a community event bringing together a variety of people from the general public to conduct a period of rapid, intensive biological surveying intended to develop an inventory of the living organisms found in a particular place. The group included people with formal training and "citizen scientists" working in the lagoon and beach area to gather data. Events like the BioBlitz are part of the suite of ongoing public educational activities that bring as many as 50,000 people to the SMDC each year. One of these activities, Watsonville Area Teens Conserving Habitats (WATCH), allows pre-college-age students to access the YLR; however, most youth programming at the Campus is based in the SMDC and Long Marine Laboratory.

In addition, as set forth in the NOID, UCSC will continue to monitor the habitat of Younger Lagoon and the beach area as required by, and described in, IM 3.6.3. The goal of the habitat monitoring program is to help document the presence and distribution of flora and fauna within the beach area and evaluate changes in distribution and density over time in order to understand how any observed changes relate to changes in human use of the area.

UCSC will also continue to submit a NOID to the Commission at five-year intervals that (1) reports on the previous five years of beach access management, (2) includes a monitoring report that evaluates beach conditions, and (3) includes all necessary supporting information to implement a beach access management plan for the next five years as outlined in the CLRDP (Condition 5). Importantly, as indicated above, these every-five-year reevaluations represent the time when UCSC and the Commission are required by the CLRDP to assess whether more or less beach access is appropriate, building upon the Commission's pre-CLRDP CDP history, as well as its certification of the CLRDP itself, during which process the Commission concluded that a permanent beach access ban or permanent set of beach access criteria were not appropriate and the level and intensity of beach access needed to be periodically reevaluated over time. Condition 5 will continue to provide a check point at which the balance of public access and the ecosystem conditions that create the unique Campus research setting can be reevaluated.

In this case, and for similar reasons as the Commission has found in the past with respect to public access at Younger Lagoon Beach, the docent-led tour program can be found consistent with the CLRDP provided it continues to operate under the previous NOID's five updated conditions. With these conditions in place, the NOID strikes an appropriate balance (i.e., between research and resource protection on the one hand, and general beach public access on the other) through the docent-led beach tour program. In making such finding, however, the Commission notes that the beach access situation here at Younger Lagoon Beach remains a conspicuous anomaly in coastal California, including inasmuch as public beach access is critically important, and ensuring it is maximized and provided to all, consistent with ensuring resource protection at the same time, is a critical component of the Commission's coastal access program under the Coastal Act. It is only because of the historical context here, namely the Commission's involvement in restricting public access to this particular pocket beach as part of UCSC's research program dating back to 1981, that such limitations on general public beach access here can be found appropriate in that larger context.

The Commission notes that it is incumbent on UCSC to recognize that same dynamic in terms of what type of access program it provides to the general beach-going public in return for that concession on the part of the Commission on behalf of those beachgoers, and the Commission finds that conditions in NOID 9 and NOID 11 are still necessary to help ensure UCSC's program is as accommodating to the general public as ecological conditions allow. Public beach access is the cornerstone of the Commission's access program, and regulations on its use are among the most important to be evaluated under the Coastal Act, and must be assessed and applied in light of the facts and evidence regarding the effect of such access on resources. The conditions applied here will help to better provide such access, including through the continued reassessment and monitoring of program provisions, both to inform this iteration of the program as well as future beach access plans and NOIDs. Thus, the Commission finds the proposed beach access management plan, as conditioned, consistent with the certified CLRDP.

D. California Environmental Quality Act (CEQA)

Section 13096 of the California Code of Regulations requires the Commission to make a specific finding that a permit application is consistent with any applicable requirements of CEQA. This requirement also applies to the Commission's review of NOIDs, based on Regulation Section 13550(d). Section 21080.5(d)(2)(A) of CEQA prohibits a proposed development from being approved if there are feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse effect which the activity may have on the environment.

The University, as the lead agency under CEQA, certified a Final EIR (FEIR) for the CLRDP in September 2004. In November 2006, the University certified an addendum to the FEIR to respond to changes in the CLRDP in the time since the original FEIR certification, including changes stemming from Coastal Commission review of the CLRDP prior to certification.[10] On January 18, 2012, the University, again as the lead agency under CEQA, certified a FEIR for the Marine Science Campus projects that constitute NOID 6. In certifying the FEIR, the University found that the projects would not have significant adverse environmental impacts. This report has discussed the relevant coastal resource issues with the proposed amendment. All above findings are incorporated herein in their entirety by reference.

The Coastal Commission's review and analysis of land use proposals has been certified by the Secretary of the Natural Resources Agency as being the functional equivalent of environmental review under CEQA. The Commission has reviewed the relevant coastal resource issues raised by the proposed project and has identified appropriate and necessary modifications to address adverse impacts to such coastal resources. All public comments received to date have been addressed in the findings above. All above findings are incorporated herein in their entirety by reference.

The Commission finds that only as conditioned will the proposed project avoid significant adverse effects on the environment, within the meaning of CEQA. As such, there are no additional feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse environmental effects that approval of the proposed project, as modified, would have on the environment within the meaning of CEQA. If so modified, the proposed project will not result in any significant environmental effects for which feasible mitigation measures have not been employed consistent with CEQA Section 21080.5(d)(2)(A).

[10] FEIR Addendum Number 1, dated certified November 29, 2006.

IV. APPENDICES

A. Substantive File Documents

- UC Santa Cruz Marine Science Campus CLRDP
- CLRDP NOID 9 Special Conditions Implementation Report #3

B. Staff Contact with Agencies and Groups

- UCSC Coastal Science Campus Planning Department

CALIFORNIA COASTAL COMMISSION
CENTRAL COAST DISTRICT
725 FRONT STREET, SUITE 300
SANTA CRUZ, CA 95060
PHONE: (831) 427-4863
FAX: (831) 427-4877
WEB: WWW.COASTAL.CA.GOV

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SCZ-NOID-0004-20 (UCSC CLRDP NOID NUMBER 11 – YOUNGER LAGOON RESERVE BEACH PUBLIC ACCESS MANAGEMENT PLAN)

OCTOBER 8, 2020 HEARING

EXHIBITS

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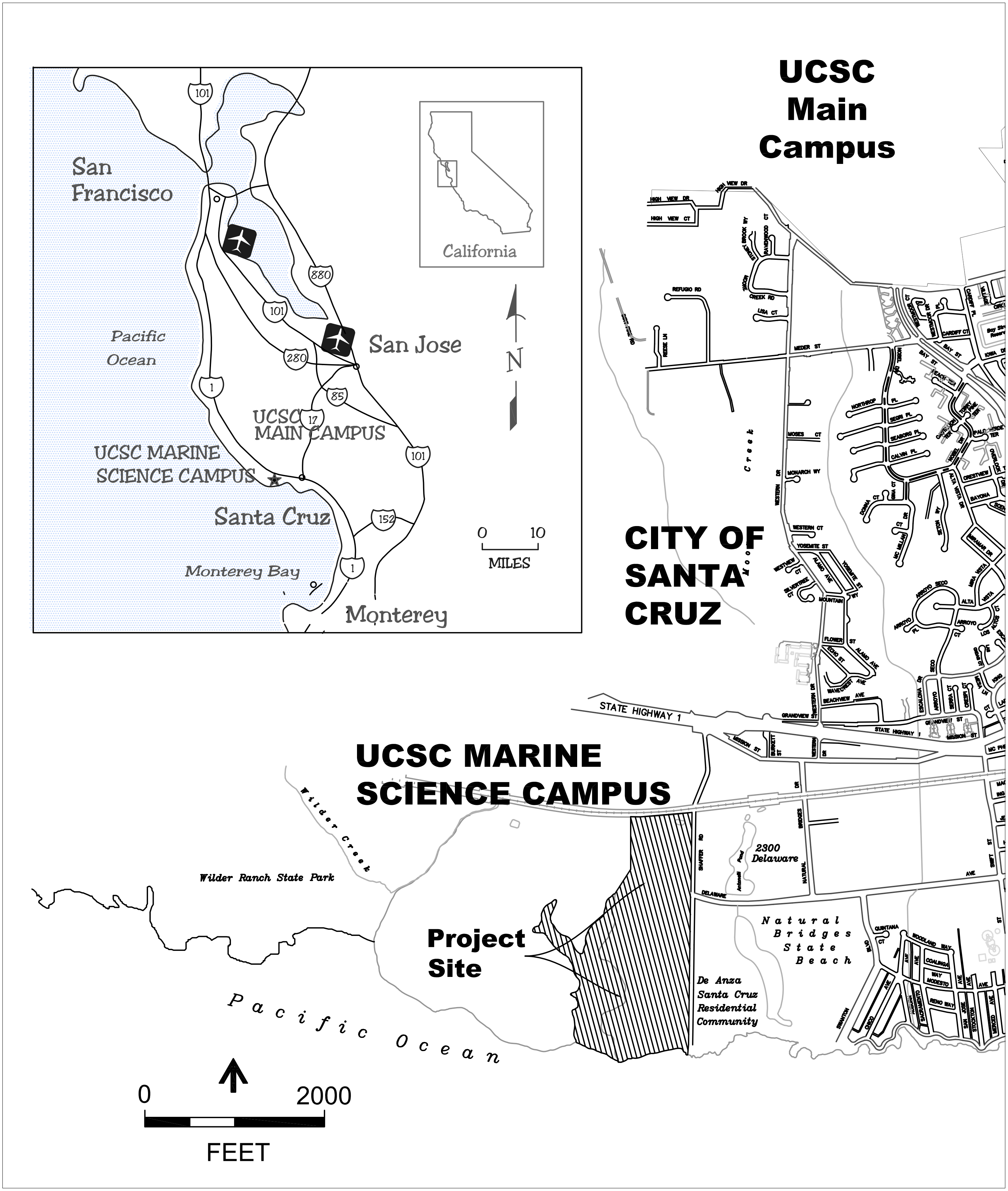
Aerial View of Younger Lagoon Beach and the Marine Science Campus

Note: All photopoint locations are approximate.


UCSC
Main
Campus
CITY OF
SANTA
CRUZ
UCSC MARINE
SCIENCE CAMPUS
Project
Site
Pacific Ocean
Wilder Ranch State Park
Wilder Creek
Moore Creek
2300 Delaware
Natural Bridges State Beach
De Anza Santa Cruz Residential Community
STATE HIGHWAY 1
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FEET
San Francisco
San Jose
Pacific Ocean
UCSC MAIN CAMPUS
UCSC MARINE SCIENCE CAMPUS
Santa Cruz
Monterey Bay
Monterey
California
N
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MILES
101
880
280
1
85
17
152

T R A N S M I T T A L

Date: **June 30, 2020**

To: **Colin Bowser, Coastal Program Analyst** *(NOID and Supporting Information)*
California Coastal Commission
725 Front Street, Suite 300
Santa Cruz, CA 95060

Re: **Notice of Impending Development 12 (NOID 12 20-1)**
Public Access To and Within Younger Lagoon Natural Reserve
Coastal Science Campus
100 Shaffer Road
Santa Cruz, CA 95060

From: **Jolie Kerns, Director of Campus Planning**
University of California, Santa Cruz
1156 High Street, Barn G
Santa Cruz, CA 95064

Copies of Notice of Impending Development (NOID 12 20-1) transmitted to:

Local Agencies
Director of Planning and Community Development
809 Center Street, Room 206
City of Santa Cruz
Santa Cruz, CA 95060

Director of Planning
County of Santa Cruz
701 Ocean Street
Santa Cruz, CA 95060

Residents and Property Owners within 100'
Manager of de Anza Mobile Home Park
2395 Delaware Avenue
Santa Cruz, CA 95060

Barry Swenson Builder (owner of 801 Shaffer Road)
740 Front Street, #315
Santa Cruz, CA 95060

Manager of Pacific Shores
1240 Shaffer Road
Santa Cruz, CA 95060

Union Pacific Railroad
1400 Douglas Street
Omaha, NE 68179

Bob Goode
1464 Upper Park Road
Santa Cruz, CA 95065

Consulted Agencies *not applicable for this NOID*

Interested Individuals

Coastal Science Campus Entities
Institute of Marine Sciences
Attn: Ashley Vizagurra
UC Santa Cruz
115 McAllister Way
Santa Cruz, CA 95060

California Department of Fish and Wildlife
Attn: Laird Henkel
151 McAllister Way
Santa Cruz, CA 95060

National Oceanic and Atmospheric Administration
Attn: Steve Linley
110 McAllister Way
Santa Cruz, CA 95060

UCSC Natural Reserves
Attn: Gage Dayton
Environmental Studies Department
UC Santa Cruz
1156 High Street
Santa Cruz, CA 95064

Caretaker 1
UC Santa Cruz
115 McAllister Way
Santa Cruz, CA 95060

Caretaker 2
UC Santa Cruz
115 McAllister Way
Santa Cruz, CA 95060

Short-term Marine Science Campus Residents *not applicable at this time*

Long-term Marine Science Campus Residents *not applicable at this time*

Notice of Impending Development 12 20-1

A Notice of Impending Development (NOID) provides notice to the public and the California Coastal Commission of UC Santa Cruz' intention to undertake a development project at its Coastal Science Campus (CSC, formerly the Marine Science Campus). In order for a project to be implemented, it must be contemplated by and within the parameters of the Marine Science Campus Coastal Long Range Development Plan (CLRDP). The CLRDP is available at UCSC's McHenry Library, the Santa Cruz Public Library and at: https://lrdp.ucsc.edu/final-clrdp.shtml.

The California Coastal Commission will review the project that is the subject of this NOID and determine if it is consistent with the CLRDP. The California Coastal Commission will provide advanced public notice of the date of the hearing.

Project Summary for NOID 12 20-1
Public Access to and Within Younger Lagoon Natural Reserve

The project is a Younger Lagoon beach access management plan for the next five years.

Supporting Information, which includes more details about this project is available at: http://ppc.ucsc.edu/planning/EnvDoc.html. A hard copy is available for review at UC Santa Cruz Office of Physical Planning, Development and Operations, 1156 High Street, Barn G, Santa Cruz, CA 95064.

University Approval Date **January 2010**
see CLRDP 8.1.4 (5)

NOID Posting Date **June 30, 2020**
see CLRDP 8.2.4

Environmental Compliance (CEQA/NEPA) Date **October 2009**
see CLRDP 8.1.4 (5)

X	CEQA	Categorical Exemption CEQA document
___	NEPA	____________________ NEPA document

UC Santa Cruz Project Manager

Name Elizabeth Howard
Phone (831) 459-2455
Email eahoward@ucsc.edu

Coastal Commission Contact

Name Colin Bowser
Phone (831) 427-4863
Email Colin.Bowser@coastal.ca.gov

Notice of Impending Development 12 20-1

Public Access to and within Younger Lagoon Natural Reserve

Supporting Information

see CLRDP 8.2.5

Table of Contents

1. Project Report

1a. NOID 12 (20-1) Project Description

PUBLIC ACCESS TO AND WITHIN YOUNGER LAGOON NATURAL RESERVE (IMPLEMENTATION MEASURE 3.6.3)

Overview

CLRDP Implementation Measure (IM) 3.6.3 requires that the public have access to Younger Lagoon Reserve beach through controlled visits, and that a monitoring program be created to document the condition of native flora and fauna within Younger Lagoon and its beach over a five-year period. IM 3.6.3 also requires that the campus prepare a report at the end of the five-year period which presents the results of the monitoring and a discussion of the potential effect of controlled beach access on flora and fauna at Younger Lagoon. At the end of each five-year period, the University must submit a Notice of Impending Development (NOID) to the Coastal Commission to implement a beach access plan for the next five years (e.g. 2010, 2015, 2020).

In March 2010, the California Coastal Commission approved the University of California, Santa Cruz's (UCSC) first NOID for Implementation Measure 3.6.3 [NOID 2 (10-1)] as consistent with UCSC's approved Coastal Long Range Development Plan.

On September 13, 2018, the California Coastal Commission approved UCSC's NOID 9 (18-1) as consistent with UCSC's approved Coastal Long Range Development Plan with the addition of five staff-recommended special conditions. These included 1) Free Beach Tours, 2) Beach Tour Outreach Plan, 3) Beach Tour Signs, 4) Beach Tour Availability and Monitoring, and 5) Beach Access Management Plan Duration. Because NOID 9 (18-1) was not approved until 2018, special condition 5 required the University to submit the next beach management NOID by June 30, 2020 to get back on the 5-year review schedule.

Due to COVID-19 precautions, the Seymour Center was temporarily closed, and the free beach tour program temporarily suspended in early March 2020. The University will restart the free beach tour program when the Seymour Center reopens (see UC Santa Cruz's Pub. Res. Code section 30611 notification letter to the Commission).

This NOID 12 (20-1) describes the University's beach access plan for the next five years, 2021-2025. The University is proposing that the current beach access plan - including the five special conditions required by NOID 9 (18-1), continue once the Seymour Center reopens. In the interim, the University is proposing to create a free bilingual (English and Spanish) virtual beach tour to continue to provide access to the Younger Lagoon beach.

Background

More than fifty years ago, the University of California Natural Reserve System began to assemble, for scientific study, a system of protected sites that would broadly represent California's rich ecological diversity. Today the UC Natural Reserve System is composed of 41 reserves that encompass approximately 750,000 acres of protected natural land available for university-level instruction, research, and outreach throughout the state. The UC Natural Reserve System supports research and education through its mission of contributing *"to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California."* By creating this system of outdoor classrooms and living laboratories, and making it available specifically for long-term study and education, the UC Natural Reserve System supports a variety of disciplines that require fieldwork in wildland ecosystems. UC Santa Cruz administers four UC Natural Reserves: Younger Lagoon, Año Nuevo Island Reserve, Landels-Hill Big Creek Reserve, and Fort Ord Natural Reserve as well as a 400-acre campus reserve at the UC Santa Cruz residential campus.

History of Public Access to Younger Lagoon Beach

This summary provides a coarse overview of the major events that affected beach access at Younger Lagoon. Prior to 1972, Younger Beach was privately owned and closed to the public. The owners (Donald and Marion Younger) actively patrolled for, and removed, trespassers from their property, including the beach. In 1972, the Younger Family donated approximately 40 acres of their property to the University of California for the study and protection of the marine and coastal environment. These lands included Younger Lagoon and Beach (approximately 25 acres), and an adjoining parcel of land (approximately 15 acres) which became the site of the original Long Marine Laboratory. At the time of their donation, Donald and Marion Younger intended that the lagoon, beach and surrounding slopes be protected in perpetuity by the University as a bird sanctuary, and the original coastal development permit for the site (P-1859) deemed that the "lagoon will be managed and preserved as a natural area for waterfowl and terrestrial birds and animals".

In the years between the donation of the property and the start of Long Marine Laboratory construction (1976), the University leased the future Long Marine Laboratory site back to farmers who had been farming the property for the Younger family prior to the donation. During those years, the same no-trespassing rules for the beach were enforced as when the property was owned by the Younger family.

Once construction of Long Marine Laboratory began in 1976, the land was no longer under the watch of the farmers, and public pressure on the beach began to increase. Many Santa Cruz locals remember the next several years at Younger Beach fondly as it became a popular nude beach. The increased public access had a noticeable impact on the flora and fauna of the beach, and was not in accordance with the intention of the original donation by the Younger family. By 1978 discussions had begun between the University and the California Coastal Commission regarding the impact of uncontrolled public access to the beach. In 1981, it was decided that the impacts to Younger Beach were significant and the California Coastal Commission, under permit P-1859, closed uncontrolled access to the beach.

After the approval of the 1981 coastal permit P-1859, the University began actively to patrol the beach for trespass and to educate the public about the closure. After Younger Lagoon Reserve was incorporated into the UC Natural Reserve System in 1986, users were required to fill out applications or contact Natural Reserve staff for specific research, education, or outreach efforts. As the Long Marine Laboratory campus grew, a protective berm and fencing were constructed around the perimeter of the lagoon, and informational 'beach closed' signs were posted on the cliffs above the beach. Over time, trespass decreased and the reduced public access had a noticeable positive impact on flora fauna as well as beach/dune habitat. (See 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2016-2017, 2017-2018, and 2018-2019 Younger Lagoon Reserve Annual Reports).

Public access to Younger Lagoon Reserve beach came to the forefront again during the CLRDP negotiation process (2000-2008). At the time negotiations began, Younger Lagoon Reserve supported a rich composition of plant and animal species despite being surrounded by agricultural and urban development. Reserve staff were concerned that any increase in public access could threaten the already heavily impacted habitat and impact ongoing and future research efforts. After CLRDP certification (2009), Beach Access Management Plans were implemented as outlined in UC Santa Cruz's NOID 2 (10-1) and NOID 9 (18-2). Under the current Beach Access Management Plan, the Younger Lagoon Reserve beach remains closed to unsupervised public access and the reserve has implemented a management and monitoring plan that is consistent with other UC Reserves and includes public access through free docent-guided beach tours. Although infrequent, unauthorized access including trespass and vandalism of the Younger Lagoon Reserve beach continue and put research equipment and sensitive resources at risk. Reserve staff will continue to work hard to protect sensitive resources and maintain the Younger Lagoon Reserve beach as an important outdoor classroom and living laboratory.

Members of the public entering Younger Lagoon Reserve are required to adhere to the UC Natural Reserve System Reserve Use guidelines. Because beach tours are limited to groups with trained docents, no additional signage or fences on the beach have been required. The beach access trail consists of a simple dirt/mulch path that was in place prior to the approval of NOID 2 (10-1). The trail is maintained by clipping overgrown vegetation and maintaining the earthen path and timber steps as needed.

Implementation of NOID 2 (10-1) and NOID 9 (18-1)

Docent Led Tour Program

From 2010 - 2017, docent-led beach tours were offered twice monthly through the Seymour Marine Discovery Center (Seymour Center) per NOID 2 (10-1) (approved in 2010).

In October 2017, in an effort to meet Commissioner requests to increase the number of tours and as part of NOID 9 (18-1) refinement and approval, Seymour Center staff analyzed historic tour data and identified those months during which tour demand was low (October-February), and those months during which there was higher demand (March-September). Based on these data, beginning in January 2018, the University conducted a pilot program with the Seymour Center and began offering tours twice a month during the slower fall and winter months (October-February), and four times a month during the busier spring and summer months (March-September). The total number of tours offered in 2018 was increased from 24 to 38 (offering approximately 60% more tours than the previous NOID 2 (10-1) required).

NOID 9 (18-1) (approved in 2018) formalized the increase in the number of tours offered piloted in 2018, as part of five special conditions of approval. The special conditions included 1) Free Beach Tours, 2) Beach Tour Outreach Plan, 3) Beach Tour Signs, 4) Beach Tour Availability and Monitoring, and 5) Beach Access Management Plan Duration.

Since 2010, the extent of the beach area accessed by the tours has varied depending on tidal conditions and the location of plants, as foot traffic is only permitted seaward of the dune vegetation. Thus, the exact access area may vary slightly from the areas depicted in Figure 2 below and Figure 3.11 of the CLRDP. The trail used to access the beach provides an interpretive experience for visitors that begins with a narrative history of the UC Natural Reserve System, an overview of the lagoon, a walk through a restored coastal scrub habitat with opportunities to view the rear dune, and ends on Younger Lagoon Reserve beach.

Tours continue to be led by Seymour Center docents trained in the natural history and ecology of YLR and provide detailed information about flora, fauna, geology, and the UC Natural Reserve System. Tour curriculum focuses on the unique ecology of the Younger Lagoon Reserve beach.

The free docent-led beach tours are part of broader public education and outreach programming on the Coastal Science Campus, including community events, volunteer stewardship workdays, and hands-on learning opportunities for K-12 students. In addition to the docent-guided beach tours, visual access to the lagoon and back dune is provided to the public via a public overlook along McAllister Way (Figure 1). This overlook (Overlook E) is open to the public and includes interpretative signage that provides information on the free beach tours. In addition to Younger Lagoon Reserve Beach tours, visual access to the Younger Lagoon beach and information about Younger Lagoon Reserve is also provided to all visitors taking the Seymour Center's other docent-guided Reserved and Daily Tours via the Overlook C (Figure 1).

Since 2010, tours have been advertised via a variety of outlets, including press releases, calendar listings, print ads, public radio ads, social media, and the Seymour Center and Younger Lagoon Reserve websites. From 2010-2018, YLR Beach tours were filled via phone reservation. Starting in 2019, free docent-led beach tour sign-ups were made available by phone and at the Seymour Center public admissions counter. Since 2010, the Seymour Center has kept track of all required user data. From 2010-2017, tours were limited to 12 persons. Since 2018, tours were increased to 14 persons with the goal to turn no one away. The free docent-led beach tours are best suited for adults in good physical condition and children over 10 years of age.

Public members entering YLR are required to adhere to the UC Natural Reserve System (NRS) Reserve Use guidelines. Because the free beach tours are limited to groups with trained docents no additional signage or fences have been required. The beach trail consists of a simple dirt/mulch path that was already in place. The trail is maintained by clipping overgrown vegetation and maintaining the earthen path and timber steps as needed.

Figure 1. Younger Lagoon Overlooks. Left panel shows the view from the Overlook E located along McAllister Way. Overlook E is open to the public without reservation and includes interpretative signage that provides information on how to sign-up for the beach tour. Right panel shows the view from the Overlook C, which is accessed by docent-led tours.

Biologcal Monitoring Program

Although Implementation Measure 3.6.3 (IM 3.6.3) of the CLRDP only requires monitoring of the YLR beach, YLR staff, faculty, and a Scientific Advisory Committee (that was jointly appointed by Executive Director, Peter Douglas and Chancellor George Blumenthal) decided to monitor nearby beaches with varying levels of use (Natural Bridges and Sand Plant Beach) during the five-year period starting in 2010 in order to examine differences in the flora, fauna and human use among the three sites. This effort required hundreds of hours of staff and student time, as well as coordination with State Parks staff. The annual survey results were included in annual reports submitted to the Coastal Commission over the past nine years. The Younger Lagoon Natural Reserve Beach Monitoring Report 2019 included in this NOID (Section 5) describes the monitoring program in detail and presents the results of the entire beach monitoring program (Section 5).

Data collected during the first five years of resource monitoring indicated that Younger Lagoon supports a wide variety of native flora and fauna, provides habitat for sensitive and threatened species, supports a unique beach dune community, and is frequently used for teaching and research.

In general, native plant species richness was greatest at YLR and Natural Bridges compared to Sand Plant Beach; however, there was quite a bit of annual variation among the sites. A parameter that we quantified in 2012, and is evident from visual observation and photo documentation, is the presence of dune hummocks and downed woody material at YLR, both of which are almost entirely absent at local beaches due to human use. These features provide habitat for plant species such as the succulent plant *dudleya*, which grow on downed woody material and dune hummocks, as well as burrowing owl that use burrows in hummocks and seek shelter beneath downed woody material. The relatively natural state of YLR beach and dune vegetation is unique among most pocket beaches in Santa Cruz County and likely represents a glimpse into what many of the pocket beaches in the greater Monterey Bay area looked like prior to significant human disturbance.

Species lists for birds, mammals, plants, reptiles, amphibians, and fish are included as Appendices I-IV. These lists provide an overview of the flora and fauna that have been recorded at Younger Lagoon over the years. Although there have been numerous surveys of the area, to the best of our knowledge the monitoring project outlined in NOID 2 (10-1) and undertaken over the last ten years provided the most extensive survey effort for flora and fauna on the Reserve, resulting in numerous additions to the Reserve's species lists. Younger Lagoon provides important habitat for numerous animals and supports a rich composition of plant species. The lack of disturbance and low human activity are likely the primary factors that maintain the high diversity in the Lagoon. Track survey and camera trap work have documented bobcat, coyote, deer, and numerous other mammals on the beach; many of these species are likely residents within the Reserve. Track survey results also indicate that several of these mammals are residing (at least occasionally) in the Reserve and use the area as hunting grounds. For example, bobcat sign indicates that this species successfully hunts for roosting pelagic birds within the Reserve boundaries. These observations suggest that although Younger Lagoon is a relatively small area, amidst agriculture and development, this relic habitat is still functioning at a level beyond most developed beaches and lagoons in the region.

The results of the monitoring program indicate that open access to the beach would result in the loss of the unique ecological characteristics of the site, reduce its effectiveness as a research area for scientific study, and likely have a negative impact on sensitive and protected species.

Proposed Project

The University is proposing to continue the existing Beach Access Management Plan for an additional five years. The Beach Access Management Plan is comprised of the free docent led beach tour program and the biological monitoring program.

Free Docent Led Beach Tour Program

Once the Seymour Center is reopened to the public, the University is proposing to continue the existing free docent-led beach tour program - including the five special conditions required by NOID 9 (18-1), for an additional five years with the inclusion of changes required by COVID-19 public health orders (e.g. masking, sanitizing, distancing). In the interim, the University is proposing to create a free bilingual (English and Spanish) virtual beach tour to continue to provide access to the Younger Lagoon beach.

Free Beach Tours

All beach tours will continue to be offered for free (without admission fee). Beach tour sign-ups will continue to be available by phone and at the Seymour Center public admissions counter. Seymour Center staff will continue to track any tour requests that are denied due to lack of tour availability or because tours are fully booked as part of their ongoing monitoring of all visitor programs. Seymour Center staff will continue to record the number of participants that were denied, the number of participants that were wait listed, as well as the date of the request and the date of the tour being requested. The Younger Lagoon Reserve and the Seymour Marine Discovery Center websites will continue to clearly identify that access to the beach is available for free via beach tours.

https://youngerlagoonreserve.ucsc.edu/about-us/index.html
https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html
https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/

Location

The tours will continue to be led by Seymour Center docents, and will include a narrative history of the UC Natural Reserve System, an overview of the lagoon, a walk through a restored coastal scrub habitat with opportunities to view the rear dune, and end on the beach. Because beach tours are limited to groups with trained docents no additional signage or fences will be required. Maintenance of the trail by clipping overgrown vegetation and maintaining the earthen path and timber steps will be continued. No changes to the tour access area are proposed (see Figure 4).

Beach Tour Outreach Plan

Outreach will continue to be conducted according to the following plan:

Venue	Language	Schedule
Seymour Center Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Permanent webpage: https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/
YLR Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Permanent webpages: https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html
Seymour Center Social Media o Facebook o Twitter o Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Facebook—Monthly Twitter, Instagram ---Once a quarter
YLR Social Media o Facebook o Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**.	Once a quarter
Calendar Listings o UCSC Events o Good Times Newspaper (Santa Cruz) o KAZU public radio (Santa Cruz) o Register Pajaronian Newspaper (Watsonville) o The Californian Newspaper (Salinas)	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 14 participants. Call **831-459-3800**. For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 14 participantes. Llame al **831-459-3800**.	Submitted monthly (calendar listings appear at the discretion of the media outlet.) Submitted monthly (calendar listings appear at the discretion of the media outlet.)

o La Network Campesina Radio 107.9 (Salinas)		

Beach Tour Signs

Information on the free beach tours will continue to be displayed “day of” on a large sign in the front window of the Seymour Center, public admissions counter, and front window. “Day of” signage includes the brown and white footprints on wave logo, and the following language “Free Younger Lagoon Reserve Beach Tours Today” (Figure 2). Signage has been added to the information kiosk outside of the Seymour Center and to Overlooks A-F. Overlooks and kiosk signage include the brown and white footprints on wave logo and include the following language “Free Younger Lagoon Reserve Beach Tours, Call (831) 459-3800” (Figure 3).

<u>Figure 2.</u> “Day of” sign design.

<u>Figure 3.</u> Overlooks and kiosk sign design.

Beach Tour Availability and Monitoring

Consistent with observed demand, free docent-led beach tours will be offered at least four times per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th, and at least two times per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (a minimum of 38 total beach tours per year). In other words, free docent-led beach tours will be offered twice a month in January and February, four times per month in March, April, May, June, July, August, and September, and twice a month in October, November, and December.

Virtual Bilingual Beach Tours

The University will create a free bilingual (English and Spanish) virtual beach tour to continue to provide public access to the Younger Lagoon beach while the Seymour Center is closed and the free docent led beach tour program suspended due to COVID-19 impacts. The virtual tour will follow the same route and include the same information on the unique history and ecology of the beach that is presented during the free docent-led beach tours. The virtual beach tour will be hosted on the Younger Lagoon Reserve and Seymour Center websites and advertised via social media accounts and newsletters. In addition, the tour will also be shared with local K-12 school groups who use the reserve for hands-on learning but are unable to visit the reserve in person due to COVID-19 impacts.

Biological Monitoring Program

The University will continue to monitor YLR Beach as required by, and described in, IM 3.6.3; however, YLR staff stopped monitoring at Natural Bridges State Beach or Sand Plant Beach in 2015 as the past five years of data collection have provided us with adequate information to assess differences in beach resources. The goal of the monitoring program is to document the presence and distribution of flora and fauna within YLR and to evaluate changes in distribution and density over time.

Variables that will be monitored include: user data, changes as observable in photo documentation, tidewater goby surveys, species composition and seed production of beach dune vegetation, species composition of animals, and abundance of feeding shore birds. Details for each of the aforementioned parameters are described below.

User Data— User data from tours and other outreach and education programming conducted by the Seymour Center, as well as research and education use of YLR, will be recorded and maintained by Seymour Center and YLR Staff.

Human Beach Use— We will use remote cameras to quantify human use of YLR Beach. A camera will be placed along the western edge of Younger Lagoon quarterly with each separate sampling events each consisting of two days. Cameras will be set to automatically take photos at 15 minute intervals. Number of people will be quantified for 15 minute intervals during the day (camera time will vary across sampling periods due to day length and position; however, we will standardize within each sampling period).

Photo Documentation—Photo point locations have been established at three locations within YLR (Figure 5). These locations were chosen to ensure coverage of all major areas of the beach. Photos will continue to be taken annually during late spring to early summer (May – July). Photos will be taken at these photo points in order to ensure repeatability over time. At each photo point we will collect the following monitoring information:

- Photo point number
- Date
- Name of photographer
- Bearing
- Camera and lens size
- Coordinates
- Other comments

In addition to these three points, a permanent camera has been installed on the west side of the lagoon.

Tidewater Goby Surveys— Tidewater goby surveys will be conducted at YLR Beach quarterly each year. Surveys will be conducted using a 4.5 ft x 9 ft beach seine with 1/8 inch mesh. The objectives of the surveys are to document tidewater goby presence and evidence of breeding activity (determined by the presence of multiple size/age classes). All fish will be identified to species and counted. When individuals exceed ~50 per seine haul, counts will be estimated. Sampling will be conducted with the goal of surveying the various habitats at the lagoon (e.g. sand, sedge, willow, pickleweed, deep, shallow, etc.).

Species Composition and Coverage of Beach Dune Vegetation—Implementation Measure 3.6.3 requires that dune vegetation "*from the lowest (nearest to the mean high tide line) occurring terrestrial plant to 10 meters inland into the strand vegetation*" be surveyed to document species composition, cover, and seed production. Figure 4 shows a potential survey area for dune vegetation; however, the exact location and extent of survey area will vary annually depending upon the location of the "lowest" plant detected each year. Within the survey area we will establish a 50-m east-west transect across the dune vegetation and measure the distance from the estimated mean high tide line to the "lowest" plant on the beach. Herbaceous species composition will be measured by visual estimation of absolute cover for each species in ten 0.25 m^2 quadrats along the transect. Quadrats will be placed every 5 m on alternating sides of the transect starting at a randomly selected point between 1 and 5 meters (a total of 10 quadrats per transect). A clear plastic card with squares representing 1, 5, and 10% of the sampling frame will be used to help guide visual cover estimations. Species cover (native and exotic), bare ground, and litter will be estimated at 5% intervals. Litter will be specifically defined as residue from previous year's growth while any senescent material that is recognizable as growth from earlier in the current growing season will be counted as cover for that species. After all cover estimates have been made, we will conduct surveys within 2 m of either side of the transect (a 4 × 50 m belt). In the belt transects, individual species will be recorded as either seedlings or greater than 1 year old. The presence of flowers and seeds will also be noted.

Non-avian Vertebrate Monitoring

Tracks— Vertebrate tracks will be measured using raked sand plots quarterly throughout the study period. Tracking stations will be placed throughout the beach area in constriction zones where vegetation is absent. The objective of these surveys will be simply to detect what species use the beach habitat. As such, plot size will vary depending upon the amount of available open sandy area at each location. Track stations will be raked each evening and checked for tracks in the morning. Stations will remain open for two days during each monitoring bout. Tracks will be identified to species when possible. Species composition will be summarized; however, abundance will not be quantified due to the fact that most often tracks cannot be used to identify individual animals (e.g. a single individual could walk across the plot multiple times).

Small Mammals—Sherman live traps will be placed on beach habitat for two nights every quarter of the study period. A total of 30 traps will be placed at each site and sampled for a period of two evenings (60 trap nights per sampling bout). Traps will be set at dusk and collected at dawn. Each trap will be baited with rolled oats and piece of synthetic bedding material will be placed in each trap to ensure animals do not get too cold. Individuals will be identified to species, marked with a unique ear tag, and released at the site of capture.

Invertebrate Monitoring—Terrestrial invertebrates on beach habitat will be monitored by placing one 12 oz plastic container (pit fall traps) at each tracking station (one at each plot) during "non-avian vertebrate monitoring" efforts. Traps will be buried to the lip of the container; terrestrial vertebrates fall into the trap passively. Traps will be checked each morning and all individuals will be identified and counted.

Avian Monitoring—Ocular surveys of birds on the beach, lagoon, and cliff habitats will be conducted at each site. Survey locations will be selected along one edge of the beach on the cliff. The entire beach area, fore portion of the lagoon, and western cliff will be surveyed from the eastern edge of the lagoon. The top and western face of the rock stack that is located at the beach/ocean edge will also surveyed. Counts will be recorded quarterly throughout the study. Surveys will be conducted in the dawn or dusk hours within approximately 2 hours of sunrise or sunset and of one another. Data from the two days during each sampling effort will be combined and individuals will be identified and counted.

Beach Access Management Plan Duration and Monitoring
Every six months (i.e., by June 30th and December 31st each year), UCSC will submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval.

Every year, UCSC will submit a summary report on the free docent led beach tour program and biological monitoring program as part of the Younger Lagoon Reserve Annual Report.

UCSC will submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2026 to December 31, 2030) no later than July 1, 2025.

Figure 4. Overview of beach tour route. Visitors on docent led tours will have beach access within the "Beach Access Area." The extent of the beach access area will vary from year to year dependent upon the location of plants (i.e. foot traffic will be seaward of the dune vegetation). The above depiction represents the approximate location of plants in the spring of 2009.

Figure 5. Locations of monitoring points, plots, and regions for YLR beach. The beach monitoring area, survey points, and track stations will vary between years depending upon the high water mark. Dune plant surveys will occur within 10 m of the high water mark as per the CLRDP guidelines.

Appendix I. Younger Lagoon Bird List

Birds of Younger Lagoon

LOONS
Red-throated Loon
Pacific Loon
Common Loon

GREBES
Pied-billed Grebe
Horned Grebe
Red-necked Grebe
Eared Grebe
Western Grebe
Clark's Grebe

FULMARS and SHEARWATERS
Northern Fulmar
Pink-footed Shearwater
Buller's Shearwater
Sooty Shearwater
Black-vented Shearwater

PELICANS and CORMORANTS
Brown Pelican
Double-crested Cormorant
Brandt's Cormorant
Pelagic Cormorant

FRIGATEBIRDS
Magnificent Frigatebird

HERONS and EGRETS
American Bittern
Great Blue Heron
Great Egret
Snowy Egret
Cattle Egret
Green Heron
Green-backed Heron
Black-crowned Night Heron

WATERFOWL
Tundra Swan

OWLS
Barn Owl
Great Horned Owl
Burrowing Owl
Short-eared Owl

SWIFTS
Black Swift
Vaux's Swift
White-throated Swift

HUMMINGBIRDS
Anna's Hummingbird

Rufous Hummingbird
Allen's Hummingbird

KINGFISHERS
Belted Kingfisher

WOODPECKERS

Downy Woodpecker
Northern Flicker
(Common Flicker)

FLYCATCHERS and KINGBIRDS
Western Wood Pewee
Willow Flycatcher
Pacific-slope Flycatcher
Black Phoebe
Say's Phoebe
Ash-throated Flycatcher
Tropical Kingbird
Western Kingbird

LARKS
Horned Lark

SWALLOWS
Tree Swallow
Violet-green Swallow
Northern

Birds of Younger Lagoon

Mute Swan
Snow Goose
Brant
Canada Goose
Green-winged Teal
Mallard
Northern Pintail
Cinnamon Teal
Northern Shoveler
Gadwall
Eurasian Wigeon
American Wigeon
Ring-necked Duck
Greater Scaup
Lesser Scaup
Harlequin Duck
Black Scoter
Surf Scoter
White-winged Scotter
Common Goldeneye
Bufflehead
Hooded Merganser
Red-breasted Duck
Ruddy Duck

VULTURES, HAWKS, and EAGLES

Turkey Vulture
Osprey
White-tailed Hawk
(Black
Northern Harrier
Sharp-shinned Hawk
Cooper's Hawk
Red-shouldered Hawk
Red-tailed Hawk
Ferruginous Hawk
Rough
Golden Eagle
American Kestrel
Merlin
Peregrine Falcon

QUAILS and PHEASANTS

Ring-necked Phaesant

Rough-winged Swallow
Cliff Swallow
Barn Swallow

JAYS and CROWS

Western Scrub
American Crow
Common Raven

CHICKADEES and BUSHTITS

Chestnut-backed Chickadee
Chickadee
Bushtit

WRENS

Bewick's Wren
House Wren
Marsh Wren

KINGLETS

Golden-crowned Kinglet
Ruby-crowned Kinglet

THRUSHES

Swainson's Thrush

Hermit Thrush
American Robin

WRENTITS

Wrentit

MOCKINGBIRDS and THRASHERS

Northern Mockingbird
Sage Thrasher

WAGTAILS and PIPITS

Yellow Wagtail
American Pipit (Water Pipit)

WAXWINGS and SHRIKES

Cedar Waxwing
Loggerhead Shrike

STARLINGS

Birds of Younger Lagoon

California Quail

RAILS and COOTS

Virginia Rail
Sora
Common Moorhen
American Coot

SHOREBIRDS

Black -bellied Plover
Snowy Plover
Semipalmated Plover
Killdeer
American Oystercatcher
(American Black
Oystercatcher
Black-necked Stilt
American Avocet
Greater Yellowlegs
Lesser Yellowlegs
Willet
Wandering Tattler
Spotted Sandpiper
Whimbrel
Long-billed Curlew
Marbled Godwit
Ruddy Turnstone
Black Turnstone
Surfbird
Sanderling
Western Sandpiper
Least Sandpiper
Baird's Sandpiper
Pectoral Sandpiper
Dunlin
Short-billed Dowitcher
Long-billed Dowitcher
Wilson's Snipe
Common Snipe

PHALARONES

Red-necked Phalarope
Red Phalarope

European Starling

VIREOS

Warbling Vireo

WARBLERS

Orange-crowned Warbler
Yellow Warbler
Yellow-rumped Warbler
Townsend's Warbler
Palm Warbler
Northern Waterthrush
MacGillivray's Warbler
Common Yellowthroat
Wilson's Warbler

BUNTINGS and GROSBEAKS

Indigo Bunting
Dickcissel

TOWHEES and SPARROWS

Spotted Towhee
Canyon Towhee
Chipping Sparrow
Clay-colored Sparrow
Vesper Sparrow
Lark Sparrow
Savannah Sparrow
Fox Sparrow
Song Sparrow
Lincoln's Sparrow
Swamp Sparrow
White-throated Sparrow
Golden-crowned Sparrow
White-crowned Sparrow

JUNCOS and LONGSPURS

Dark-eyed Junco
Lapland Longspur

BLACKBIRDS, MEADOWLARKS, and ORIOLES

Bobolink
Red-winged Blackbird
Tricolored Blackbird

Birds of Younger Lagoon

JAEGERS
Pomarine Jaeger
Parasitic Jaeger

GULLS
Bonaparte's Gull
Heermann's Gull
Mew Gull
Ring-billed Gull
California Gull
Herring Gull
Thayer's Gull
Western Gull
Glaucous-winged Gull
Black-legged Kittiwake
Sabine's Gull

TERNS
Caspian Tern
Elegant Tern
Common Tern
Arctic Tern
Forster's Tern

ALCIDS
Common Murre
Pigeon Guillemot
Marbled Murrelet
Ancient Murrelet
Rhinoceros Auklet

DOVES and PIGEONS
Rock Pigeon
Band-tailed Pigeon
Mourning Dove

Western Meadowlark
Rusty Blackbird
Brewer's Blackbird
Brown-headed Cowbird
Hooded Oriole
Scott's Oriole

FINCHES
House Finch
Pine Siskin
Lesser Goldfinch
Lawrence's Goldfinch
American Goldfinch

WEAVER FINCHES
House Sparrow

Appendix II: Younger Lagoon Mammal List

Mammals of Younger Lagoon
DIDELPHIDAE
Virginia Opossum *Didelphis virginiana*

SORICIDAE
Vagrant Shrew *Sorex sp.*

LEPORIDAE
Brush Rabbit *Sylvilagus bachmani*

SCIURIDAE
California Ground Squirrel *Spermophilus beecheyi*

GEOMYIDAE
Botta's Pocket Gopher *Thomomys bottae*

CRICETIDAE
Western Harvest Mouse *Reithrodontomys megalotis*
Deer Mouse *Peromyscus maniculatus*
Pinyon Mouse *Peromyscus truei*
Dusky-footed Woodrat *Neotoma fuscipes*
California Vole *Microtus californicus*

MURIDAE
Norway Rat *Rattus norvegicus*
House Mouse *Mus musculus*

CANIDAE
Coyote *Canis latrans*
Common Gray Fox *Urocyon cinereoargenteus*

PROCYONIDAE
Common Raccoon *Procyon lotor*

MUSTELIDAE
Long-tailed Weasel *Mustela frenata*
Striped Skunk *Mephitis mephitis*

FELIDAE
Bobcat *Felis rufus*
CERVIDAE
Mule Deer *Odocoileus hemionus*

Appendix III: Younger Lagoon Plants

FAMILY	*Scientific name*	Common name
FERNS AND FERN-ALLIES		
DENNSTAEDTIACEAE		
	Dryopteris argute	Coastal wood fern
	Polypodium californicum	California polypody
	Polystichum munitum	Sword Fern
	Pteridium aquilinum var. pubescens	Bracken fern
CONIFERS (GYMNOSPERMS)		
PINACEAE		
	**Pinus radiate*	Monterey pine
CUPRESSACEAE		
	**Hesperocyparis macrocarpa*	Monterey cypress
FLOWERING PLANTS (ANGIOSPERMAE - DICOTYLEDONEAE)		
ADOXACEAE		
	Sambucus nigra	Black elderberry
	Sambucus racemosa var. racemose	Pacific red elderberry
AIZOACEAE		
	**Carpobrotus edulis*	Iceplant
ANACARDIACEAE		
	Toxicodendron diversilobum	Poison oak
APIACEAE		
	**Conium maculatum*	Poison hemlock
	**Foeniculum vulgare*	Fennel
	Oenanthe sarmentosa	Pacific oenanthe
	Sanicula arctopoides	Footsteps of spring
	Sanicula crassicaulis	Pacific sanicle

ASTERACEAE		
	Achillea millefolium	Yarrow
	Ambrosia chamissonis	Beach bur
	Anaphalis margaritacea	Pearly everlasting
	**Anthemis cotula*	Stinking pineapple weed
	**Artemisia biennis*	Biiennial wormwood
	Artemisia californica	California sagebrush
	Artemisia douglasiana	Douglas' mugwort
	Artemisia pycnocephala	Beach sagewort
	Baccharis glutinosa	Douglas' baccharis
	Baccharis pilularis	Coyote brush
	**Carduus pycnocephalus*	Italian thistle
	**Centaurea melitensis*	Malta star thistle
	**Circium arvense*	Canada thistle
	Circium quercetorum	Brownie thistle
	**Cirsium vulgare*	Bull thistle
	Corethrogyne filaginifolia	Common sandaster
	Cotula coronopifolia	Brass buttons
	**Delairea odorata*	Cape ivy
	Erigeron Canadensis	Horseweed
	Erigeron glaucus	Seaside daisy
	Eriophyllum staechadifolium	Lizard's tail
	Gnaphalium palustre	Western marsh cudweed
	Grindelia stricta	Coastal gum plant
	**Helminthotheca echioides*	Bristly oxtounge
	**Hypocharis glabra*	Smooth cat's ear
	**Hypocharis radicata*	Rough cat's ear
	**Hypocharis glabra*	Bristly ox-tonge
	Jaumea carnosa	Fleshy jaumea
	**Lactuca serriola*	Prickly lettuce
	Madia gracilis	Gumweed
	**Matricaria discoidea*	Pineapple weed
	Pseudognaphalium beneolens	Cudweed
	Pseudognaphalium californicum	Ladies tobacco
	**Pseudognaphilum luteoalbum*	Jersey cudweed
	Pseudognaphalium ramosissimun	Pink everlasting

	Pseudognaphalium stramineum	Cottonbatting plant
	**Senecio cf. elegans*	Purple ragwort
	**Silybum marianum*	Milk thistle
	**Sonchus asper*	Spiny sowthistle
	**Sonchus oleraceus*	Common sowthistle
	Symphyotrichum chilense	California aster
BORAGINACEAE		
	Heliotropium curassavicum	Seaside heliotrope
BRASSICACEAE		
	Barbarea orthoceras	Winter cress
	**Brassica nigra*	Black mustard
	**Brassica rapa*	Field mustard
	**Cakile maritime*	Beach rocket
	**Raphanus sativus*	Wild radish
	**Sinapis arvensis*	Charlock mustard
CAPRIFOLIACEAE		
	Symphoricarpos albus	Common snowberry
CARYOPHYLLACEAE		
	Spergularia macrotheca	Sand spurry
	**Silene gallica*	Common catchfly
CHENOPODIACEAE		
	Atriplex patula	Saltbush
	**Atriplex prostrata*	Fat-hen
	**Chenopodium album*	Lamb's quarters
	**Chenopodium macrospermum*	Largeseed goosefoot
	Salicornia pacifica	Pickleweed
CONVOLVULACEAE		
	Calystegia occidentalis	Western morning glory
	Calystegia purpurata	Morning glory
	Calystegia soldanella	Beach morning glory
CRASSULACEAE		
	Dudleya farinaosa	Sea lettuce

CUCURBITACEAE		
	Marah fabaceus	Wild cucumber
DIPSACACEAE		
	**Dipsacus fullonum*	Fuller's teasel
FABACEAE		
	Acmispon glaber	Deer weed
	**Genista monspessulana*	French broom
	Lupinus albifrons	Silver leaf lupine
	Lupinus arboreus	Yellow bush lupine
	Lupinus bicolor	Miniature lupine
	Lupinu nanus	Sky lupine
	**Medicago polymorpha*	Burr clover
	**Melilotus indicus*	Yellow sweet clover
	**Trifolium angustifolium*	Narrowleaf clover
	Trifolium willdenovii	Tomcat clover
	**Vicia sativa ssp. Sativa*	Common vetch
FRANKENIACEAE		
	Frankenia salina	Alkali heath
GERANIACEAE		
	**Erodium botrys*	Longbeak stork's bill
	**Erodium cicutarium*	Red stemmed filaree
	**Erodium moschatum*	White stemmed filaree
	**Geranium dissectum*	Cutleaf geranium
GROSSULARIACEAE		
	Ribes divaricatum	Spreading gooseberry
	Ribes sanguineum	Flowering currant
IRIDACEAE		
	Sisyrinchium bellum	Blue eyed grass
LAMIACEAE		
	Clinopodium douglasii	Yerba buena
	**Marrubium vulgare*	Common horehound
	Prunella vulgaris	Selfheal

	Stachys bullata	hedge nettle
MALVACEAE		
	**Malva nicaeenis*	Bull mallow
	**Malva parviflora*	Cheeseweed
	Sidalcea malviflora	Checkerbloom
MONTIACEAE		
	Claytonia perfoliate	Miners lettuce
MYRICACEAE		
	Morella californica	California wax myrtle
MYRINACEAE	**Anagallis arvensis*	Scarlet pimpernel
NYCTAGINACEAE		
	Abronia latifolia	Yellow sand verbena
	Abronia umbellata ssp. umbellata	Pink sand verbena
ONAGRACEAE		
	Camissoniopsis cheiranthifolia	Beach evening-primrose
	Epilobium brachycarpum	Fireweed
	Epilobium canum	California fuchsia
	Epilobium ciliatum ssp. watsonii	Willow herb
	Taraxia ovata	Sun cup
OXALIDACEAE		
	Oxalis albicans	Hairy wood sorrel
	Oxalis pes caprae	Bermuda buttercup
PAPAVERACEAE		
	Eschscholzia californica	California poppy
PHRYMACEAE		
	Mimulus aurantiacus	sticky monkey flower
	Mimulus guttatus	seep monkey flower
PLANTAGINACEAE		
	**Plantago coronopus*	Cut leaf plantain
	**Plantago lanceolata*	English plantain
	Plantago maritima	California seaside plantain
PLUMBAGINACEAE		
	Armeria maritima	California seapink

POLEMONIACEAE		
	Navarretia squarrosa	Skunkweed
POLYGONACEAE		
	Eriogonum latifolium	Coastal buckwheat
	Persicaria punctata	Dotted smartweed
	* *Polygonum aviculare*	Prostrate knotweed
	**Rumex acetosella*	Sheep sorrel
	**Rumex conglomeratus*	Green dock
	Rumex crassus	Willow-leaved dock
	**Rumex crispus*	Curly dock
RANUNCULACEAE		
	Ranunculus californicus	California buttercup
RHAMNACEAE		
	Frangula californica	California coffeeberry
PORTULACACEAE		
	**Portulaca oleracea*	Purslane
RHAMNACEAE		
	Ceanothus thyrsiflorus	Blueblossom
ROSACEAE		
	Acaena pinnatifida var. californica	California sheepburr
	Fragaria chiloensis	Beach strawberry
	Horkelia californica	Californica horkelia
	Potentilla anserina ssp. pacifica	Pacific silverweed
	Rosa californica	California wild rose
	Rosa gymnocarpa	Wood rose
	Rubus ursinus	California blackberry
	Rubus armeniacus	Himalayan blackberry
RUBIACEAE		
	***Galium sp.*	**Bedstraw
SALICACEAE		
	Salix lasiolepis	Arroyo willow
SAPINDACEAE		
	Aesculus californica	California buckeye

SCROPHULARIACEAE		
	Scrophularia californica ssp. californica	Bee plant
SOLANACEAE		
	Solanum americanum	American black nightshade
	**Solanum nigrum*	Black nightshade
URTICACEAE		
	Urtica dioica ssp. gracilis	Stinging nettle
	Urtica holosericea	Hoary nettle
FLOWERING PLANTS (ANGIOSPERMAE - MONOCOTYLEDONEAE)		
AGAVACEAE		
	Chlorogalum pomeridianum	Soap plant
CYPERACEAE		
	Bolboschoenus maritimus	Praire bulrush
	Bolboschoenus robustus	Seacoast bulrush
	Carex hafordii	Monterey sedge
	Carex obnupta	Slough sedge
	Cyperus eragrostis	Tall cyperus
	Eleocharis macrostachya	Creeping spike rush
	Isolepis cernua	Low bulrush
	Schoenoplectus acutus var. occidentalis	Hardstem bulrush
	Schoenoplectus americanus	3 Square sedge
	Schoenoplectus californicus	California tule
	Schoenoplectus cernuus var. californicus	Low club rush
JUNCACEAE		
	Juncus balticus	Baltic rush
	Juncus bufonius	Toad rush
	Juncus effusus brunneus	Bog rush
	Juncus mexicanus	Mexican rush
	Juncus occidentalis	Western rush
	Juncus patens	Common rush
	Juncus phaeocephalus	Brown-headed rush
LILIACEAE		
	Triteleia laxa	Ithuriel's spear
MELANTHIACEAE		

	Toxicoscordion fremontii	Fremont's star lily
POACEAE		
	Agrostis pallens	Bent grass
	**Aira caryophyllea*	Shiver grass
	**Avena barbata*	Slender oat
	**Avena fatua*	Wild oat
	**Briza minor*	Liittle quaking grass
	**Brachypoduim distachyon*	False brome
	Bromus carinatus	California brome
	**Bromus catharticus*	Rescue grass
	**Bromus diandrus*	Ripgut brome
	**Bromus hordeaceus*	Soft chess
	**Bromus madritensis ssp. madritensis*	Foxtail chess
	Bromus marginatus var. maritimus	Seaside large mountain brome grass
	**Cortaderia jubata*	Jubata grass
	**Cynodon dactylon*	Bermuda grass
	* *Cynosurus echinatus*	Dogtail grass
	Danthonia californica	California oatgrass
	Distichlis spicata	Salt grass
	Elymus glacus	Blue wild rye
	Elymus triticoides	Beardless wild rye
	Festuca californica	California fescue
	**Ehrharta erecta*	Panic veldtgrass
	**Festuca bromoides*	Six weeks fescue
	Festuca rubra	Creeping red fescue
	**Festuca myuros var. myuros*	Rat tail fescue
	* *Festuca perennis*	Italian ryegrass
	**Holcus lanatus*	Velvet grass
	Hordeum brachyantherum	Meadow barley
	**Hordeum murinum ssp. leporinum*	Farmer's foxtail
	Koeleria macrantha	June grass
	Melica californica	California melicgrass
	Melica torreyana	Torrey's melica
	**Polypogon monspeliensis*	Annual rabitsfoot grass
	Stipa lepida	Foothill needlegrass
	Stipa pulchra	Purple needlegrass

THEMIDACEAE		
	Brodiaea elegans ssp. elegans	Harvest brodiaea
TYPHACEAE		
	Sparganium eurycarpum var. greenei,	Simplestem bur-reed
	Typha domingensis	Southern cattail
	Typha latifolia	Broadleaf cattail
*denotes non-native plant		
**denotes species where identification is only to genera.		

Appendix IV: Younger Lagoon Fish, Reptiles, and Amphibians

Fish, Reptiles, and Amphibians of YLR

Tidewater Goby (*Eucyclogobius newberryi*)
Threespine Stickleback (*Gasterosteus aculeatus*)
Sculpin (unknown)

Reptiles

California Legless Lizard (*Anniella pulchra*)
Coast Horned Lizard (*Phrynosoma coronatum*)
Common Garter Snake (*Thamnophis sirtalis*)
Common Kingsnake (*Lampropeltis getulus*)
Gopher Snake (*Pituophis melanoleucus*)
Northern Rubber Boa (*Charina bottae*)
Racer (*Coluber constrictor*)
Ringneck Snake (*Diadophis punctatus*)
Sharp-tailed Snake (*Contia tenuis*)
Southern Alligator Lizard (*Gerrhonotus multicarinatus*)
Striped Racer (California Whipsnake) (*Masticophis lateralis*)
Western Aquatic Garter Snake (*Thamnophis couchi*)
Western Fence Lizard (*Sceloprus occidentalis*)
Western Pond Turtle (*Clemmys marmorata*)
Western Rattlesnake (*Crotalus viridus*)
Western Skink (*Eumeces skiltonianus*)
Western Terrestrial Garter Snake (*Thamnophis elegans*)

Amphibians

California Slender Salamander (*Batrachoseps attenuatus*)
Pacific Treefrog (*Pseudacris regilla*)
California Red-legged Frog (*Rana draytoni)*

1b. CLRDP Consistency Determination

As stated in Policy 1.1 (Development Consistency), "Development shall be deemed consistent with the CLRDP if it is consistent with the provisions of Chapters 5, 6, 7, 8, 9, and Appendices A and B."

The following is a list of all the Policies, Implementation Measures and Figures found in Chapter 5. Those that apply directly to this NOID are highlighted in black and followed with a comment regarding the project's consistency; those that do not are indicated with strikethrough text. In addition, any sections of Chapters 6, 7, 8, 9, and Appendices A and B that apply to this NOID are referenced with comments if relevant or as strikethrough text if they are not pertinent to this project.

CHAPTER 5 Long Range Land Use Development Plan

5.1 Application of the Long Range Land Use Development Plan

Policy 1.1 Development Consistency

The University finds the project contemplated under NOID 12 (20-1) to be consistent with the CLRDP.

IM 1.1.1 Figures of Chapter 5.

This project does not involve physical development, but is "development" as defined in Section 8.1.1 and the Coastal Act as a "…change in …intensity of use of land…" Only Figure 5.6 applies and the project is consistent with that figure.

~~IM 1.1.2 Lease Agreements.~~

~~IM 1.1.3 Federal In-holding and CLRDP.~~

Policy 1.2 University Commitments

The University commitments in the CLRDP have been undertaken

5.2. Land Use

~~Figure 5.1 Building Program~~

~~Figure 5.2 Land Use Diagram~~

~~Figure 5.3 Locational Restrictions for Building Program~~

~~Stable Urban / Rural Boundary~~

Policy 2.1 Maintaining a Stable Urban / Rural Boundary

~~IM 2.1.1 Over sizing of Utility Lines Prohibited.~~

~~IM 2.1.2 Utility Prohibition Zone.~~

Policy 2.2 Strengthening the Urban / Rural Boundary through the Protection of Adjacent Agricultural Resources

IM 2.2.1 Setback of Development and Uses from Adjacent Agricultural Use.

As mentioned in IM 1.1.1, the project does not involve physical development, therefore agricultural setback does not apply.

Policy 2.3 Designing for the Urban Edge

~~IM 2.3.1 Cluster Development.~~

~~IM 2.3.2 Impervious Coverage.~~

~~IM 2.3.3 Windbreak Vegetation~~

~~IM 2.3.4 Buildout Planning.~~

~~IM 2.3.5 Interim Weed Abatement Measures for Undeveloped Land Within Development Zones.~~

Short-term and Caretaker Accommodations

Policy 2.4 Short-term and Caretaker Accommodations

~~IM 2.4.1 Short-Term Accommodation Use Restrictions.~~

~~IM 2.4.2 Caretaker Accommodations.~~

~~IM 2.4.3 Use Conversion.~~

Campus Land Uses Limited to Marine / Coastal Research and Education, Resource Protection, and Public Access

Policy 2.5 Ensuring Appropriate Land Uses on the Marine Science Campus

5.3 Natural Resource Protection

Policy 3.1 Protection of the Marine Environment

~~IM 3.1.1 Seawater System.~~

~~IM 3.1.2 Discharge of Drainage/Storm water.~~

Policy 3.2 Protection and Restoration of Habitat Areas

~~IM 3.2.1 Restoration of Wetlands on the Marine Science Campus.~~

~~IM 3.2.2 Management of Terrace Wetlands.~~

~~IM 3.2.3 Protection and Enhancement of Wildlife Movement.~~

~~IM 3.2.4 Management of Special Status Species Habitat.~~

IM 3.2.5 Protect Habitat Areas From Human Intrusion.

Under the project, the tours will use the existing YLR trails and will be docent-led. Additional wayfinding and interpretive signage are not required.

~~IM 3.2.6 Natural Area Management.~~
~~IM 3.2.7 Management of Water Quality and Drainage Features.~~
~~IM 3.2.8 Maintenance and Monitoring of Terrace Habitats.~~
~~IM 3.2.9 Wetland Buffers.~~
~~IM 3.2.10 Natural Areas Habitat Management.~~
~~IM 3.2.11 CRLF Protection.~~
~~IM 3.2.12 USFWS Consultation Required~~
~~IM 3.2.13 Rodenticides.~~
~~IM 3.2.14 Non-Invasive Native Plant Species Required.~~

Policy 3.3 Use and Protection of Coastal Waters and Wetlands

~~IM 3.3.1 Pre-development Evaluation of Wetland Conditions.~~
~~IM 3.3.2 Update CLRDP With Respect to Wetlands.~~

Policy 3.4 Protection of Environmentally Sensitive Areas (ESHAs)

~~IM 3.4.1 Additional Measures to Protect Habitat Areas.~~
~~IM 3.4.2 Noise Intrusion into Terrace ESHA.~~
~~IM 3.4.3 Noise Intrusion into LR (original YLR).~~
~~IM 3.4.4 Pre-development Evaluation of ESHA Conditions.~~
~~IM 3.4.5 Update CLRDP With Respect to ESHA.~~

Younger Lagoon Reserve

Policy 3.5 Special Protection for the Original Younger Lagoon Reserve

IM 3.5.1 Protection and Enhancement of YLR Habitats.

This project addresses limited access of humans to Younger Lagoon.

IM 3.5.2 Protection of Special Status Species in YLR.

Based on the results of the previous 5-year monitoring program, no special status species are anticipated to be impacted.

IM 3.5.3 Protection of YLR Resources.

Increased visitor use to beach as part of the required actions of IM 3.6.3 has the potential to impact flora and fauna. Only supervised tours will be permitted in order to minimize this potential impact.

IM 3.5.4 Development of Monitoring and Maintenance Program.

Plant, animal, and human activities/presence will be monitored as part of this project.

~~IM 3.5.5 Siting of Windbreak Vegetation.~~

IM 3.5.6 YLR Manager Consultation.

The Administrative Director of the UCSC Natural Reserves and the Field Manager of the Younger Lagoon Natural Reserve have reviewed the scope of the Public Access to and Within Younger Lagoon Natural Reserve Project (NOID 12 20-1) and concur the Project would not result in significant impacts to the Reserve beyond those described above.

Gage Dayton, Administrative Director, UCSC Natural Reserves

6/30/2020
Date

IM 3.5.7 Movement Not Visible From YLR (original YLR)

Monitoring efforts and public use of Younger Lagoon will be visible from the original Younger Lagoon Reserve.

~~IM 3.5.8 Protective Measures for YLR (original YLRR) in Middle Terrace.~~

Policy 3.6 Public Access to and within YLR (original YLR)

IM 3.6.1 Provision of Controlled Access within YLR (original YLR).

The project is consistent with public access polices for the beach and lagoon areas of YLR.

IM 3.6.2 Visual Access to YLR (original YLR).

Visual access to the original YLR is available from existing overlooks.

IM 3.6.3 Public Beach Access within YLR (original YLR).

This project addresses Implementation Measure 3.6.3: *"Public Access to and within YLR."* The project description provides details pertaining to the schedule of tours of the beach at the YLR, parameters for beach access and a program to monitor the effects of human, plant, and animal use/presence on the beach. An assessment of beach area resources and the effect of beach area use and activities on these resources is included.

Coastal Bluffs and Blufftops

Policy 3.7 Protection of Coastal Bluff and Bluff top Areas

~~IM 3.7.1 Bluff Setbacks.~~
~~IM 3.7.2 Coastal Bluff and Bluff top Area Protection and Enhancement Measures.~~
~~IM 3.7.3 Protecting Existing Development from Coastal Erosion.~~

Agricultural Resources

Policy 3.8 Protection of Adjacent Agricultural Resources

~~IM 3.8.1 Cooperation.~~
~~IM 3.8.2 Agreement to Indemnify and Hold Harmless.~~

Cultural Resources

Policy 3.9 Conservation of Cultural Resources

~~IM 3.9.1 Construction Monitoring.~~

Hazardous Materials Management

Policy 3.10 Hazardous Materials Management
~~IM 3.10.1 Hazardous Materials Management.~~
~~IM 3.10.2 Protective Measures for Laydown Yard.~~
Air Quality and Energy Consumption
Policy 3.11 Energy Efficiency in New Construction
~~IM 3.11.1 Energy Efficiency in New Construction.~~
~~IM 3.11.2 Energy Efficiency in Use.~~
Policy 3.12 Air Quality and Energy Conservation through Land Use and Transportation Controls
~~IM 3.12.1 Air Quality and Energy Conservation through On-Campus Short-Term Accommodations.~~
~~IM 3.12.2 Air Quality and Energy Conservation through Controlling Travel Mode Split.~~
~~IM 3.12.3 Air Quality and Energy Conservation through Parking Control.~~
~~IM 3.12.4 Air Quality and Energy Conservation through Alternative Transportation.~~
~~IM 3.12.5 Air Quality and Energy Conservation through Transportation Demand Management.~~
Natural Resource Protection Analysis
Policy 3.13 Natural Resource Protection Analysis Required
Policy 3.14 Permanent Protection
~~IM 3.14.1 Natural Areas Protection.~~

5.4. Scenic and Visual Qualities
~~Figure 5.4 Development Subareas~~
Policy 4.1 Protection of Scenic Views
~~IM 4.1.1 Location of Development.~~
Policy 4.2 Protection of Scenic Quality
~~IM 4.2.1 Design Standards and Illustrative Campus Build out Site Plan.~~
~~IM 4.2.2 Alteration of Natural Landforms.~~
~~IM 4.2.3 Building and Other Structure Heights.~~
~~IM 4.2.4 Laboratory Buildings.~~
~~IM 4.2.5 Maximum Building Gross Square Footage.~~
~~IM 4.2.6 Maximum Additional Gross Square Footage in Lower Terrace.~~
~~IM 4.2.7 Construction Materials.~~
~~IM 4.2.8 Building Setbacks.~~
~~IM 4.2.9 Building Length Limitations.~~
~~IM 4.2.10 Placement of Utility Lines Underground.~~
~~IM 4.2.11 Windbreak Vegetation.~~
~~IM 4.2.12 Development in Northernmost Portion of Middle Terrace.~~
~~IM 4.2.13 Development Along Edge of Lower Terrace.~~
~~IM 4.2.14 Building Development West of McAllister Way in Lower Terrace.~~
~~IM 4.2.15 Building Development West of McAllister Way in Middle Terrace.~~
~~IM 4.2.16 Building Development Outside of Subareas Prohibited.~~
Policy 4.3 Visual Intrusion and Lighting
~~IM 4.3.1 Visual Intrusion into YLR (original YLR).~~
~~IM 4.3.2 Visual Intrusion into YLR (Terrace Lands).~~
~~IM 4.3.3 All Lighting.~~
~~IM 4.3.4 Building Lighting.~~
~~IM 4.3.5 Street and Trail Lighting.~~
~~IM 4.3.6 Parking Lot and Maintenance Yard Lighting.~~
~~IM 4.3.7 Sign Lighting.~~
~~IM 4.3.8 Lighting Plan Required.~~

5.5. Circulation and Parking
~~Figure 5.5 Circulation and Parking Diagram~~
Auto Circulation
Policy 5.1 Vehicular Access
~~IM 5.1.1 New Circulation System.~~
~~IM 5.1.2 Improve Shaffer Road / Delaware Avenue Intersection~~
~~IM 5.1.3 Shaffer Road Improvements.~~
~~IM 5.1.4 Access for Wildlife Across Shaffer Road (Upper Wildlife Corridor).~~
~~IM 5.1.5 Access for Wildlife Across Shaffer Road (Lower Wildlife Corridor).~~
~~IM 5.1.6 Use of Former Access Road.~~
~~IM 5.1.7 Emergency Access.~~
Travel Mode Split
Policy 5.2 Travel Mode Split
~~IM 5.2.1 Encourage Alternatives to Single-Occupant Vehicle.~~
~~IM 5.2.2 Alternatives to the Single-Occupant Vehicle.~~
Parking
Policy 5.3 Parking for Campus Use and Public Coastal Access
~~IM 5.3.1 All Campus Users Off-Hour Parking.~~

~~IM 5.3.2 Public Coastal Access Parking.~~
~~IM 5.3.3 Campus Entrance Public Coastal Access Parking.~~
~~IM 5.3.4 Middle Terrace Public Coastal Access Parking.~~
~~IM 5.3.5 Lower Terrace Dual Use Parking (Public Coastal Access Parking and Discovery Center Parking).~~
~~IM 5.3.6 Lower Terrace Public Coastal Access Parking.~~
~~IM 5.3.7 Parking Demand Satisfied On-Campus.~~
~~IM 5.3.8 Free and/or Low Cost Public Coastal Access Parking.~~
Parking Supply
Policy 5.4 Parking Supply
~~IM 5.4.1 Development of New Parking~~
~~IM 5.4.2 Lease Agreements~~
~~IM 5.4.3 Distribution and Intensity of Parking~~
Parking Management
Policy 5.5 Parking Management
~~IM 5.5.1 Permits Required.~~
~~IM 5.5.2 Public Coastal Access Parking.~~
~~IM 5.5.3 Carpools and Vanpools.~~
~~IM 5.5.4 Parking Management Strategy for Special and/or Temporary Events.~~
~~IM 5.5.5 Entrance Kiosk.~~
~~IM 5.5.6 Parking Limitation Seaward of Whale Skeleton.~~
~~IM 5.5.7 Parking Enforcement.~~
Pedestrian and Bicycle Facilities
Policy 5.6 Promotion of Bicycle Use and Walking
~~IM 5.6.1 Sheltered and Secured Bike Parking.~~
~~IM 5.6.2 Bike Parking Outside Buildings.~~
~~IM 5.6.3 Personal Lockers and Showers.~~
~~IM 5.6.4 Coordinated Marketing with City of Santa Cruz.~~
~~IM 5.6.5 Crosswalk Design.~~
~~IM 5.6.6 Siting Buildings for Ease of Access.~~
Transit
Policy 5.7 Promotion of Transit Use
~~IM 5.7.1 Extension of Santa Cruz Municipal Transit District Transit Services.~~
~~IM 5.7.2 Expansion of Shuttle Services.~~
~~IM 5.7.3 Physical Infrastructure for Transit.~~
Transportation Demand Management (TDM) Coordination
Policy 5.8 TDM Coordination
~~IM 5.8.1 Carpool and Vanpool Services.~~
~~IM 5.8.2 TDM Coordination.~~
~~IM 5.8.3 Transportation Information.~~
Traffic Impacts on City Streets
Policy 5.9 Impacts Offset
Circulation and Parking Plan
Policy 5.10 Circulation and Parking Plan Required

5.6. Public Access and Recreation
~~Figure 5.6 Coastal Access and Recreation Diagram~~
Policy 6.1 Public Access to the Marine Science Campus
~~IM 6.1.1 Free Public Access for Visitors.~~
~~IM 6.1.2 Public Access Parking.~~
IM 6.1.3 Public Access Trails.
Access to trails to the beach are described in the project description.
~~IM 6.1.4 Public Access Overlooks.~~
IM 6.1.5 Docent-Led Tours and Education Programs for the Public.
The project provides beach access and docent led tours to the YLR beach.
~~IM 6.1.6 Educational Programs for Pre-College Students.~~
~~IM 6.1.7 Interpretive Information.~~
Policy 6.2 Management of Public Areas
~~IM 6.2.1 Public Use Hours for the Marine Science Campus.~~
~~IM 6.2.2 Public Trail Continuity.~~
IM 6.2.3 Access to Resource Protection Areas.
This project provides public access to the Younger Lagoon Beach area in conformance with the CLRDP.
~~IM 6.2.4 Access to Resource Protection Buffer Areas.~~
~~IM 6.2.5 Access to Coastal Bluffs.~~
~~IM 6.2.6 Access to Laboratories and Research Areas.~~
~~IM 6.2.7 Caretaker Residence and Lab Security.~~
~~IM 6.2.8 Bicycles on the Marine Science Campus.~~
~~IM 6.2.9 Domestic Pets.~~

~~IM 6.2.10 Public Access Signage.~~
~~IM 6.2.11 Off-Campus Trail Connectivity.~~
~~IM 6.2.12 Maintenance of Existing Public Access.~~
IM 6.2.13 Public Access to Younger Lagoon Beach.
The project provides public access to Younger Lagoon Beach in conformance with IM 3.6.3.
Policy 6.3 Public Access and Recreation Plan Required

5.7. Hydrology and Water Quality
~~Figure 5.7 Utilities Diagram~~
Policy 7.1 Productivity and Quality of Coastal Waters
~~IM 7.1.1 Management of Storm water and Other Runoff.~~
~~IM 7.1.2 Water Quality Standards.~~
~~IM 7.1.3 Pre- and Post-Development Flows.~~
~~IM 7.1.4 Pre-Development Drainage Patterns Defined.~~
~~IM 7.1.5 Pre-Development Drainage Peak Flow Rates Defined.~~
~~IM 7.1.6 Groundwater Recharge.~~
~~IM 7.1.7 Seawater System (Seawater Containment)~~
~~IM 7.1.8 Irrigation and Use of Chemicals for Landscaping.~~
~~IM 7.1.9 Wastewater.~~
~~IM 7.1.10 Elements of the Storm water Treatment Train.~~
~~IM 7.1.11 Runoff Containment for Laydown Yard and Food Service Washdown Areas.~~
~~IM 7.1.12 Location of Treatment Train Components.~~
~~IM 7.1.13 Permeable Hardscape.~~
~~IM 7.1.14 Ocean Discharge.~~
~~IM 7.1.15 Drainage System Interpretive Signs.~~
~~IM 7.1.16 Design of Vegetated Storm water Basins.~~
~~IM 7.1.17 Designation of Treatment Train.~~
Policy 7.2 Long-Term Maintenance and Monitoring
~~IM 7.2.1 Drainage System Monitoring and Maintenance.~~
~~IM 7.2.2 Storm water System Natural Features Maintenance.~~
~~IM 7.2.3 Drainage System Sampling.~~
~~IM 7.2.4 Long-Term Maintenance of Storm wate r System.~~
Policy 7.3 Drainage Discharge Points
~~IM 7.3.1 Discharge to the Original Younger Lagoon Reserve.~~
~~IM 7.3.2 Discharge Siting and Design.~~
Policy 7.4 Drainage Plan Required

5.8 Utilities
Policy 8.1 Provision of Public Works Facilities
~~IM 8.1.1 Sizing of Utilities.~~
~~IM 8.1.2 Seawater System.~~
Policy 8.2 Protection of Biological Productivity and Quality of Coastal Waters When Providing Public Works Facilities
~~IM 8.2.1 Installation of New Utility Lines and Related Facilities.~~
~~IM 8.2.2 Seawater System.~~
~~IM 8.2.3 Evaluation of Western Utility Corridor.~~
Policy 8.3 Water Conservation Required
Policy 8.4 Impacts to City Water and Sewer Systems Offset
Policy 8.5 Utility Plan Required

CHAPTER 6 Design Guidelines
~~6.1 Building Design~~
~~6.2 Campus Street Design~~
~~6.3 Parking Design~~
~~6.5 Landscape Design~~
~~6.6 Lighting Design~~
~~6.7 Signage Design~~
~~6.8 Fence / Barrier Design~~

CHAPTER 7 Illustrative Campus Buildout Site Plan and Preliminary Designs
Paths used for tours and research are already in place. Beyond normal maintenance, there will be no additional buildout.

CHAPTER 8 Development Procedures

This NOID and the public notification process is submitted in conformance with the requirements of the CLRDP.

CHAPTER 9 Capital Improvement Program

The beach monitoring and guided tours to the beach are consistent with Chapter 9 requirements.

APPENDIX A Resource Management Plan

The proposed project is consistent with the RMP and Younger Lagoon Natural Reserve polices.

APPENDIX B Drainage Concept Plan

The proposed project would have no impervious surface and thus would not affect storm water runoff.

1c. Environmental Compliance Documentation

See attached

1d. Technical Reports

See Section 5.

1e. Consultation Documentation with other Agencies

Not required for this NOID

1f. Implementing Mechanisms

There are no mitigations required by CEQA.

1g. Correspondence Received

None

1h. UC Santa Cruz Project Manager

Elizabeth Howard phone: 831-459-2455 email: eahoward@ucsc.edu

2. University Approval Documentation

See attached

3. Environmental Compliance Documentation

See attached

4. Plans, Specifications, etc.

(this section used if project documentation is large format or extensive)

N/A

5. Technical Reports

See attached: Younger Lagoon Natural Reserve Beach Monitoring Report, 2019.

6. Correspondence

N/A

2. University Approval Documentation

January 8, 2010

<u>**VICE CHANCELLOR THOMAS VANI**</u>
Business and Administrative Services

Re: NOID 10-1
Public Access to and Within Younger Lagoon Reserve

Dear Tom:

Notice of Impending Development (NOID) 10-1 Public Access to and Within Younger Lagoon Reserve is an atypical project. As described in IM 3.6.3 in the CLRDP, it would provide for controlled public access to the Younger Lagoon Beach and does not involve physical development. However, this "project" is considered "development" as defined in Section 30106 of the California Coastal Act and Section 8.1.1 of the Coastal Long Range Development Plan because the "project" would result in a "...change in the intensity of use of water, or access thereto...". Applying The Regents' delegated authority for approval of projects, the cost of this project is below the $750,000 threshold and therefore you have the authority to certify the CEQA action and approve the project.

For your consideration, the University's Environmental Classification Form and the "Project Report" prepared for this NOID 10-1 are attached. The Project Report, which has been prepared in consultation with the Office of the President and Office of General Counsel. The Project Report includes a detailed description of the project.

Physical Planning and Construction recommended approval:

Frank L Zwart　　　　　　　　　　　　1/12/10

Frank Zwart, AIA Campus Architect　　　　　　Date
Associate Vice Chancellor Physical Planning and Construction

Reviewed by

JB (initials)
John Barnes
Director of Campus Planning

ITEM FOR ACTION

FOR VICE CHANCELLOR, BUSINESS AND ADMINSTRATIVE SERVICES APPROVAL

NOID 10-1 PUBLIC ACCESS TO AND WITHIN THE YOUNGER LAGOON NATURAL RESERVE

Associate Vice Chancellor for Physical Planning and Construction recommends that, upon review and consideration of the potential for environmental consequences of the proposed Public Access to and Within the Younger Lagoon Natural Reserve (the Project) as described in the Project Report of Notice of Impending Development 10-1, and in accordance with University Delegation of Authority, the Vice Chancellor of Business and Administrative Services of the Santa Cruz campus:

1. Determine the Public Access to and Within the Younger Lagoon Natural Reserve Project to be Categorically Exempt under the California Environmental Quality Act (CEQA), as described in the Project Report (see Section 1c); the Environmental Compliance Documentation; and

2. Approve the Public Access to and Within the Younger Lagoon Natural Reserve Project

The Project would not result in any significant environmental impacts. The University has determined that the Project is Categorically Exempt from the provisions of CEQA under exemptions: Class 1 (Existing Facilities), Class 6 (Information Collection) and Class 22 (Educational Programs) as shown in the Project's Environmental Impact Classification form (see Section 1c Environmental Compliance Documentation).

APPROVED

Tom Vani
Vice Chancellor, Business and Administrative Services

1.12 2010
Date

1c. Environmental Compliance Documentation

UNIVERSITY OF CALIFORNIA **ENVIRONMENTAL IMPACT CLASSIFICATION**

(revised)

Campus or Field Station Santa Cruz **Project Account:** ______

Project Title **PUBLIC ACCESS TO AND WITHIN YLR (Revised)**

For purposes of compliance with the California Environmental Quality Act of 1970 (CEQA), and Amended University of California Procedures for Implementation of CEQA, this project has been reviewed and initially classified as indicated below. Please check (X) as appropriate. Include project description and appropriate local map.

X **I. EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT**

When it can be seen with certainty that there is no possibility the action will result in physical changes to the environment or the action is specifically exempted by statute, the project is classified as exempt from CEQA.

X **II. CATEGORICALLY EXEMPT**

This project falls under the indicated Class of Exemption and there is no significant effect on the environment.

X	Class 1: Existing Facilities		Class 17: Open Space Contracts
	Class 2: Replacement or Reconstruction		Class 18: Designation of Wilderness Areas
	Class 3: New Construction of Small Structures		Class 19: Annexation of Existing Facilities and Lots
	Class 4: Minor Alterations to Land		Class 20: Changes in Organization of Local Agencies
	Class 5: Alterations in Land Use Limitations		Class 21: Regulatory Enforcement Actions
X	Class 6: Information Collection	X	Class 22: Educational Programs
	Class 7: Regulatory Protection of Natural Resources		Class 23: Normal Operation
	Class 8: Regulatory Protection of the Environment		Class 24: Regulations of Working Conditions
	Class 9: Inspection		Class 25: Transfer of Ownership of Land to Preserve Open Space
	Class 10: Loans		Class 26: Acquisition Housing for Housing Assistance
	Class 11: Accessory Structures		Class 27: Leasing New Facilities
	Class 12: Surplus Government Property Sales		Class 28: Small Hydroelectric Projects
	Class 13: Acquisition for Conservation		Class 29: Cogeneration Projects
	Class 14: Minor Additions to Schools		Class 30: Minor Actions to Prevent Hazardous Substance Release
	Class 15: Minor Land Divisions		Class 31: Historic Resource Restoration/Rehabilitation
	Class 16: Transfer of Ownership of Land to Create Parks		Class 32: In-fill Development Projects

---

____ **III. INITIAL STUDY**

This project is not Exempt from CEQA or Categorically Exempt; an Initial Study is to be prepared to determine if the project may have a significant effect on the environment that has not been substantially and adequately analyzed in a certified program EIR.

Checklist____ Narrative____

____ **IV. ENVIRONMENTAL IMPACT REPORT (EIR)**

It is known that the project will have a significant effect on the environment and has not been adequately and substantially analyzed in a certified program EIR.

PROJECT DESCRIPTION: The project would implement CLRDP IM 3.6.3 to provide controlled public access to Younger Lagoon Natural Reserve through docent-guided tours, in conjunction with vegetation and wildlife monitoring. Visitors would use existing trails and timber steps under the supervision of a knowlegeable docent. Effects upon vegetation and wildlife of increased visitation would be monitored over a five-year period through periodic documentation of species composition and seed production of beach dune vegetation, and species composition and abundance of animals present. Data collection methods will include periodic photo documentation, camera traps, track surveys, and population and density counts for various plant and animal species. Although increased visitation has the potential to affect wildlife and vegetation, the project has no potential to result in significant environmental effects because access will be limited and supervised. Concurrent biological data collection will provide input in future decisions regarding on-going public access to the reserve, to avoid significant environmental effects.

V. Does this project conform to the approved CLRDP? X YES ____ NOT APPLICABLE

VI Sally Morgan 10/16/09 [signature] 10.20.09

Prepared by Date Local Approved by: Thomas Vani Date

VI OFFICE OF THE PRESIDENT **COMMENTS:**

______ Concur with Classification

______ Do not Concur

Signed Date Date

NOID 12 (20-1) was posted on the Coastal Science Campus on June 30, 2020. Posting locations included UCSC's Ocean Health Building, Seymour Center, Coastal Biology Building, NOAA Southwest Fisheries Science Center, CDFW Facility, the campus entrance, and entrance to De Anza Trail. A picture of the posting at the campus entrance is included here.

Younger Lagoon Reserve

Beach Monitoring Report

2019

***Watsonville Area Teens Conserving Habitats* (WATCH) *Program* Participants at Younger Lagoon**Ā
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Figures

Tables

Appendices

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Overview and Executive Summary

Introduction

[illegible] *to the understanding and wise management of the Earth and its natural systems by supporting university-level teaching, research, and public service at protected natural areas throughout California* [illegible]

[illegible]

[illegible]

Younger Lagoon Access History

History of Public Access to Younger Lagoon Beach

[illegible]

Beach Access Tours

Public Education and Outreach Programming on the Coastal Science Campus

Seymour Marine Discovery Center

Watsonville Area Teens Conserving Habitat (WATCH)

Community Bioblitz

Volunteer Stewardship Days


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Study Areas

Younger Lagoon Reserve

Sand Plant Beach ("Little Wilder")

Natural Bridges Lagoon

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Methods

User Data

Human Beach Use

Photo Documentation of Younger Lagoon Natural Reserve

Tidewater Goby Surveys

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Species Composition and Coverage of Beach Dune Vegetation

Non-avian Vertebrate Monitoring

Tracks

Small Mammals

Invertebrate Monitoring

Avian Monitoring

Results

User Data

Younger Lagoon Reserve

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University of California Campus
University of California, Berkeley
University of California, Santa Cruz
University of California, Los Angeles

California State Universities
California Polytechnic State University, San Luis Obispo
California State University, San Jose

California Community College
Cabrillo Community College

Universities outside California
University of Utah

K-12 system
Aptos High School
Half Moon Bay High School
Pajaro Valley High School
Watsonville High School

Non-governmental organizations
Bird School Project
California Academy of Sciences
California Environmental DNA
California Naturalist Program
Monterey Bay Aquarium WATCH Program
Santa Cruz Bird Club
Seymour Marine Discovery Center
Watsonville Wetlands Watch

Governmental Agencies
Army Corps of Engineers

Volunteer Groups
UCSC Wilderness Orientation
Enviroteers

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RESERVE USE DATA Academic year: 2018-2019

Campus: University of California, Santa Cruz
Reserve: Younger Lagoon Reserve

	UC Home		UC Other		CSU System		CA Comm College		Other CA College		Out of State College		International University		Government		NGO/Non-Profit		Business Entity		K-12 School		Other		Total	
	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs	Users	UDs
UNIVERSITY- LEVEL RESEARCH																										
Faculty	4	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	77
Research Scientist/Post Doc	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Graduate Student	9	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	180
Undergraduate Student	42	534	21	645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	1179
K-12 Student	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12	0	0	1	12
Professional	9	104	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	106
Volunteer	0	0	1	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	64
SUBTOTAL	65	896	24	711	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12	0	0	90	1619
UNIVERSITY - LEVEL INSTRUCTION (CLASS)																										
Faculty	12	19	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	21
Graduate Student	11	19	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	22
Undergraduate Student	510	1763	24	24	25	25	18	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	577	1830
K-12 Student	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
Professional	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50
SUBTOTAL	534	1851	36	36	27	27	19	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	616	1933
OTHER																										
Faculty	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Research Scientist/Post Doc	1	1	1	1	0	0	0	0	0	0	0	0	0	0	40	40	1	1	0	0	0	0	0	0	43	43
Graduate Student	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Undergraduate Student	56	56	40	40	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	97	98
K-12 Instructor	0	0	70	280	0	0	0	0	0	0	0	0	0	0	0	0	3	6	0	0	55	99	0	0	128	385
K-12 Student	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	705	0	0	100	705
Professional	14	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	65	0	0	1	1	1	1	26	83
Other	2	4	35	35	0	0	0	0	0	0	0	0	0	0	0	0	31	721	0	0	0	0	27934	27934	28002	28694
Docent	128	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	35	163	163
Volunteer	0	0	0	0	0	0	0	0	0	0	18	18	0	0	0	0	1	24	0	0	0	0	100	100	119	142
SUBTOTAL	207	211	146	356	0	0	0	0	0	0	19	20	0	0	40	40	46	817	0	0	156	805	28070	28070	28684	30319
TOTAL	**806**	**2958**	**206**	**1103**	**27**	**27**	**19**	**19**	**0**	**0**	**19**	**20**	**0**	**0**	**40**	**40**	**46**	**817**	**0**	**0**	**157**	**817**	**28070**	**28070**	**29390**	**33871**

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*Other includes members of the public who took the SMDC's docent-led tours. All daily tours in FY 2018-2019 visited the Younger Lagoon / Marine Mammal Overlook and received information about the reserve.

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Sand Plant Beach (Little Wilder)

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FHWJX"Ā\NYMĀT[JWĀ(*ĀRNQJXĀTKĀYWFNQX!ĀFSIĀNXĀAXQĀNXQAZSPTSYXQFHQ^ĀMT\
RFS^ĀUJTUQJĀ[NXNYĀAFSIĀ?QFSYĀ3JFHMĀJFHMĀ^JFWZSĀAYNYĀWAZZNSYXĀFĀMNPJĀNYĀ
TKĀYMJĀRTWJĀUTUZQFWĀGJFHMJXĀFQTSLĀYMNXĀXAYWYNTSĀTKĀWNQIWA@QFSIFX^ĀFHI
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Natural Bridges Lagoon

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AYFYJĀ?FWPXĀ'%&%!$ĀĀBMJĀUWTUTWYNTSĀTKĀMJĀGJFHMĀFSIĀQFLTTSĀMFXĀXFYĀNXĀ
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Human Use During Survey Efforts

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ZXJWXĀFYĀE;@ĀGJFHMĀIZWNSLĀYMJĀXZW[J^ĀJKKTWYXĀ[FWNJIĀFHWTXXĀXNYJXĀNSĀ
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Site	Month	[1]Total # of people	[1]Ave # of People / 15 minute
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ETZSLJWĀ;FLTTSĀ	>HYTGJW"Ā'%&*Ā	%Ā	%Ā
ETZSLJWĀ;FLTTSĀ	7JGWZFW^"Ā'%&+Ā	%Ā	%Ā
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ETZSLJWĀ;FLTTSĀ	:ZQ^"Ā'%&+Ā	%Ā	%Ā
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Photo Documentation of YLR

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Tidewater Goby Surveys

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NSHQZIJĀWJXZQYXĀNSĀTWIJWĀYTĀMF[JĀXYFSI[illegible]6[NIJSHJĀ
TKĀGWJJINSLĀ RZQYNUQJĀXN_JĀHQFXXJX!ĀHTSY[illegible]
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	Tidewater Goby	Stickleback	Sculpin	Mosquito Fish	Halibut	CRLF [1]	Bluegill
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April 9, 2010	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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November 18, 2010	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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ĀĀĀĀĀETZSLJWĀ;FLTTSĀ	DĀ	Ā	Ā	Ā	Ā	Ā	Ā
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February 23, 2011	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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August 8, 2011	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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August 29, 2012	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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October 23, 2012	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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February 2, 2013	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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March 1, 2017	Ā	Ā					
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May 3, 2017	Ā	Ā					
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Species Composition and Coverage of Beach Dune Vegetation

2QYMTZLMĀ\JĀFWJĀSTĀQTSLJWĀRTSNYTWNSLĀ=FYZWFQĀ3WNILJXĀFSIĀ4FWSXĀNSZJĀ NSHQZIJĀWJXZQYXĀNSĀTWIJWĀYTĀMF[JĀXYFSIFWIĀWJKJWJSHJĀITHZRJSYFYNTSĀ6[NIJSHJĀ TKĀWJUWTIZHYNTSĀKQT\JWX"ĀXJJIX"ĀFSIĀXJJIQNSLXĀTKĀYMJĀUQFSYĀMFXĀGJJSĀ IJYJHYJIĀFYĀFQQĀYMWJJĀXNYJX$Ā5NXYFSHJĀKWTRĀYMJĀUQFSYĀYTĀYMJĀXJFĀMFXĀ HTSXNXYJSYQ^ĀLWJFYJXYĀFYĀ=FYZWFQĀ3WNILJXĀFSIĀQJFXYĀFYĀETZSLJWĀ;FLTTSĀ BFGQJĀ*!$ĀĀ?QFSYĀHT[JWĀ\FXĀLJSJWFQQ^ĀMNLMJXYĀFYĀETZSLJWĀ;FLTTSĀFSIĀGNYJIĀG^Ā UWTUTWYNTSĀTKĀGFWJĀLWTZSI!ĀGZYĀ[FWNJIĀFRTSLĀXNYJXĀIZWNSLĀJKKTWYXĀ

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=FYN[JĀUQFSYĀXUJHNJXĀWNHMSJXXĀ\FXĀHTSXNXYJSYQ^ĀMNLMJXYĀFYĀETZSLJWĀ;FLTTSĀFSIĀ FHWTXXĀXFRUQNSLĀUJWNTIXĀ7NLZWJĀ+!$ĀĀ<JFSĀSFYN[JĀXUJHNJXĀWNHMSJXXĀ\FXĀ+$.ĀFYĀ =FYZWFQĀ3WNILJXĀ+.À!ĀFSIĀQJFXYĀFYĀETZSLJWĀ;FLTTSĀ((À!Ā BFGQJĀ

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Site	**Spring, 10**	**Summer, 10**	**Fall, 10**	**Winter, 11**	**Spring, 11**	**Summer, 11**	**Fall, 11**	**Winter, 12**	**Spring, 12**
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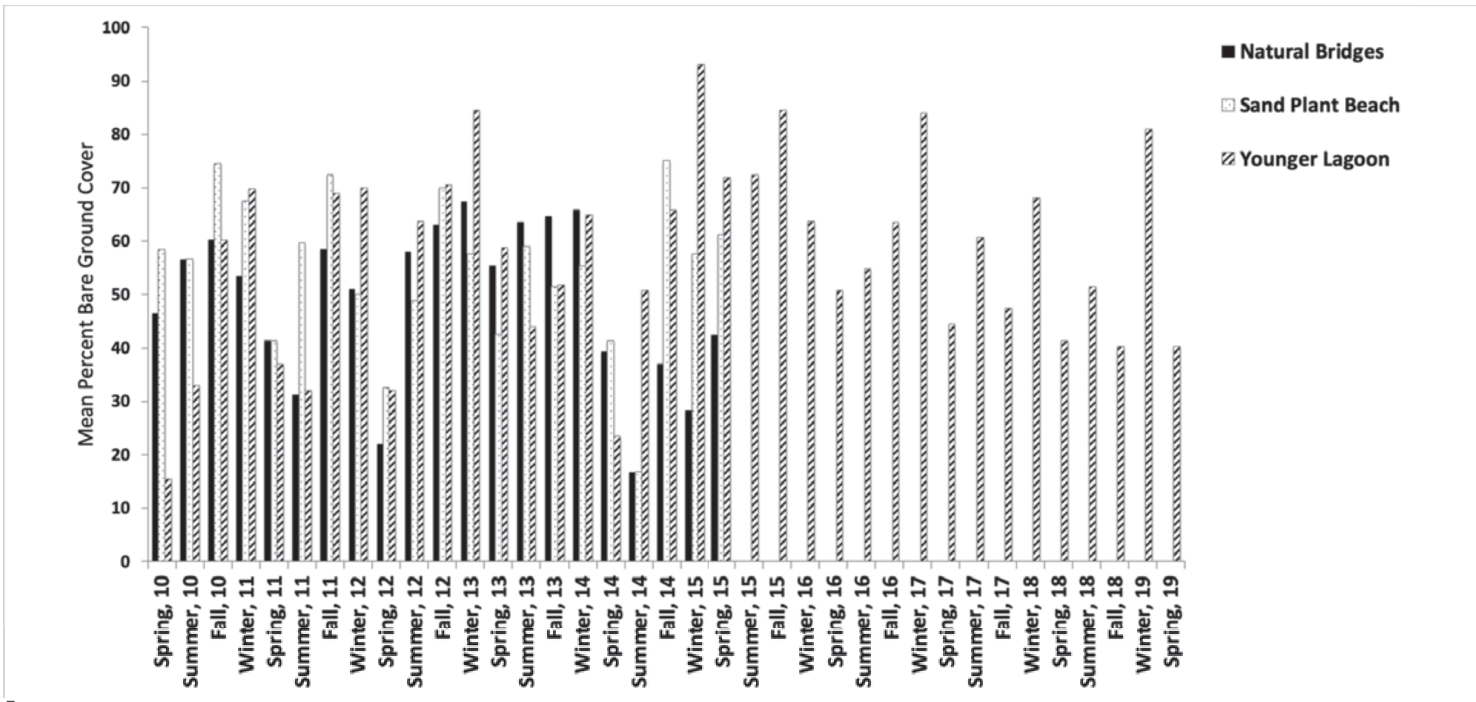

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Exhibit 3
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Site	Proportion of native and non-native species across all sample periods
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ĀĀĀĀĀ9BTJVFĀ	**47%**
ĀĀĀĀĀ9ON#NBTJVFĀ	**53%**
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ĀĀĀĀĀ9BTJVFĀ	**74%**
ĀĀĀĀĀ9ON#NBTJVFĀ	**26%**
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ĀĀĀĀĀ9BTJVFĀ	**68%**
ĀĀĀĀĀ9ON#NBTJVFĀ	**31%**
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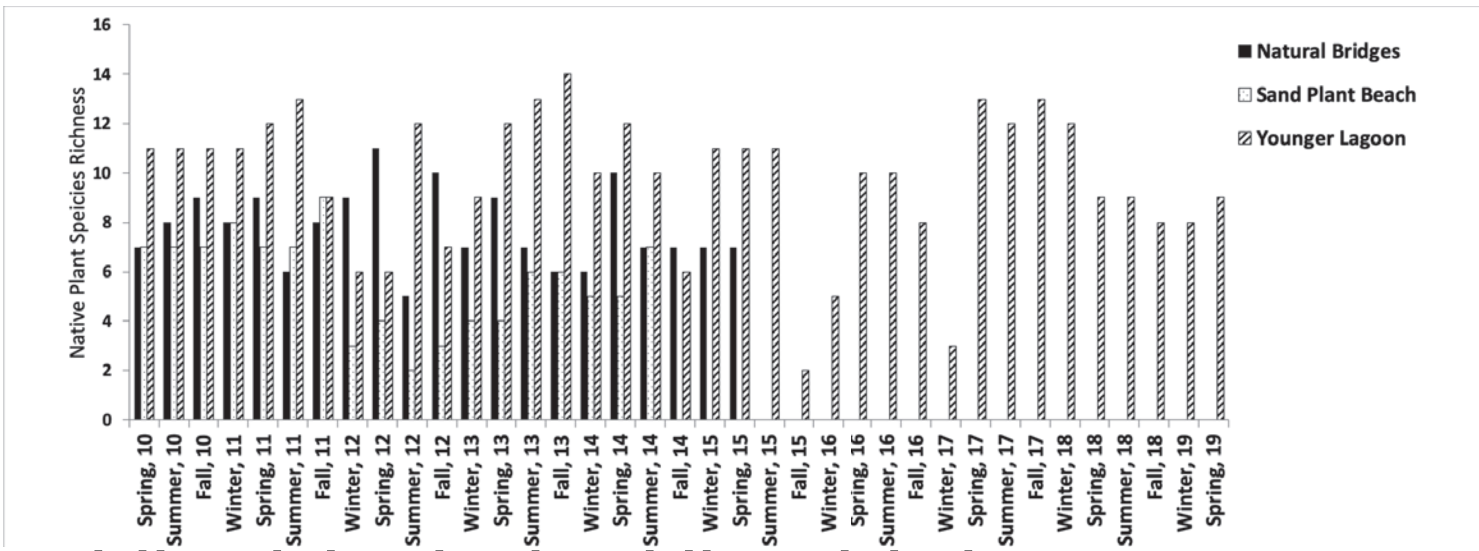

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Track Plate Monitoring

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NOTĀEFTFDTFEĀBTĀ9BTURBLĀ2RJEHFSĀBNEĀOPOSSUMĀ...
JSĀLJKFLYĀTIBTĀHROUNEĀSQUJRRFLSĀODDURĀBTĀ...
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	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
May 1-2, 2010	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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August 11-12, 2010	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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February 8 -9, 2011	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā
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	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
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	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
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ĀĀĀĀĀ9BTURBLĀ2RJEHFS	@Ā	Ā	Ā	Ā	@Ā	Ā	@Ā	Ā	@Ā	Ā	@Ā	@Ā	@Ā
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April 14-15, 2015	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā	Ā

	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
ĀĀĀĀĀ7JTTLFĀ?JLEFRĀ	@Ā	@Ā	Ā	Ā	Ā	Ā	Ā	Ā	@Ā	Ā	Ā	Ā	@Ā
ĀĀĀĀĀĀAOUNHFRĀ7BHOONĀ	@Ā	@Ā	Ā	@Ā	Ā	Ā	Ā	Ā	@Ā	Ā	Ā	Ā	Ā
ĀĀĀĀĀ9BTURBLĀ2RJEHFSĀ	@Ā	Ā	Ā	Ā	@Ā	Ā	@Ā	Ā	@Ā	Ā	@Ā	@Ā	@Ā
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July 8-9, 2015	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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October 29-30, 2015	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
ĀĀĀĀĀĀAOUNHFRĀ7BHOONĀ	Ā	@Ā		@Ā	Ā		Ā		Ā	Ā			Ā
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February 2-3, 2016	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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May3-4, 2016	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
ĀĀĀĀĀĀAOUNHFRĀ7BHOONĀ	Ā	@Ā		Ā	Ā		Ā		@Ā	Ā			Ā
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July 12-13, 2016	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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November 9-10, 2016	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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March 1-2, 2017	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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April 25-26, 2017	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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August 2-3, 2017	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
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October 25-26, 2017	Ā	Ā		Ā	Ā		Ā		Ā	Ā			Ā
AOUNHFRĀ7BHOONĀ	Ā	@Ā		Ā	Ā		@Ā		@Ā	@Ā			@Ā
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February 7-8, 2018	Ā	Ā		Ā	Ā		Ā		Ā				Ā
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	Rodent[1]	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human
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May 1-2, 2018	Ā	Ā		Ā			Ā		Ā				Ā
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July 12-13, 2018	Ā	Ā		Ā			Ā		Ā				Ā
AOUNHFRĀ7BHOONĀ	@Ā	Ā		@Ā			Ā		@Ā				@Ā
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November 7-8, 2018	Ā	Ā		Ā			Ā		Ā				Ā
AOUNHFRĀ7BHOONĀ	@Ā	@Ā		Ā			@Ā		@Ā				@Ā
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February 20-21, 2019	Ā	Ā		Ā					Ā				Ā
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May 15-16, 2019	Ā	Ā		Ā					Ā				Ā
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EFTFDTJONSĀBRFĀJNDLUEFEĀPBRFNTIFTJDBLLY$ĀĀ

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Site	Rodent	Raccoon	Cottontail	Bobcat	Skunk	Squirrel	Deer	Opossum	Coyote	Bicycle	Vehicle	Dog	Human	[1]Native sp. Richness
7JTTLFĀ2EFRĀ	&*!Ā,&ĀĀ	&%!Ā)-ĀĀ	)!Ā&.ĀĀ	&*!Ā,&ĀĀ	+!Ā'.ĀĀ	&!Ā+Ā	' !Ā&%ĀĀ	%ĀĀ	&*!Ā,&ĀĀ	' !Ā&%ĀĀ	%ĀĀ	(!Ā&)ĀĀ	&.!Ā.&ĀĀ	-Ā
AOUNHFRĀ7BHOONĀ&!Ā+%ĀĀ	'(!Ā+*ĀĀ	'!Ā+ĀĀ	'*!Ā,&ĀĀ	.!Ā'*ĀĀ	'!Ā+ĀĀ	ĀĀĀ*!Ā&)ĀĀ	%ĀĀ	' +!Ā)ĀĀ	&!Ā(ĀĀ	%ĀĀ	%ĀĀ	&*!Ā(ĀĀ	-Ā	
9BTURBLĀ2RJEHFSĀ!Ā)(ĀĀ	&*!Ā,&Ā	)!Ā& ĀĀ	.!Ā(ĀĀ	&(!Ā' ĀĀ	%ĀĀ	-!Ā(-ĀĀ	&!Ā*ĀĀ	.!Ā)(ĀĀ	&!Ā*ĀĀ	&)!Ā+,ĀĀ	&+!Ā,+ĀĀ	'&!Ā&%%ĀĀ	-Ā	

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Small Mammal Trapping

0JQGMRFGĀTDĀ@ODĀLMĀJMLFDOĀKMLHQMOHLFĀ8@QRO@JĀ1OHCFD<GMOQGĀ@QĀ<QDSDLĀ<KHQG
HLBJRCDĀODPRJQPĀHLĀMOCDOĀQMĀG@SDĀPQ@QDĀ@LCĀ@QĀIMHLQĀKMLHQMOHLFĀMHLQPĀHLĀQG
&,%ĀHLCHSHCR@JĀPK@JJĀK@KK@JPĀODNODPDLQHLFĀQGODDĀPNDBHDPĀGRKĀ@LC
K@KK@JĀQO@NNHLFĀDEEMOQPĀ=@AJDĀ- #ĀĀ

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=@AJDĀ-#ĀĀ<RKK@OVĀMEĀ<GDOK@LĀQO@NNHLFĀDEEMOQPĀ

<HQDĀ	:DK@%Ā	7HB@%Ā	;DKD%Ā	;@O@%Ā	**TOTAL**
	Ā	Ā	Ā	Ā	
April 24 -25, 2010	Ā	Ā	Ā	Ā	
ĀĀĀĀĀ6HQQJDĀ>HJCDO	)Ā	)Ā	Ā	Ā	**13**
ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	&Ā	Ā	Ā	Ā	**2**
ĀĀĀĀĀ8@QRO@JĀ1OHCFDPĀ	Ā	Ā	'Ā	Ā	**3**
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August 11-12, 2010	Ā	Ā	Ā	Ā	
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ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	Ā	Ā	%Ā	Ā	**1**
ĀĀĀĀĀ8@QRO@JĀ1OHCFDPĀ	Ā	Ā	Ā	Ā	**0**
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November 15-16, 2010	Ā	Ā	Ā	Ā	
ĀĀĀĀĀ6HQQJDĀ>HJCDO	)Ā	%Ā	Ā	Ā	**6**
ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	Ā	Ā	Ā	%Ā	**1**
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February 15-16, 2011					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	)Ā	Ā	Ā		**5**
ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	*Ā	)Ā	$Ā		**11**
ĀĀĀĀĀ8@QRO@JĀ1OHCFDPĀ	Ā	Ā	&Ā		**2**
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April 29-30, 2011					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	(Ā	Ā	Ā		**4**
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ĀĀĀĀĀ8@QRO@JĀ1OHCFDPĀ	Ā	Ā	Ā		**0**
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August 8-9, 2011					
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<HQDĀ	:DK@%Ā	7HB@%Ā	;DKD%Ā	;@O@%!&Ā	**TOTAL**
	Ā	Ā	Ā		
March 30, 2012					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	*Ā	Ā	Ā		**6**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	%Ā	Ā	%Ā	Ā	**2**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	)Ā	&Ā	Ā	**7**
	Ā	Ā	Ā	Ā	
May 15-16, 2012					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	(Ā	%Ā	Ā	Ā	**5**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	Ā	Ā	Ā	Ā	**3**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	)Ā	Ā	Ā	**5**
Ā	Ā	Ā	Ā	Ā	
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August 25-26, 2012					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	(Ā	Ā	Ā	Ā	**4**
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November 5-6, 2013					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	&Ā	Ā	%Ā	Ā	**3**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	Ā	Ā	Ā	Ā	**3**
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January 13-14, 2013					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	&Ā	Ā	(Ā	Ā	**6**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	&Ā	Ā	Ā	Ā	**2**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	&Ā	%Ā	Ā	**3**
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	Ā	Ā	Ā	Ā	
May 1-2, 2013					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	%Ā	Ā	%Ā	Ā	**2**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	Ā	Ā	&Ā	Ā	**5**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	)Ā	Ā	Ā	**5**
	Ā	Ā	Ā	Ā	
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July 16-17, 2013					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	'Ā	Ā	%Ā	Ā	**4**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	%Ā	Ā	Ā	Ā	**1**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	Ā	%Ā	Ā	**1**
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		Ā	Ā	Ā	
October 22-23, 2013					
ĀĀĀĀĀ6HQQJDĀ>HJCDO	)Ā	%Ā	Ā	%Ā	**7**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀMLĀ	%Ā	Ā	Ā	Ā	**1**

<HQDĀ	:DK@%Ā	7HB@%Ā	;DKD%Ā	;@O@%!&Ā	**TOTAL**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	%Ā	&Ā	Ā	**3**
	Ā	Ā	Ā	Ā	
		Ā	Ā	Ā	
February 12-13, 2014					
ĀĀĀĀĀ6HQQJDĀ>HJCDOĀ	&Ā	%Ā	%Ā	Ā	**4**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	%Ā	Ā	%Ā	Ā	**2**
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April 28-29, 2014					
ĀĀĀĀĀ6HQQJDĀ>HJCDOĀ	(Ā	%Ā	Ā	Ā	**5**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	Ā	Ā	%Ā	Ā	**4**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	%Ā	Ā	Ā	Ā	**1**
Ā	Ā	Ā	Ā	Ā	
	Ā	Ā	Ā	Ā	
July 30-31, 2014					
ĀĀĀĀĀ6HQQJDĀ>HJCDOĀ	%Ā	%Ā	Ā	Ā	**2**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	&Ā	Ā	Ā	Ā	**2**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	%Ā	Ā	%Ā	Ā	**2**
Ā	Ā	Ā	Ā	Ā	
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November 4-5, 2014					
ĀĀĀĀĀ6HQQJDĀ>HJCDOĀ	'Ā	%Ā	Ā	Ā	**4**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	(Ā	Ā	Ā	Ā	**4**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	&Ā	%Ā	'Ā	Ā	**6**
Ā	Ā	Ā	Ā	Ā	
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January 26-27, 2015					
ĀĀĀĀĀ6HQQJDĀ>HJCDOĀ	'Ā	Ā	%Ā	Ā	**4**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	(Ā	Ā	)Ā	Ā	**9**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	Ā	'Ā	Ā	**3**
Ā	Ā	Ā	Ā	Ā	
	Ā	Ā	Ā	Ā	
April 14-15, 2015					
ĀĀĀĀĀ6HQQJDĀ>HJCDOĀ	&Ā	Ā	'Ā	Ā	**5**
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	Ā	Ā	Ā	Ā	**3**
ĀĀĀĀĀ8@QRO@JĀ1OHCĀDPĀ	Ā	Ā	Ā	Ā	**0**
Ā	Ā	Ā	Ā	Ā	
	Ā	Ā	Ā	Ā	
July 8-9, 2015					
ĀĀĀĀĀ?MRLFDOĀ6@FMĀLĀ	+Ā	Ā	%Ā	Ā	**8**

October 29-30, 2015	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	&Ā	*Ā		**8**
February 2-3, 2016	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ		*Ā		**6**
May 3-4, 2016	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ		'Ā	%Ā	**4**
July 12-13, 2016	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ		(Ā		**4**
November 9-10, 2016	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	&Ā	%Ā		**3**
March 1-2, 2017	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ	&Ā	%Ā		**3**
April 25-26, 2017	ĀĀĀĀĀ?MRLFDOĀ6@FMMLĀ		%Ā		**1**
August 2-3, 2017	?MRLFDOĀ6@FMMLĀ				**0**
October 25-26, 2017					

<HQD	:DK@[1]	7HB@[1]	;DKD[1]	;@O@[1,2]	**TOTAL**
?MRLFDO6@FMML	%	%	&		**4**
February 8-9, 2018					
?MRLFDO6@FMML	&				**2**
May 1-2, 2018					
?MRLFDO6@FMML	%		&		**3**
July 12-13, 2018					
?MRLFDO6@FMML	*				**6**
November 7-8, 2018					
?MRLFDO6@FMML	+		&		**8**
February 20-21, 2019					
?MRLFDO6@FMML	)		&	%	**8**
May 14-15, 2019					
?MRLFDO6@FMML	(				**4**
TOTAL	**164**	**56**	**84**	**4**	**309**

[1] :DK@ *Peromyscus maniculatus*. 7HB@ *Microtus californicus*. ;DK *Reithrodontomys megalotis*. ;@O@ *Rattus norvegicus*. [2] 3PB@NDCĀADEMODĀNCFHDOBPD...

Invertebrate Monitoring

Avian Surveys

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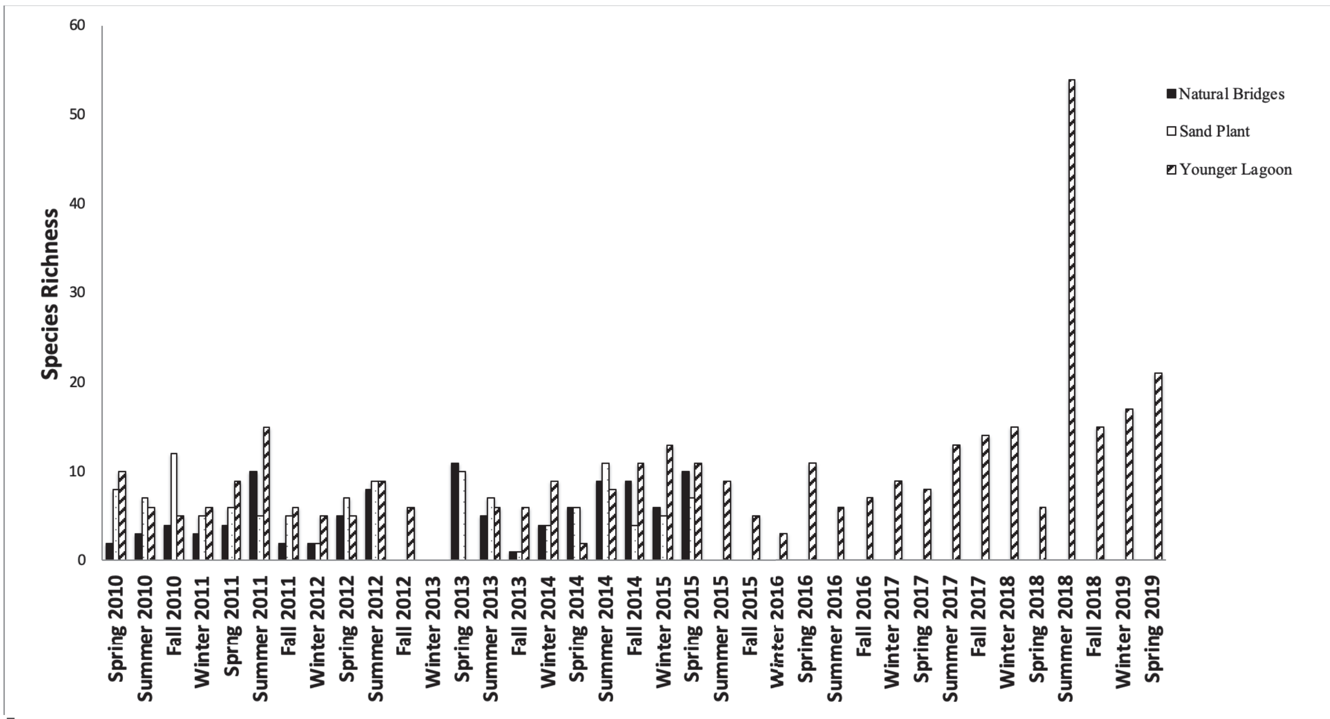
&53>;1Ā# Ā*:1/51<Ā;5/481<<Ā92Ā58?1;=1.;-=1<Ā-/;9<<Ā-66Ā.1-/41<Ā



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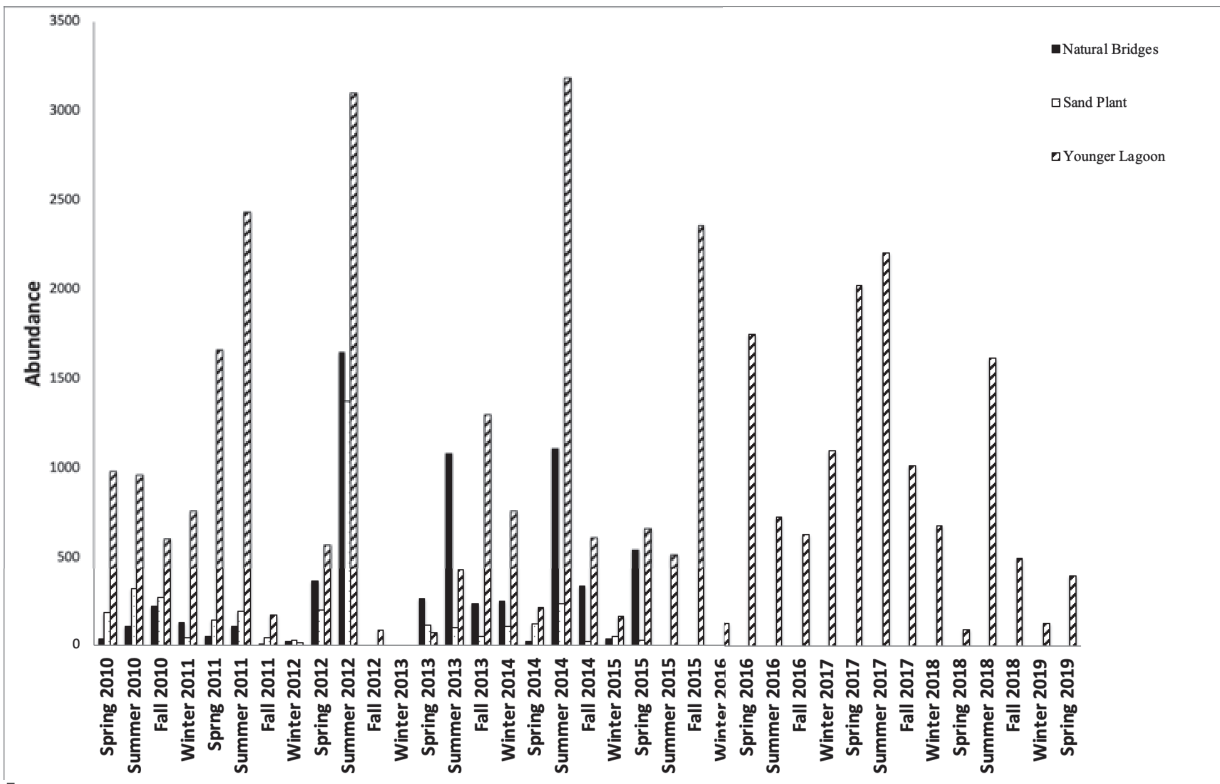

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Site	AMCO	AMCR	AMPE	BBPL	BEWR	BCNH	BASW	BLOY	BLPH	BLTU	BRAC	BRBL	BRPE	BUHE	BUSH	CAGO	CAGU	CLSW	CORA	COOT	COYE	DOCO	DUSP	EUST	GCSP	GRHE	GREG	GRTE	HEGU	HOFI
April 24 & 26, 2010																														
Sand Plant																														
Younger Lagoon																														
Natural Bridges												2																		
August 11-12, 2010																														
Sand Plant																													1	
Younger Lagoon								2														1		1					2	
Natural Bridges		2										19																		
November 15 & 16, 2010																														
Sand Plant																										3				
Younger Lagoon										1			27							2			3	1						
Natural Bridges												1														2	2		24	
February 15 & 16, 2011																														
Sand Plant																														
Younger Lagoon																						5								
Natural Bridges		3										2		1			58													
May 3 & 4, 2011																														
Sand Plant		2											8																	
Younger Lagoon																														
Natural Bridges		1							1								3					6					1			
July 22 & 23, 2011																														
Sand Plant							4		1									4											8	
Younger Lagoon																														
Natural Bridges		9					4					6										10							48	
March 29 & 30, 2012																														
Sand Plant																	1													
Younger Lagoon												5								3				2						
Natural Bridges										1																		2		
May 15 & 16, 2012																														
Sand Plant																														
Younger Lagoon								3				2												2						
Natural Bridges		1										1																		
August 25 & 26, 2012																														
Sand Plant																	2		2											
Younger Lagoon			1					1	1								4													
Natural Bridges																	1													
November 5& 6, 2012																														
Sand Plant																				5										
Younger Lagoon												4								8										
Natural Bridges		2																												
January 13&14, 2013																														
Sand Plant																														
Younger Lagoon								1						1						5										
Natural Bridges																			1							1				
May 1 & 2, 2013																														
Sand Plant																														
Younger Lagoon												1				2								2						
Natural Bridges		2																									2			
July 16-17, 2013																														
Sand Plant						1											1		1											
Younger Lagoon						1			2			7					2									1				
Natural Bridges									2			1					1									1			11	
October 22-23, 2013																														
Sand Plant																	1		2											
Younger Lagoon				3					3								2					1		1					300	
Natural Bridges		2		1									1				3												3	
February 13-14, 2014																														
Sand Plant																6														
Younger Lagoon																											1			
Natural Bridges		1																												
April 27-28, 2014																														
Sand Plant		3											20																	
Younger Lagoon								8					13			2														
Natural Bridges		3						2					11				7	2				8					1			
July 30-31, 2014																														
Sand Plant																	10										1		10	
Younger Lagoon													18														4			
Natural Bridges													18																15	
November 4-5, 2014																														
Sand Plant																				2									6	
Younger Lagoon									2				5							6										
Natural Bridges		11										2								10							1		9	
January 26-27, 2015																														
Sand Plant									2							2														
Younger Lagoon													6							9										
Natural Bridges		12							1				27						3								1			
April 14-15, 2015																														
Sand Plant									1							2				1										
Younger Lagoon									2											1										
Natural Bridges													6							7										

Site	AMCO	AMCR	AMPE	BBPL	BEWR	BCNH	BASW	BLOY	BLPH	BLTU	BRAC	BRBL	BRPE	BUHE	BUSH	CAGO	CAGU	CLSW	CORA	COOT	COYE	DOCO	DUSP	EUST	GCSP	GRHE	GREG	GRTE	HEGU	HOFI
July 8-9, 2015																														
Younger Lagoon						2	4																							
October 29-30, 2015																														
Younger Lagoon									1				4				2													
February 2-3, 2016																														
Younger Lagoon									1															2						
May 3-4, 2016																														
Younger Lagoon							4		2							2													1	
July 12, 2016																														
Younger Lagoon							3		1			12					2										1			
November 9-10, 2016																														
Younger Lagoon									2				1														1			
March 1-2, 2017																														
Younger Lagoon									1								3										1			
April 25-26, 2017																														
Younger Lagoon		1																6						2						
August 2-3, 2017																														
Younger Lagoon							8	2	2		8																1		2	6
October 25-26, 2017																														
Younger Lagoon									1		6		2																	
February 7-8, 2018																														
Younger Lagoon									1		2		2												1				3	
May 2-3, 2018																														
Younger Lagoon							5	2	2		5	1																		
August 13-4, 2018																														
Younger Lagoon							6					2					1										3			
November 7-8, 2018																														
Younger Lagoon					1				11		29		40		1										1					
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Younger Lagoon	4								2						12	4					1									1
May 14-15, 2019																														
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Site	KILL	LESA	LOCU	MALL	MAGO	MEGU	MODO	NOHA	PECO	PEFA	PIGR	PIGU	REHA	REPH	RWBB	RODO	SAND	SAPH	SNEG	SOSP	SPSA	SURF	VGSW	WEGU	WESA	WHIM	YRWA	Richness
April 24 & 26, 2010																												
Sand Plant				2																				2				1
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August 11-12, 2010																												
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Site	KILL	LOCU	MALL	MAGO	MEGU	MODO	NOHA	PECO	PIGR	PIGU	REHA	REPH	RWBB	RODO	SAND	SAPH	SNEG	SPSA	SURF	WEGU	WESA	WHIM	Richness
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Discussion

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Literature Cited

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Fig 3.11 Biotic Resources

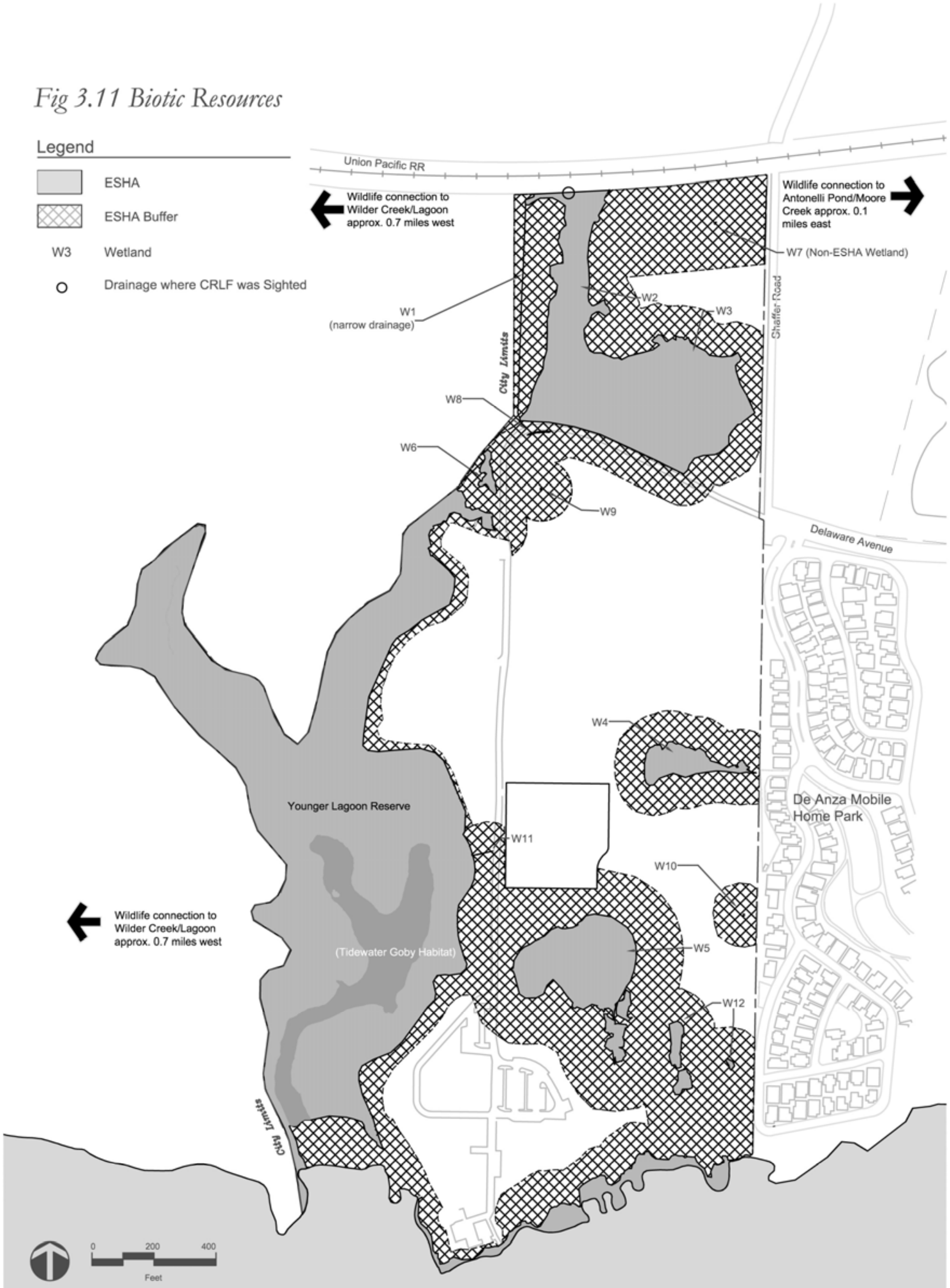
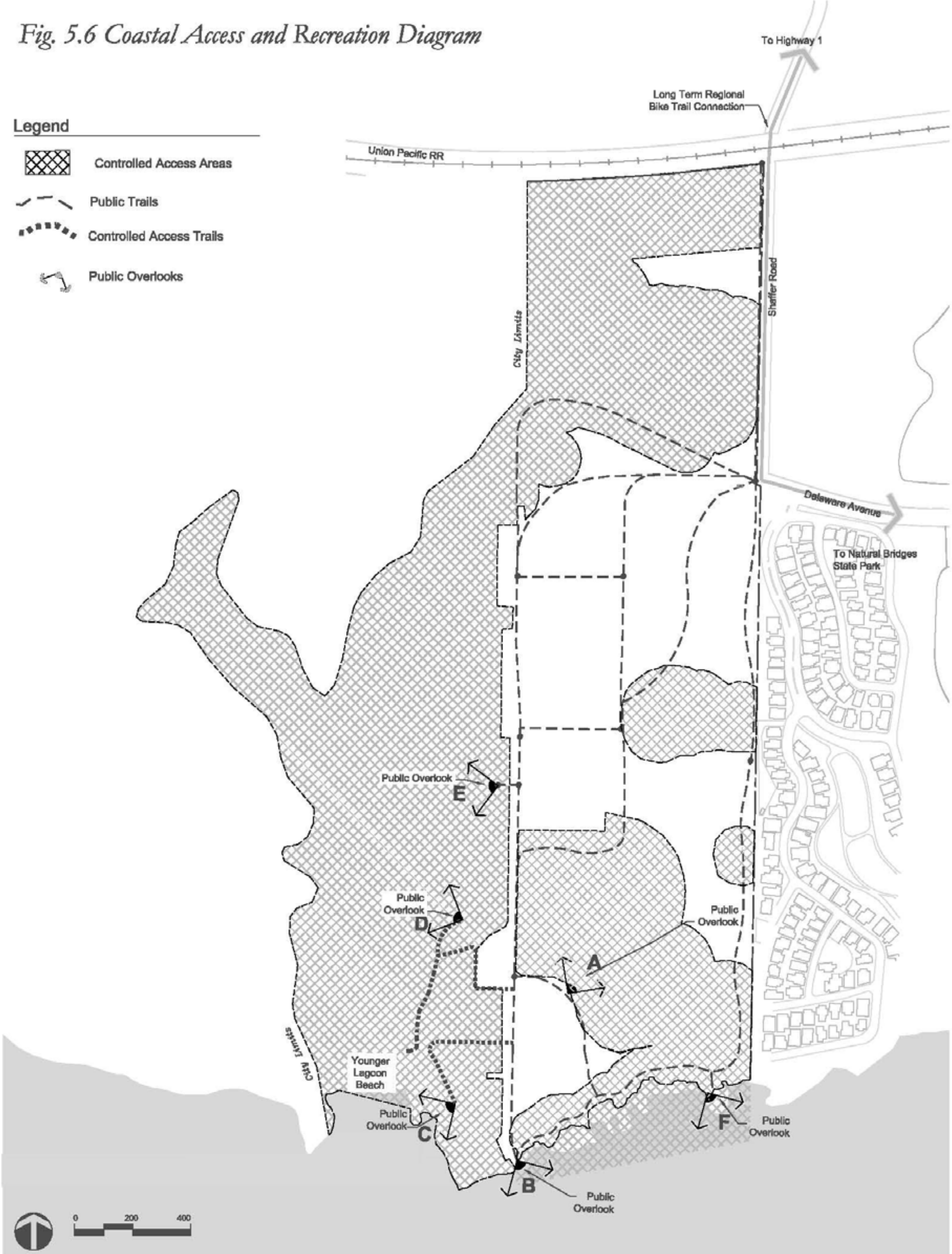


Fig. 5.6 Coastal Access and Recreation Diagram



STATE OF CALIFORNIA — NATURAL RESOURCES AGENCY GAVIN NEWSOM, *GOVERNOR*

CALIFORNIA COASTAL COMMISSION
CENTRAL COAST DISTRICT
725 FRONT STREET, SUITE 300
SANTA CRUZ, CA 95060
PHONE: (831) 427-4863
FAX: (831) 427-4877
WEB: WWW.COASTAL.CA.GOV

Th7a

Prepared October 5, 2020 for October 8, 2020 Hearing

To: Commissioners and Interested Persons

From: Susan Craig, Central Coast District Manager
Colin Bowser, Coastal Program Analyst

Subject: Additional hearing materials for Th7a (NOID Application Number SCZ-NOID-0004-20 (Younger Lagoon Reserve Beach Public Access Management Plan)

This package includes additional materials related to the above-referenced hearing item as follows:

Additional correspondence received since the staff report was distributed

Colin - See email below and summary from Beth to help support your response to the comment you received.

The high school students that Mr. Levy mentioned observing on the beach are part of a program that we are especially proud to support, the *Monterey Bay Aquarium's Watsonville Area Teens Conserving Habitat (WATCH) Program*. This program brings students from the Pajaro Valley Unified School District to the reserve to conduct field-based hands-on science projects. The students make multiple visits over the summer and fall to set up their projects and collect data. They spend the winter analyzing and writing up their data, and then present to members of the public in the spring. The students are accompanied by staff from the reserve, aquarium, and Seymour Center on their visits, as well as their classroom teachers and science mentors (usually grad students from a local institution) who help to ensure that they are respectful of the reserve and its habitats.

Oxo Slayer, Senior Physical Planner

University of California, Santa Cruz

Physical Planning, Development & Operations

Tel: (831) 212-0185 Email: oslayer@ucsc.edu

---------- Forwarded message ---------
From: **Elizabeth Howard** <eahoward@ucsc.edu>
Date: Tue, Sep 29, 2020 at 12:52 PM
Subject: Fwd: Public Comment on September 2018 Agenda Item Thursday 12a - University of California Santa Cruz Notice of Impending Development SCZ-NOID-0004-18 (Younger Lagoon Reserve Beach Public Access Plan, Santa Cruz)
To: Oxo Slayer <oslayer@ucsc.edu>, Gage Dayton <ghdayton@ucsc.edu>, Jolie Kerns <kernsj@ucsc.edu>

---------- Forwarded message ---------
From: **Kimberly Swan** <KSwan@mbayaq.org>
Date: Fri, Sep 7, 2018 at 2:12 PM
Subject: Public Comment on September 2018 Agenda Item Thursday 12a - University of California Santa Cruz Notice of Impending Development SCZ-NOID-0004-18 (Younger Lagoon Reserve Beach Public Access Plan, Santa Cruz)
To: CentralCoast@coastal.ca.gov <CentralCoast@coastal.ca.gov>
Cc: Amy Wolfrum <AWolfrum@mbayaq.org>, Rita Bell <RBell@mbayaq.org>, Elizabeth Howard <eahoward@ucsc.edu>

On behalf of Monterey Bay Aquarium, I'm contacting you in support of agenda item Th12a, the University of California at Santa Cruz's Marine Science Campus Coastal Long Range Development Plan that includes Younger Lagoon.

Since 2006, over 550 high school students from Pajaro Valley Unified School District (PVUSD) have participated in Watsonville Area Teens Conserving Habitats (WATCH), a year-long field-based research program co-taught by PVUSD faculty and Monterey Bay Aquarium educators. Many of these students have been Latino, first generation students who have a limited experience with the environment. Beginning in 2014, WATCH students from Aptos High School began conducting field research investigations at Younger Lagoon. The reserve staff and volunteers provide guidance, equipment and expertise asthe students develop their own testable questions, design their investigations and gather and analyze data in the Lagoon. This unique ecosystem provides a fantastic location for students to conduct experiments, carry out long-term scientific monitoring projects, and learn about this unique natural space that has limited impact from the public.

We truly appreciate the access and resources that the staff of Younger Lagoon has provided for the students of the Monterey Bay Aquarium's WATCH program. The experience the students receive at Younger Lagoon and support from the staff are critical elements to the success of WATCH. Thank you for your consideration.

Sincerely,

Kim Swan

Teen Programs Manager

Monterey Bay Aquarium

Kimberly Swan
Teen Programs Manager
P 831-647-6852   M 831-402-9014   F 831-855-1461

Monterey Bay Aquarium
886 Cannery Row, Monterey, CA 93940
www.montereybayaquarium.org
Our mission is to inspire conservation of the ocean.

From: CentralCoast@Coastal
To: Bowser, Colin@Coastal
Subject: Fwd: Younger Lagoon Reserve Beach public access SCZ-NOID-004-20
Date: Wednesday, September 23, 2020 12:49:56 PM

Sent from Samsung Galaxy smartphone.
Get Outlook for Android

From: Seth Levy <seth@rtpacific.com>
Sent: Wednesday, September 23, 2020 10:07:53 AM
To: CentralCoast@Coastal <CentralCoast@coastal.ca.gov>
Subject: Younger Lagoon Reserve Beach public access SCZ-NOID-004-20

Dear Coastal Commision,

I have found the current Younger lagoon access to be public in name only and insufficient to allow for ocean beach access for water users as provided under california state law. I propose a simple path that can exclude sensitive areas and allow the public to truly access this beach and the water. This is the only practical access point for this portion of the coast, the areas north either being private land or inaccessible cliffs. Wilder beach is closed to the public.

I took the docent led private tour which is quite restrictive in when you can go and what you can do. Due to these restrictions it renders the beach worthless as a public access point for recreation and ocean access. While on the tour I observed 20+ high school students roaming all over the area and flying a drone as part of a school project. This begs the question if the area is so sensitive why are high impact activities such as this allowed?

In my mind the reserve in its current form remains the private domain of the marine lab, and the supposedly public access does not come close to meeting the standards the coastal commission should be enforcing.

Sincerely,

Seth Levy
Santa Cruz, CA

Notice of Impending Development 12 (20-1)

Public Access to and within Younger Lagoon Natural Reserve
Special Conditions Implementation Plan
(2021-2025)

Burrowing owl on the Younger Lagoon Reserve Beach Dunes

Public Access to and within Younger Lagoon Natural Reserve Special Conditions Implementation Plan

Overview

On October 7, 2020, the California Coastal Commission approved UCSC's NOID 12 (20-1) as consistent with UCSC's approved Coastal Long Range Development Plan with the addition of new requirements supplementing the existing (NOID 9 18-1) five staff-recommended special conditions. The five special conditions included 1) Free Beach Tours, 2) Beach Tour Outreach Plan, 3) Beach Tour Signs, 4) Beach Tour Availability and Monitoring, and 5) Beach Access Management Plan Duration. Within 30 days of the approval (i.e., by November 7, 2020), UCSC was required to submit a plan for implementation of special condition 2 (Outreach Plan) to the Executive Director of the California Coastal Commission. UCSC's plan for implementation of new Outreach Plan requirements and a continuation of all five previous special conditions requirements are detailed below.

Due to COVID-19 precautions, the Seymour Center remains temporarily closed and the free beach tour program temporarily suspended. The University will restart the free beach tour program when the Seymour Center reopens and Orders of the State Public Health Officer and County of Santa Cruz Health Officer currently in effect are rescinded or amended (see UC Santa Cruz's Pub. Res. Code section 30611 notification letter to the Commission).

<u>Condition 1.</u>

FREE BEACH TOURS

All beach tours shall be offered for free, and UCSC shall not require that beach tour users pay any separate admission fee to any other facility in order to take the beach tour. This condition shall not be construed as affecting existing, already-allowed admission fees for UCSC's Seymour Marine Discovery Center. At a minimum, beach tour sign-ups shall be provided online (e.g., at UCSC Marine Science Campus and Seymour Marine Discovery Center websites), by phone, and at the Seymour Marine Discovery Center front desk. UCSC shall also identify and implement a mechanism for tracking the number of tour requests that are denied due to lack of tour availability or because tours are fully booked. All UCSC materials referencing the beach at Younger Lagoon and/or beach tours shall be required to be modified as necessary to clearly identify that access to the beach is available for free via beach tours.

Implementation Plan

All beach tours will continue to be offered for free (without admission fee). Beach tour sign-ups will be available online through the Seymour Marine Discovery Center (Seymour Center) website, by phone and at the Seymour Center public admissions counter. Seymour Center staff will track any tour requests that are denied due to lack of tour availability or because tours are fully booked as part of their ongoing monitoring of all visitor programs. Seymour Center staff will record the number of participants that were denied, the number of participants that were wait listed, as well as the date of the request, the date of the tour being requested, and how participants heard about the tour (see Condition 2 and Appendix A). All UCSC public materials referencing the beach at Younger Lagoon and/or beach tours, including the websites below, will clearly identify that access to the beach is available for free. (Note that there is no UCSC Marine Science Campus website; tour information will be posted to the Younger Lagoon Reserve and Seymour Marine Discovery Center websites).

https://youngerlagoonreserve.ucsc.edu/about-us/index.html

https://youngerlagoonreserve.ucsc.edu/research-teaching-public-service/visit/public-tours.html
https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/

Condition 2.

BEACH TOUR OUTREACH PLAN

Within 30 days of this approval (i.e., by November 7, 2020), UCSC shall submit two copies of an updated Outreach Plan for Executive Director review and approval, where such Plan shall identify all measures and venues to be used to advertise and increase awareness of the beach tours, including the online virtual tours. Promotional methods shall include, but are expected to not be limited to: UCSC Marine Science Campus and Seymour Marine Discovery Center websites, press releases, calendar listings with UCSC Events and local media (e.g., Good Times newspaper, Santa Cruz Sentinel, The Register-Pajaronian, The Half Moon Bay Review, The Monterey Herald, etc.), ads on radio (e.g., local radio stations KAZU, KRML, and others), print ads, social media (including Facebook, Twitter, and Instagram), and contacts with influential organizations in local environmental and community advocacy groups who may facilitate promotional opportunities. The Plan shall identify the language to be used in describing the virtual and free in-person beach tours (where said language shall be required to be consistent with the terms and conditions of this approval), and shall provide a schedule for each type of outreach, with the goal being to reach as many potential online viewers and potential beach tour participants as possible, including audiences beyond Santa Cruz that might not normally be reached through traditional and local means (e.g., inland communities). The Plan shall describe how UCSC will monitor and track the Outreach Plan's execution so that UCSC and the Coastal Commission can note the effectiveness of the plan and make changes as needed. UCSC shall implement the updated approved Outreach Plan.

Implementation Plan

Outreach will be conducted according to the following plan, which includes all of the measures and venues described in Condition 2:

Venue	Language	Schedule	Mechanism for Monitoring and Tracking
Seymour Center Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up here*. Virtual tours are available here**. * hyperlink to online sign-up **hyperlink to virtual tour	Permanent webpage: https://seymourcenter.ucsc.edu/visit/behind-the-scenes-tours/	Provide link to updated website and date that updates were made
YLR Website	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants.	Permanent webpage: https://youngerlagoonreserve.ucsc.edu/	Provide link to updated website and date that updates were made

	Call **831-459-3800** or sign-up online. Virtual tours are available online. **seymourcenter.ucsc.edu**	research-teaching-public-service/visit/public-tours.html	
Seymour Center Social Media o Facebook o Twitter o Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up online. Virtual tours are available online. **seymourcenter.ucsc.edu**	Facebook—Monthly Twitter, Instagram ---Once a quarter	Document date that posts are made and capture a link to the post
YLR Social Media o Facebook o Instagram	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up online. Virtual tours are available online. **seymourcenter.ucsc.edu**	Once a quarter	Document date that posts are made and capture a link to the post
Calendar Listings o UCSC Events o Good Times Newspaper (Santa Cruz) o Register Pajaronian Newspaper (Watsonville) o The Half Moon Bay Review o The Monterey Herald o KAZU public radio (Santa Cruz) o KRML (Monterey Bay)	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up online. Virtual tours are available online. **seymourcenter.ucsc.edu** For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 18 participantes. Llame al **831-459-3800** o regístrese en línea. Las visitas virtuales están disponibles en línea. **seymourcenter.ucsc.edu**	Submitted monthly (calendar listings appear at the discretion of the media outlet.)	Document date that listings are submitted, and verify that the listing ran by capturing a link to the website (if online)
Ads o Santa Cruz Sentinel Newspaper (Santa Cruz)	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up online. Virtual	Quarterly	Document date that ads ran, and verify that the ad ran by capturing a link to the website (if online)

- Good Times Newspaper (Santa Cruz) - KAZU public radio (Santa Cruz)	tours are available online. **seymourcenter.ucsc.edu** For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 18 participantes. Llame al **831-459-3800** o regístrese en línea. Las visitas virtuales están disponibles en línea. **seymourcenter.ucsc.edu**		
Press Release	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up online. Virtual tours are available online. **seymourcenter.ucsc.edu** For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 18 participantes. Llame al **831-459-3800** o regístrese en línea. Las visitas virtuales están disponibles en línea. **seymourcenter.ucsc.edu**	Announce the virtual tours and resumption of free in-person beach tours post-COVID via two bilingual (English and Spanish) UCSC press releases.	Document the date of the press releases, distribution list of media outlets and verify that the press releases were posted by capturing a link to the website (if online).
Contacts who may facilitate promotional opportunities SMDC Educator Email Mailing List (815 subscribers)	Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Call **831-459-3800** or sign-up online. Virtual tours are available online. **seymourcenter.ucsc.edu**	Once a quarter	Information about the tours will be emailed to contacts once a quarter. Date of email and recipients will be documented.

- Homeschool Mailing Email List (124 subscribers) - Seymour Center E-newsletter list - 10,000 email recipients from all over California and beyond - UCSC Events Email-newsletter - Andy Carman at Enviroteers, weekly newsletter - CSUMB Outdoor Recreation Resources and Opportunities Website - Outdoor World Outdoor Resources Website: https://www.theoutdoorworld.com/info/outdoor-resources	For Spanish language outlets: Las visitas guiadas a la reserva de la laguna Younger son gratuitas y están abiertas al público. El espacio está limitado a 18 participantes. Llame al **831-459-3800** o regístrese en línea. Las visitas virtuales están disponibles en línea. **seymourcenter.ucsc.edu**		

In addition, tour participants will be surveyed to determine how they heard about the tour. This information will be tracked with sign-up information (see Condition 1 and Appendix A).

Condition 3.

BEACH TOUR SIGNS

UCSC will continue to implement the Beach Tour Sign Plan that was previously-approved by the Executive Director under NOID 9 where such Plan has provided for installation of signage outside of the Seymour Marine Discovery Center and inside at its front desk, at Campus overlooks, and at other appropriate public access locations on the Marine Science Campus that describe free beach tour availability, including "day of" signs for each day beach tours are offered to ensure maximum notice is provided. All such signs shall continue to be sited and designed to be visually compatible with the area, consistent with the Campus sign program (and CLRDP sign requirements) and continue to *provide clear information in a way that minimizes public view impacts. UCSC shall continue to implement the approved Beach Tour Sign Plan from NOID 9.*

Implementation Plan

Information on the free beach tours will continue to be displayed "day of" on a large colorful monitor in the front window of the Seymour Center and at the public admissions counter. Admissions counter signage will continue to include the brown and white footprints on wave logo, and include the following language "Free Younger Lagoon Reserve Beach Tours Today" (see Figure 1). Signage will continue to be displayed at the information kiosk outside of the Seymour Center and at Overlooks A-F. Overlooks, admissions counter, and kiosk signage includes the brown and white footprints on wave logo, and include the following language "Free Younger Lagoon Reserve Beach Tours, Call (831) 459-3800" (see Figure 2).

Figure 1. "Day of" sign design.

Figure 2. Overlooks and kiosk sign design.

Condition 4.

BEACH TOUR AVAILABILITY AND MONITORING

UCSC shall offer at least four beach tours per month (of which at least one per month is a weekday tour and at least two per month are weekend tours) from March 1st through September 30th each year and shall provide at least two beach tours per month (of which at least one per month is a weekday tour and at least one per month is a weekend tour) otherwise (totaling a minimum of 38 total beach tours per year). UCSC may limit the number of beach tour participants to 18 persons per tour, but this number may be exceeded per tour on a case-by-case basis, and beach tours shall not require any minimum number of participants to be provided (i.e., if at least one person signs up, the tour shall be provided). UCSC shall document the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also Condition 1).

At least every six months (i.e., by June 30 and December 31 of each year), UCSC shall submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the

Report shall, at a minimum, provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved updated Beach Tour Outreach Plan (see Condition 2) and which shall include specific information regarding the dates that each advertisement for beach tours was placed in each venue/media/social media outlet, as well as the required information described in the previous paragraph. Each such Monitoring Report shall include a section that identifies recommendations about whether user data suggests that beach tours should be increased in terms of frequency of tours and/or number of tour attendees, or otherwise modified to better respond to user demand, including the potential to offer a more limited beach area tour (e.g., designed to allow participants to access just the sandy beach area itself in a shorter amount of time) as a means of offsetting demand. Each Monitoring Report shall also include a section that describes how the beach-lagoon ecosystem has responded to beach tours. This assessment will include data and analysis useful for assessing whether the ecosystem shows any impacts from beach tours. This assessment will be used to help determine if larger tours have any impacts on the YLR ecosystem, its environmental quality, and UCSC research opportunities at the site. UCSC shall implement any Executive Director-approved recommendations from each Beach Tour Monitoring Report.

Implementation Plan

Free beach tours will be offered at least four times per month (at least one on a weekday and two on a weekend tours) from March 1st through September 30th each year, and will be offered at least two times per month (at least one on a weekday and one on a weekend) for the remainder of the year (a minimum of 38 total beach tours per year). Beach tour participants will be limited to 18 persons per tour, but this number may be exceeded per tour on a case by case basis, and beach tours will not require any minimum number of participants to be provided (i.e., if at least one person signs up, the tour will be provided). UCSC will document the date/time and number of participants for each beach tour, as well as the number of tour requests that are denied due to lack of tour availability or because tours are fully booked (see also Condition 1). In addition, tour participants will be surveyed to determine how they heard about the tour. This information will be tracked with sign-up information (see Condition 1, Condition 2 and Appendix A).

At least every six months (i.e., by June 30th and December 31st each year), UCSC will submit two copies of a Beach Tour Monitoring Report for Executive Director review and approval, where the Report will at a minimum provide information regarding compliance with these conditions of approval, including a section identifying UCSC's activities under the approved updated Beach Tour Outreach Plan (see Condition 2), as well as the required information described in the previous paragraph and Condition 4 above. The first such report under this implementation plan will be submitted by June 30, 2021. (Note that the final report under the NOID 9 implementation plan will be submitted by December 31, 2020.)

Condition 5.

BEACH ACCESS MANAGEMENT PLAN DURATION

This approval for UCSC's public beach access management plan at Younger Lagoon Beach shall be effective through December 31, 2025. UCSC shall submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2026 to December 31, 2030) no later than July 1, 2025. Such a complete NOID shall, at a minimum, summarize the results of the Beach Tour Monitoring Reports (see Condition 4), and shall identify the manner in which UCSC's proposed *management plan responds to such data, including with respect to opportunities to increase public access to the beach area when considered in light of potential impacts to UCSC research and coastal resources. If such a complete NOID has not been submitted by July 1, 2025, then UCSC shall allow supervised (via beach and trail monitors only) general public access to Younger Lagoon Beach during daylight hours (i.e., one hour-before sunrise to one-hour after sunset) until such NOID has been submitted.*

Implementation Plan

UCSC will submit a complete NOID, consistent with all CLRDP requirements, to implement its next public beach access management plan at Younger Lagoon Beach (for the period from January 1, 2026 to December 31, 2030) no later than July 1, 2025.

Appendix A.

BEACH TOUR ONLINE SIGN-UP FORM

DRAFT - Younger Lagoon Reserve Tours: Online Reservation Form

Younger Lagoon Reserve tours are free and open to the public. Space is limited to 18 participants. Advanced reservations are highly recommended. After submitting an online reservation form, you will be contacted via email or phone within three business days or sooner to confirm participation. Please call 831-459-3800 with any questions or concerns.

A tour is offered on selected Thursdays and Sundays of each month beginning at 10:30 AM. Tours are best suited for children 10 years of age and older. Participants must be physically able to walk up and down steep inclines. Water and weather protection is strongly suggested. Younger Lagoon Reserve Tours may be cancelled due to inclement weather or unsafe conditions at the discretion of the Seymour Marine Discovery Center. You will be notified if a Younger Lagoon Reserve Tour is cancelled.

* Required

Contact Information

1. Last Name *

2. First Name

3. Email *

4. Phone Number

5. Are you an active Seymour Center member?

Mark only one oval.

- Yes
- No
- Unsure

Younger Lagoon Reserve Tour Date Selection

6. Reserve a Younger Lagoon Reserve Tour date *

All Younger Lagoon Reserve Tours begin at 10:30 AM. After submitting an online reservation form, you will be contacted via email or phone within three business days or sooner to confirm participation. Please call 831-459-3800 with any questions or concerns.

Mark only one oval.

- DATE TBD - 1
- DATE TBD - 2
- DATE TBD - 3

Number of Participants

7. Specify the number of adults, including yourself, that will attend the tour:

Younger Lagoon Reserve Tours are free and open to the public. Space is limited to a total of 18 participants. Adults include anyone 16 and older, college students, and seniors.

Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18

8. Specify the number of children (ages 10-16), including yourself, that will attend the tour:

Younger Lagoon Reserve Tours are free and open to the public. Space is limited to a total of 18 participants.

Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18

9. Specify the number of children (ages 10 and under), that will attend the tour:

Younger Lagoon Reserve Tours are free and open to the public. Space is limited to a total of 18 participants per tour.

Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18

How Did You Hear About Us?

10. How did you hear about Younger Lagoon Reserve Tours?

Mark only one oval.

- Ad: Good Times Newspaper
- Ad: KAZU Public Radio
- Ad: Santa Cruz Sentinel Newspaper
- Community Calendar Listing: Good Times Newspaper
- Community Calendar Listing: KAZU public radio
- Community Calendar Listing: KRML radio
- Community Calendar Listing: Register Pajaronian Newspaper
- Community Calendar Listing: The Half Moon Bay Review
- Community Calendar Listing: The Monterey Herald
- Community Calendar Listing: UC Santa Cruz (UCSC) Events
- Email Newsletter: Enviroteers
- Email Newsletter: Seymour Marine Discovery Center
- Email Newsletter: Seymour Marine Discovery Center Educators
- Email Newsletter: Seymour Marine Discovery Center Homeschool Groups
- Press Release
- Social Media: Seymour Marine Discovery Center
- Social Media: Younger Lagoon Reserve
- Website: CSU Monterey Bay (CSUMB) Outdoor Recreation Resources and Opportunities
- Website: Outdoor World Outdoor Resources
- Website: Seymour Marine Discovery Center
- Website: Younger Lagoon Reserve
- Other

11. If other, please describe.

Know Before You Go

-[Add COVID protocols (if appropriate) for in-person tours once they resume]
-Younger Lagoon Reserve Tours may be cancelled due to inclement weather or unsafe conditions at the discretion of the Seymour Marine Discovery Center. You will be notified if a Younger Lagoon Reserve Tour is cancelled.

12. I understand that after I submit an online reservation form, I will be contacted via email or phone within three business days or sooner to confirm participation. Participants must be physically able to walk up and down steep inclines. Water and weather protection is strongly suggested. Please call 831-459-3800 with any questions or concerns. *

Check all that apply.

☐ I understand

Appendix 6. Publications

MADROÑO, Vol. 67, No. 2, pp. 105–111, 2020

GERMINATION OF MULTI-YEAR COLLECTIONS OF CALIFORNIA GRASSLAND AND SCRUB SEEDS

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ABSTRACT

Successful restoration of California terrestrial ecosystems requires knowledge of seed germination rates for a diversity of native species. We quantified greenhouse germination of 25 native perennial forbs, shrubs, and grasses collected coastally near Santa Cruz, CA for restoration at the Younger Lagoon Reserve and nine annual forb species from interior grasslands at Pinnacles National Park. Seeds of most species were collected in multiple years. Twenty-seven of our 34 study species had at least 25% germination without complicated germination triggers. All but two of the 13 species that were collected in $\geq$3 years and germinated showed significant interannual variation in germination; seven species had a trend of decreasing percent germination with increasing age. These species- and collection-year specific results indicate a necessity to test seed stock when possible prior to seeding to increase restoration success, and highlight the importance of following best practices for seed collection and storage.

Key Words: central California, coastal prairie, grassland, restoration, sage scrub, seed germination, seed longevity.

Sage scrub and grassland ecosystems are critically threatened in California (Hoekstra et al. 2005) due to land conversion, non-native invasive species, and altered disturbance regimes (Vasey and Holl 2007). The long-term recovery of California native ecosystems depends on developing best management strategies for their restoration, in particular propagating and planting native seed to ensure conservation of biodiversity and genetic diversity at the project site and increasing site resistance to invasive species (Stromberg et al. 2007; Vasey and Holl 2007). Restoration requires species-specific information on seed germination rates and seed longevity data for the huge variety of California native species.

Seed germination rates are determined by many variables including seed age, storage practices, maternal effects, climate, and site conditions (Rajjou et al. 2008; Baskin and Baskin 2014). Past studies of orthodox seeds, i.e., seeds that survive drying and/or freezing events in storage, have shown that many species retain viability for decades, whereas seed viability decreases rapidly over time for other species (Priestley et al. 1985; Walters et al. 2005; Fenner 2017). Furthermore, a number of past studies have found reduced seed longevity over time when seeds are exposed to conditions with higher moisture and temperature (Dickie et al. 1988; Brown and Briggs 1991; Nguyen et al. 2012). Maternally expressed genetic factors strongly influence seed development and resulting seed mass, which both influence resulting germination (Wulff 1995; Wang et al. 2016). Likewise, site conditions (e.g., soil moisture and nutrients) can affect seed germination (Fenner 2017).

This study aimed to quantify the percent germination of 34 native California grassland and coastal species that are commonly used in restoration projects in central California, most of which were collected in multiple years. Our results supplement existing information on seed germination requirements and rates (e.g., Emery 1988; Gulmon 1992; Keeley and Fotheringham 1998; Wall and Macdonald 2009) to better enable restorationists to collect and store high quality seed, and in turn reduce project costs and increase plant establishment (Barton et al. 2016).

MATERIALS AND METHODS

This study was conducted with seed collected for restoration at Younger Lagoon Reserve (YLR) and Pinnacles National Park. YLR is a 29-hectare area of protected land (36.95370°N, –122.06654°W) adjacent to the Pacific Ocean that belongs to the University of

California Natural Reserve System and is dominated by coastal scrub and grassland habitat. Much of the site is currently being restored following a long history of agricultural land use. Seeds for the YLR study site were collected in Santa Cruz County along State Route 1 at Año Nuevo State Park (37.11931°N, –122.30765°W), Wilder Ranch State Park (36.96080°N, –122.08345°W), Coast Dairies State Park (36.98439°N, –122.15570°W), Scaroni Farms (36.97800°N, –122.13815°W), 4 mile Beach (36.96633°N , –122.12272°W), and the University of California at Santa Cruz (UCSC) at West Marshall Field (37.01869°N, –122.07562°W).

Pinnacles National Park (PNP) is a federally designated U.S. National Park about 65 km inland from the coast which includes chaparral, oak woodlands, and grassland ecosystems. Park staff are restoring a nearly flat 80.9-hectare degraded grassland near the east entrance to the park (36.49066°N, 121.18252°W). Seeds were collected at many sites within the boundaries of PNP.

We tested germination rates for 25 native perennial grass, forb, and shrub species that are commonly used for restoration at YLR and 9 native annual forb species that are being reintroduced to PNP (Appendix 1). Sixteen species from YLR were collected in 3–7 consecutive years (Appendix 1). Nine species from YLR and nine species from PNP were collected in 1 or 2 years (Appendix 1). Nomenclature throughout follows Jepson Flora Project (2019).

Seeds were collected from a minimum of 50 plants and at multiple sites, when possible, to ensure genetic diversity, following standard seed collection recommendations (Maschinski et al. 2012). The relative amount of seed of individual species collected from different sites varied annually depending on seed abundance at a given site. Seed collections from a given year were usually combined into one collection container after cleaning to conserve storage space. All seeds were initially stored in paper bags and air dried for 6–12 months. Seeds were then cleaned manually by passing seeds through a minimum of two mesh screens (0.074–3.8 mm) until the target seed was completely free of chaff. After cleaning, YLR seeds were primarily stored at ambient temperature, except for three species that were stored at –2°C (Appendix 1); all collections of individual species were stored at the same temperature. YLR species were stored in one-gallon plastic bags or paper envelopes (depending on volume), except for a few very-small seeded species in glass jars; most collections of the same species were stored in the same container type. All seeds from PNP were stored at ambient temperature in paper envelopes.

We conducted three rounds of germination testing at the Jean Langenheim Greenhouses, University of California, Santa Cruz. All PNP seed testing started on 13 January 2017; a small set of YLR seed was tested on 3 February 2017; and most YLR seeds, including species that were collected in $\geq$3 years, were tested starting 11–13 January 2018. All collections of the same species were tested in the same round, and each species was only tested during one round. For each species $\times$ collection year combination, 100 seeds were divided equally between four $10.16 \times 10.16 \times 15.24$-cm pots filled with Pro-mix HP mycorrhizae soil. In each pot, 25 pre-cleaned, pre-counted seeds were placed into a 5×5 seed grid to avoid aggregation. We placed a light covering of soil over the seeds, approximately 1.5$\times$ the seed length. Pots were maintained at ambient temperature in a greenhouse receiving some indirect and some direct light. Pots were misted twice daily by the greenhouse irrigation system and watered additionally when the soil surface was dry to the touch. We monitored germination weekly for 11 weeks and removed all visible germinants from the soil with forceps cleaned with 70% alcohol solution to reduce microbial contamination.

For 2017 PNP seed testing, *Amsinckia menziesii* (Lehm.) A.Nelson & J.F.Macbr., *Calandrinia menziesii* (Hook.) Torr & A.Gray, *Castilleja exserta* subsp. *venusta* (A.Heller) T.I.Chuang & Heckard, *Clarkia unguiculata* Lindl., *Lasthenia gracilis* (DC.) Greene, and *Madia sativa* Molina were cold stratified at 2.78°C for 2–3 weeks (Emery 1988). For 2017 YLR seed testing, all seeds were initially placed in cold stratification without light at 2.78°C for five weeks and then moved to ambient temperature. No species were stratified in 2018 except for *Sisyrinchium bellum* S.Watson, which was stratified at 2.78°C for 6 weeks pre-sowing (Emery 1988).

ANOVA was used to evaluate whether the percent germination varied significantly among collection years for species that were collected in $\geq$3 years. When the effect of collection year was significant ($\alpha = 0.05$), we conducted Tukey's multiple comparison tests to compare individual years.

Results

Germination rates varied greatly across species and collection year with 27 of the 34 species (76%), including all the annual species from PNP, exhibiting at least 25% germination in one or more collection years. No additional treatments were used to stimulate germination aside from stratification of several species as mentioned previously (Fig. 1, Table 1). *Artemisia californica* Less., *Frangula californica* (Eschsch.) A.Gray, and *Symphyotrichum chilense* (Nees) G.L.Nesom did not germinate, and *Carex gynodynama* Olney, *Danthonia californica* Bol., and *Sisyrinchium bellum* had $\leq$3% germination in all collection years. Of the 13 species that were collected over a period of $\geq$3 years that germinated, all but two showed significant interannual variation, and seven (54%) showed a trend of decreasing germination with increasing year since collection (Fig. 1, Appendix 2).

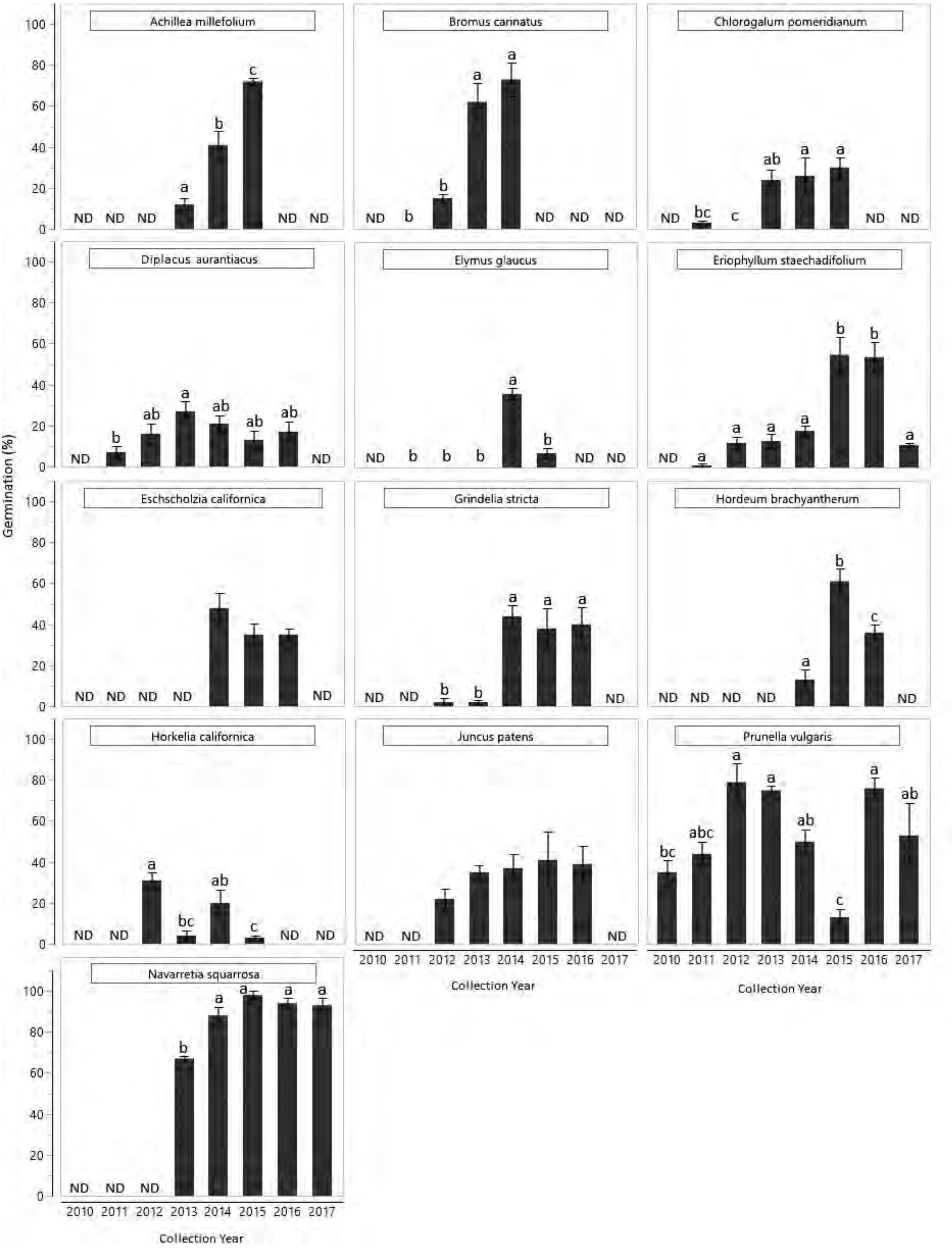

FIG. 1. Percent germination of species tested in ≥3 years. Error bars indicate 1 SD. When ANOVA (Appendix 2) indicated a significant effect of collection year on percent germination ($P < 0.05$), differences in means using Tukey's mean separation procedure are indicated with lower case letters. ND = no data for that collection year. All seeds were stored at ambient temperature, except *Achillea millefolium* Ledeb. and *Bromus sitchensis* var. *carinatus* which were stored at -2°C.

TABLE 1. PERCENT SEED GERMINATION OF ALL SPECIES COLLECTED IN 1 OR 2 YEARS. Values are mean germination percentages ± 1SD for n = 4.

Species	Test year	Site	Seed age (yr)	Germination (%)
Amsinckia menziesii	2017	PNP	1	84.0 ± 5.7
			5	76.0 ± 15.0
Calandrinia menziesii	2017	PNP	1	43.0 ± 24.1
Castilleja exserta ssp. *venusta*	2017	PNP	5	43.0 ± 6.0
Chaenactis glabriuscula	2017	PNP	1	79.0 ± 14.4
Clarkia unguiculata	2017	PNP	1	60.0 ± 19.9
			5	83.0 ± 11.9
Delphinium sp.	2017	PNP	1	94.0 ± 5.2
Lasthenia gracilis	2017	PNP	1	37.0 ± 6.0
			5	26.0 ± 6.9
Lupinus bicolor	2017	PNP	1	91.0 ± 3.8
			5	92.0 ± 3.3
Madia sativa	2017	PNP	1	85.0 ± 3.8
			5	58.0 ± 14.8
Cirsium quercetorum	2018	YLR	1	53.0 ± 11.0
			2	3.0 ± 3.8
Danthonia californica	2017	YLR	1	1.0 ± 2.0
Erigeron glaucus	2017	YLR	2	7.0 ± 3.8
			3	18.0 ± 8.3
Juncus mexicanus	2018	YLR	2	32.0 ± 10.3
			3	34.0 ± 9.5
Lupinus variicolor	2018	YLR	3	51.0 ± 10.0
			5	50.0 ± 5.2
Scrophularia californica	2017	YLR	2	57.0 ± 6.0
			5	74.0 ± 30.2
Stipa pulchra	2017	YLR	2	23.0 ± 8.2
			6	47.0 ± 11.9

DISCUSSION

Our results show that the vast majority of species studied had >25% germination without requiring seed pretreatment to break dormancy, despite the fact that many native species in California have complex germination triggers to ensure that germination only occurs when microclimatic conditions are favorable, such as sufficient rainfall and light (Keeley 1987; Emery 1988; Vaughn and Young 2010). While it is recommended to test viability of non-germinating seeds through a cut or crush test or tetrazolium chloride (Baskin and Baskin 2014), this was not possible for several of the tiny-seeded species we studied. A lack of appropriate germination triggers was likely the cause of little to no germination observed for *Sisyrinchium bellum* and *Frangula californica* in all collection years. Emery (1988) suggests 1.5 months stratification for newer seeds and no treatment for 3–6 year old seeds for *S. bellum*, and reports that stored *F. californica* seeds require at least three months of stratification. Also, some species may require two or more years of after-ripening to allow for gas exchange, water penetration, and neutralization of inhibitory chemicals to initiate germination events (Emery 1988; Baskin and Baskin 2014), a pattern consistent with the germination of *Eriophyllum staechadifolium* Lag. Likewise, Holl (unpublished data) observed that *S. bellum* germinated in the second year after sowing in another grassland restoration study near YLR.

Percent germination varied strongly by collection year. One explanatory factor could be seed age, consistent with previous studies, as approximately half of the species that were collected in three or more years showed a decrease in percent germination over time (Gulmon 1992; Tielbörger and Petrů 2010; Barton et al. 2016). Our results showing that *Bromus sitchensis* var. *carinatus* (Hook. & Arn.) R.E.Brainerd & Otting. and *Elymus glaucus* Buckley (both Poaceae) seeds are short lived when stored at room temperature are consistent with (Dremmen 2003) who reported seeds of those species only last around three years. Three of the four Asteraceae species we tested decreased in germination over time, and *Artemisia californica* seed that was three to five years old had low germination in all years. Observations from restoration efforts at the University of California, Santa Barbara concur that stored Asteraceae seeds tend to be short-lived (J. Luong, University of California, Santa Cruz, personal communication).

A number of other factors besides seed age could also explain the effect of collection year on germination, particularly given that the percent germination of four species (*Elymus glaucus*, *Hordeum brachyantherum* Nevski, *Horkelia californica* Cham. & Schltdl., and *Prunella vulgaris* L.) varied by collection year but showed no obvious directional trend. Past studies have shown that the rate of seed germination depends on initial seed quality and health of the parent population upon collection, which inevitably varies annually (Rajjou et al. 2008; Kochanek et al.

2011; Nguyen et al. 2012), often based on rainfall in the prior year (Kochanek et al. 2010; Zani and Müller 2017).

Collection practices may also partially explain the mixed germination trends we observed. Variation in local site conditions of the mother plant has been shown to explain germination variation in past studies (Gulmon 1992; Tielbörger and Petrů 2010). However, since PNP and YLR seed collections from different locations were pooled into one collection container to conserve space and labeled only with the collection year, we cannot tease out the separate effects of seed age and site on germination. Furthermore, the majority of seeds used in this study were stored in ambient temperature and moisture conditions, whereas best management practices call for storing seed at –20°C and low moisture conditions to maximize seed longevity (Linington and Manger 2014).

Recommendations

Our results suggest several recommendations for collecting, storing, and testing restoration seed stocks. First, in light of the species-specific rates of seed germination and the strong effect of collection year on germination, we recommend that restorationists test seed stock periodically to calibrate appropriate seeding rates and increase restoration success. Second, as a general rule of thumb, seeds should be used for restoration within a couple of years of collection to avoid potential reduced germination due to seed aging (Brown and Briggs 1991). Third, our results highlight the importance of collecting seed in multiple years and at multiple locations to ensure the greatest genetic diversity possible and to increase germination success (Emery 1988; Brown and Briggs 1991; Maschinski et al. 2012). Fourth, best management practices should be followed, such as labeling collections from different locations separately and cold storing seeds that will be held for multiple years (Maschinski et al. 2012). To date, most of the knowledge of seed germination triggers and longevity for California native species amassed by horticulturalists and restoration practitioners have not been widely disseminated. Hence, our final recommendation is for enhanced sharing of written documentation of successful and failed strategies in seed collection, storage, and sowing practices, which will enhance the success of native plant restoration throughout California.

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APPENDIX 1. SPECIES TESTED IN 2017 AND 2018 GERMINATION TESTS. Species marked with "*" were species that were collected over a period of $\geq$3 years and tested in 2018.

Latin name	Common name	Growth form	Site	Collections tested in 2017	Collections tested in 2018	Storage temperature
Amsinckia menziesii	Menzies' fiddleneck	annual forb	PNP	2012, 2016		ambient
Calandrinia menziesii	redmaids	annual forb	PNP	2016		ambient
Castilleja exserta subsp. *venusta*	purple owl's clover	annual forb	PNP	2012		ambient
Chaenactis glabriuscula DC	yellow pincushion	annual forb	PNP	2016		ambient
Clarkia unguiculata	elegant clarkia	annual forb	PNP	2012, 2016		ambient
Delphinium sp.	larkspur	annual forb	PNP	2016		ambient
Lasthenia gracilis	goldfield	annual forb	PNP	2012, 2016		ambient
Lupinus bicolor Lindl.	miniature lupine	annual forb	PNP	2012, 2016		ambient
Madia sativa	coast tarweed	annual forb	PNP	2012, 2016		ambient
Bromus sitchensis var. *carinatus*	California brome	perennial graminoid	YLR		2011–2014, *	−2°C,
Carex gynodynama	Olney's hairy sedge	perennial graminoid	YLR		2015, 2016	ambient
Danthonia californica	California oatgrass	perennial graminoid	YLR	2016		ambient
Elymus glaucus	blue wild rye	perennial graminoid	YLR		2011–2015, *	−2°C
Hordeum brachyantherum	meadow barley	perennial graminoid	YLR		2014–2016, *	2014–2016 ambient
Juncus mexicanus Willd.	Mexican rush	perennial graminoid	YLR		2015, 2016	ambient
Juncus patens E.Mey	California grey rush	perennial graminoid	YLR		2012–2016, *	ambient
Stipa pulchra Hitchc.	purple needlegrass	perennial graminoid	YLR	2011, 2015		ambient
Eschscholzia californica Cham.	California poppy	annual/perennial forb	YLR		2014–2016, *	ambient
Achillea millefolium	common yarrow	perennial forb	YLR		2013–2015, *	−2°C
Chlorogalum pomeridianum Kunth	California soaproot	perennial forb	YLR		2011–2015, *	ambient
Cirsium quercetorum Jeps.	brownie thistle	perennial forb	YLR		2016, 2017	ambient
Erigeron glaucus Ker Gawl.	seaside daisy	perennial forb	YLR		2015, 2016	ambient
Grindelia stricta DC.	Oregon gumplant	perennial forb	YLR		2012–2016, *	ambient
Horkelia californica	California horkelia	perennial forb	YLR		2012–2015, *	ambient
Navarretia squarrosa (Eschsch.) Hook. & Arn.	skunkweed	perennial forb	YLR		2013–2017, *	ambient
Prunella vulgaris	self-heal	perennial forb	YLR		2010–2017, *	ambient
Scrophularia californica Cham. & Schltdl.	California bee plant	perennial forb	YLR	2012, 2015		ambient
Sisyrinchium bellum	blue-eyed grass	perennial forb	YLR		2013–2016, *	ambient
Symphyotrichum chilense	California aster	perennial forb	YLR	2012, 2016		ambient
Artemisia californica	California sagebrush	shrub	YLR		2013–2015, *	ambient
Diplacus aurantiacus (Curtis) Jeps.	sticky monkeyflower	shrub	YLR		2011–2016, *	ambient
Eriophyllum staechadifolium	lizard tail	shrub	YLR		2011–2017, *	ambient
Frangula californica	California coffeeberry	shrub	YLR		2013–2016, *	−2°C
Lupinus variicolor Steud.	many colored lupine	shrub	YLR		2013, 2015	ambient

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Research

Ecosystem size shapes antipredator trait evolution in estuarine threespine stickleback

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Ecosystem size is known to influence both community structure and ecosystem processes. Less is known about the evolutionary consequences of ecosystem size. A few studies have shown that ecosystem size shapes the evolution of trophic diversity by shaping habitat heterogeneity, but the effects of ecosystem size on antipredator trait evolution have not been explored. Ecosystem size may impact antipredator trait evolution by shaping predator presence (larger ecosystems have longer food chains) and habitat complexity (larger ecosystems may have more diverse habitat structure). We tested these effects using threespine stickleback from bar-built estuaries along the Central Coast of California. These stickleback populations are polymorphic for *Ectodysplasin-A* (*Eda*), a gene that controls bony lateral plates used as antipredator defense. We inferred *Eda* genotypes from lateral plate phenotypes and show that the frequency of the complete (C) allele, which is associated with greater number of lateral plates, increases as a function of ecosystem size. Predator presence and habitat complexity are both correlated to ecosystem size. The strongest proximate predictor of *Eda* allele frequencies was the presence of predatory fishes (steelhead trout and sculpin). Counter to expectations, habitat complexity did not have a strong modifying effect on *Eda* allele frequencies. Our results point to the importance of ecosystem size for determining predator presence as being the primary pathway to evolutionary effects. Ecosystem size has received much attention in ecology. Our work shows that it may be an important determinant of adaptive evolution in wild populations.

Keywords: antipredator traits, bar-built estuaries, ecosystem size, *Ectodysplasin A* gene, *Gasterosteus aculeatus*, predation

Introduction

Ecosystem size is a fundamental characteristic of natural habitats that has widespread ecological effects. The physical size of an ecosystem plays an important role in structuring the community (Spencer and Warren 1996, Post et al. 2000, Sabo et al. 2010)

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and affects ecological functions such as rate of primary production and decomposition (Wardle et al. 2003, Ward and McCann 2017). Larger ecosystems often have more habitat complexity and structural diversity, thereby providing more open niche space and ecological opportunity (Barbour and Brown 1974, Brönmark 1985). Increases in the diversity of available niche space with ecosystem size may help drive the positive relationship between species number and ecosystem area (Gavrilets and Losos 2009). However, we still understand relatively little about how ecosystem size affects trait evolution and through which ecological pathways it acts.

While the ecological effects of ecosystem size are diverse and well-studied, evolutionary effects have received less attention. In some adaptive radiations, ecosystem size has been shown to be positively correlated with speciation rate, where increased ecosystem size represents increased habitat heterogeneity or 'ecological opportunity' (Losos and Schluter 2000, Parent and Crespi 2006, Seehausen 2006, Kisel and Barraclough 2010). Here we instead focus on the effects of ecosystem size on trait evolution within species. With such far-reaching ecological effects, ecosystem size could influence natural selection on traits through a wide variety of proximate mechanisms. For example, several studies have shown that lake size influences habitat heterogeneity and therefore resource diversity and distribution, which in turn influences genetic, morphological and ecological diversity in postglacial fishes (Nosil and Reimchen 2005, Lucek et al. 2016, Recknagel et al. 2017, Doenz et al. 2019, Bolnick and Ballare 2020). Taken together, these examples suggest that ecosystem size influences resource diversity, which in turn influences intraspecific competition and subsequent trophic diversification.

In addition to resource diversity, another ubiquitous source of natural selection on populations that may be related to ecosystem size is predation risk. As with resource diversity, food chain length also tends to increase with ecosystem size, and therefore the smallest ecosystems often lack top predators (Tonn and Magnuson 1982, Schoener 1989, Post et al. 2000, Takimoto et al. 2008). Ecosystem size may limit top predator presence for a number of reasons. Small ecosystems may have insufficient resources to support top predators (Elton 1927, Yodzis 1984). Top predators may have diverse habitat requirements (Lawrence et al. 2018) or might be limited by disturbances like flooding, drought or other physical and chemical extremes (Tonn and Magnuson 1982, Sabo et al. 2010). If predator presence is correlated with ecosystem size, then local adaptation of prey to different predation regimes may be a proximate effect that is ultimately driven by variation in ecosystem size (Nosil and Reimchen 2005). Yet the relative importance of predator presence and habitat complexity as proximate mechanisms shaping the evolutionary effects of ecosystem size remains unexplored (Table 1).

Here we test the effect of ecosystem size on the evolution of antipredator traits in estuarine threespine stickleback *Gasterosteus aculeatus* populations along the Central Coast of California, USA. The majority of these estuaries are only intermittently connected to the ocean by surface water due to the seasonality of rainfall and oceanographic deposition of sand along the shore (Heady et al. 2014). Such bar-built estuaries, also called intermittently closed/open lakes and lagoons (ICOLLs), are found in wave dominated coastlines across the world (Mcsweeney et al. 2017). The top aquatic predators in California bar-built estuaries include predatory sculpins

Table 1. Previous studies that report significant effects of ecosystem size on trait evolution. Comparison of mechanisms proposed and tested.

Ecosystem size mechanisms proposed	Alternative mechanisms proposed	Mechanisms measured	Significant responses	Taxa	References
Habitat (resource) heterogeneity		habitat (resource) heterogeneity	variation in individual diet specialization	stickleback	Bolnick and Ballare 2020
Habitat (resource) heterogeneity			number of trophically and genetically distinct morphotypes	Arctic charr	Doenz et al. 2019
Habitat (resource) heterogeneity			trophic trait, defensive trait, neutral genetic divergence	stickleback	Lucek et al. 2016
Habitat (resource) heterogeneity			trophic trait variation	Arctic charr	Recknagel et al. 2017
Habitat (resource) heterogeneity			tropic trait min, mean, max	Arctic charr	Recknagel et al. 2017
Habitat heterogeneity	productivity	productivity	trophic diversification	whitefish	Siwertsson et al. 2010
Habitat heterogeneity			trophic trait variation	stickleback	Nosil and Reimchen 2005
Predator presence		predator presence	defensive trait polymorphism	stickleback	Moodie and Reimchen 1976
Predator presence		predator presence	defensive trait mean	stickleback	Reimchen 1994
Predator presence			defensive trait variation	stickleback	Nosil and Reimchen 2005
Unspecified		presence of other fish species	trophic trait mean	stickleback	Moodie and Reimchen 1976

and salmonids that eat a mix of invertebrates and small fishes including threespine stickleback. Salmonids (*Oncorhynchus* spp.) and sculpins (*Cottus* spp.) require adequate perennial freshwater habitat upstream for spawning, and salmonid population viability is predicted to be correlated with the amount of freshwater habitat upstream (Moyle 2002, Williams et al. 2016).

Threespine stickleback vary widely in predator defense traits, including the number and arrangement of a row of bony armor plates along the flank which begin behind the head and end in a keel on the caudal peduncle and protect stickleback against predatory fishes (Reimchen 1994, Barrett 2010). There is extensive inter- and intra-population variation in plate number and arrangement reflective of variation in predation pressure (Hagen and Gilbertson 1972, Bell et al. 1993, Reimchen et al. 2013). Experimental studies confirm that higher plate numbers allow increased survival during encounters with predatory fishes including salmonids (Reimchen 1991, 1992, 2000). Variation at the *Ectodysplasin-A* (*Eda*) locus explains 75–80% of the variation in plate number (Colosimo et al. 2004, Kitano et al. 2008, Des Roches et al. 2020). Individuals with two copies of the low allele (L) tend to have few plates (<10), those with two copies of the complete allele (C) tend to have a continuous row of plates (>30 in some populations), and heterozygotes are more variable but generally have an intermediate phenotype or look like homozygous completes (Colosimo et al. 2005, Miller et al. 2015). Marine or anadromous fish are usually homozygous for the complete allele, whereas many derived freshwater resident populations are homozygous for the low allele (Colosimo et al. 2005).

Stickleback plate number is also correlated with factors other than predator presence. In California, stickleback populations transition from primarily completely plated anadromous populations in the north to exclusively low-plated, freshwater resident populations in the south, a shift that tracks changes in temperature, precipitation and habitat (Baumgartner and Bell 1984, Des Roches et al. 2020). Bar-built estuary stickleback populations along the Central Coast of California are located in a transition zone between anadromous and resident populations and are polymorphic for plate number and underlying *Eda* genotype (Baumgartner and Bell 1984, Des Roches et al. 2020). However, site-to-site differences in *Eda* allele frequencies can be large (Paccard et al. 2018). Thus, latitudinal gradients might not explain more local differences in stickleback plate number among neighboring estuaries in the Central Coast transition zone. Our focal sites are south of the range of anadromous threespine stickleback and thus, while polymorphic for *Eda* and plate phenotype, these stickleback populations are made up of resident freshwater fish and are unlikely to represent a hybrid zone between anadromous and resident types (Howe 1973, Paccard et al. 2018).

One factor that might modify the effect of predators on stickleback plates is habitat complexity and the availability of cover (Leinonen et al. 2011). Low plate counts might be favored over complete plates in complex, vegetated habitats such as the estuary if the relative risks of predation between genotypes differs in vegetated habitats and open-water habitats. There are a number of reasons why relative predation risk might differ as a function of habitat complexity, including differences in predator type or density, predator preference or prey escape probability (Reimchen et al. 2013). Experimental evidence indicates that natural selection by pike favors completely plated fish in open habitat, but favors low plated fish in habitats with more refuge (Leinonen et al. 2011). Low plates might be favored if hiding in refuge is an effective antipredator strategy, but large numbers of plates reduce the flexure and fast-start speeds necessary to quickly retreat to cover (Reimchen 1983, Taylor and McPhail 1986, Bergstrom 2002). Selection against low plates from fish predators may be relaxed if those fish predators prefer open water habitats and are less dense in the vegetated habitat. A study across the whole state of California found that higher frequencies of low plate morphs in estuaries that had lower proportions of flowing riverine wetlands and more lotic habitat (Des Roches et al. 2020).

In this study we test for the effect of ecosystem size on prey traits and compare the roles of predator presence and habitat complexity to explain that effect. We hypothesize that ecosystem size determines the presence of predatory fish, which is the major determinant of stickleback plate evolution. However, we further predict that habitat complexity modifies the role of predators on stickleback plates by favoring different antipredator traits in different environments.

Material and methods

Ecosystem size

We studied 20 estuaries along the coasts of Santa Cruz and San Mateo counties, California, USA (Table 2). We measured ecosystem size in several complementary ways as is common in studies of riverine ecosystems (Post et al. 2007). We measured the total stream length (km) of the river network draining into each estuary using ArcGIS ver. 10.2 (ESRI 2013). Then we measured estuary area, since water levels (and therefore estuary area) in bar-built estuaries fluctuate dramatically during the annual cycle of wet and dry seasons, breaches and impoundments (Fig. 1), (Webb et al. 1991, Behrens et al. 2013, Williams and Stacey 2016, Orescanin and Scooler 2018). To do so we used GIS data from the National Wetlands Inventory, which consists of polygons classifying wetlands using Cowardin's classification scheme (Cowardin et al. 1979, US Fish and Wildlife Service 1993, Federal Geographic Data Committee 2013). This dataset consists of polygons of wetland and open water habitats that were developed from expert interpretation of high-altitude aerial photographs (US Fish and Wildlife Service 1993). We calculated the Channel area by adding up the area of all wetland polygons of either estuarine deepwater or tidal

Table 2. Site characteristics and stickleback sample sizes for 20 bar-built estuaries in Santa Cruz and San Mateo Counties, California, sorted in order from north to south along the coast. Stickleback samples with fewer than 10 fish are not reported here or included in our analyses. In 2016 and 2017, fish were only sampled at six sites.

Site	Latitude	Longitude	Channel area (km^2)	Permanently flooded area (km^2)	Total wetland area (km^2)	Total stream length (km)	Proportion vegetated area	Steelhead	Sculpin	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017
San Gregorio Creek	37.32	−122.40	0.0352	0.0352	0.0770	122.826	0.543	present	present	18	30						
Pomponio Creek	37.30	−122.41	0.0102	0.0102	0.0157	13.411	0.349	present	present	17	30	30	30				
Pescadero Creek	37.27	−122.41	0.1511	0.3160	1.0686	206.965	0.704	present	present	30	32	10					
Bean Hollow	37.23	−122.41	0.0086	0.0086	0.0278	13.023	0.691	absent	absent	30	30	59	30				
Yankee Jim Gulch	37.19	−122.40	0.0004	0.0004	0.0004	2.648	0.000	absent	present	30		30	30				
Gazos Creek	37.17	−122.36	0.0053	0.0053	0.0053	26.368	0.000	present	present	30	30	12					
Waddell Creek	37.10	−122.28	0.0204	0.0204	0.1691	56.463	0.879	present	present	30	30			30	30	18	30
Scott Creek	37.04	−122.23	0.0064	0.0128	0.1252	67.360	0.897	present	present	60	60	121	91	45	26	30	35
Laguna Creek	36.98	−122.15	0.0203	0.0219	0.0536	21.743	0.592	present	present	30		30	30	11	31	29	11
Baldwin Creek	36.99	−122.11	0.0041	0.0120	0.0627	11.982	0.809	present	present			30					
Lombardi Creek	36.96	−122.11	0.0012	0.0012	0.0280	6.389	0.958	absent	absent	30	37	60	59	30	30	23	30
Old Dairy Creek	36.96	−122.09	4.0E-05	4.0E-05	0.0133	11.032	0.997	absent	absent	30	60	60	25	30	30	21	30
Younger Lagoon	36.95	−122.07	0.0108	0.0108	0.0209	1.919	0.484	absent	absent	60	88	60	59	31	34	54	30
Moore Creek	36.95	−122.06	0.0032	0.0032	0.0415	4.388	0.924	absent	absent	30		30					
San Lorenzo River	36.97	−122.01	0.0874	0.0874	0.0992	322.680	0.119	present	present	30	30						
Corcoran Lagoon	36.96	−121.98	0.0003	0.0614	0.0770	9.932	0.202	absent	absent	30	42	37	30				
Moran Lake	36.96	−121.98	0.0098	0.0100	0.0100	0.805	0.000	absent	absent	30		30					
Soquel Creek	36.97	−121.95	0.0273	0.0273	0.0373	99.094	0.269	present	present	30	39	14	55				
Aptos Creek	36.97	−121.91	0.0077	0.0077	0.0112	55.120	0.310	present	present	30		29	17				
Pajaro River	36.85	−121.81	0.2483	0.2597	1.2855	3280.012	0.798	present	present	12		30					

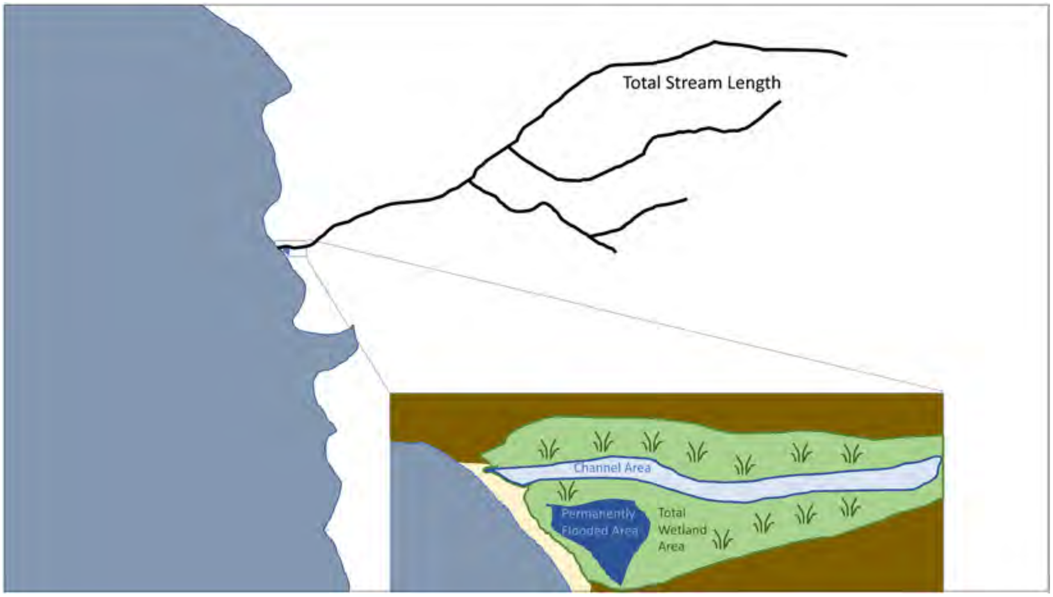

Figure 1. Schematic diagram of estuary wetland habitat types. We used the Cowardin et al. (1979) wetland classification system to create three nested metrics of estuary size. Channel area (light blue fill and outline in inset) is comprised of all wetland polygons of 'Estuarine deepwater' and 'Tidal riverine' habitats that were part of the main river channel, as opposed to side-channels, ponds and lakes. Permanently flooded area (dark blue fill and outline in inset) includes all polygons in the channel area plus any estuarine, riverine or palustrine deepwater polygons within the floodplain below the upstream extent of tidal riverine habitat. Total wetland area (light green fill and dark green outline in inset) includes all polygons in the permanently flooded area plus any estuarine, riverine or palustrine wetland polygons that were immediately adjacent to the channel and permanently flooded areas. Thus, channel area is nested within permanently flooded area, which is nested within total wetland area. Finally, we measured the total stream length (black lines, main panel) of all stream segments in the river network. In the inset, brown represents upland habitat that does not flood and yellow represents the sandbar that closes the stream off from the ocean seasonally.

riverine habitats that were part of the main river channel, as opposed to side-channels, ponds and lakes. We calculated the Permanently flooded area by adding the Channel area plus any estuarine, riverine or palustrine deepwater polygons within the floodplain below the upstream extent of tidal riverine habitat. We calculated the Total wetland area by adding the Permanently flooded area plus any estuarine, riverine or palustrine wetland polygons that were immediately adjacent to the Channel and Permanently flooded areas. All areas were measured in square kilometers.

The proximate mechanism for the habitat complexity hypothesis is the increased availability of structured habitats. Unlike the deepwater polygons in the channel area and permanently flooded area metrics, the additional habitats included in the total wetland area metric are mostly emergent marsh and scrub/shrub wetlands that seasonally dry. When emergent marsh and scrub/shrub habitats are inundated, vegetation remains above the water level. These seasonally flooded habitats are therefore highly structured. While there is some emergent vegetation included in Channel area, Permanently flooded area and Total stream length, it is likely only on the margins and doesn't make up the majority of those wetland polygons. Therefore, from these ecosystem size metrics we also calculated a simple index of the availability of complex habitat for prey to use to avoid predators: proportion vegetated area (PVA) $= 1 -$ permanently flooded area/total wetland area.

Predator presence

We determined the presence of juvenile steelhead *Oncorhynchus mykiss* based on published accounts since these larger, faster predators often evade the type of sampling gear we used to target stickleback (Becker and Reining 2008). Coho salmon *Oncorhynchus kisutch* are present but locally rare and only occur at a subset of the sites with steelhead, so we did not consider them further (Williams et al. 2016). We recorded the presence of sculpin during our stickleback surveys. Sculpin were not identified to species, but three different species are present in the area: marine Pacific staghorn sculpin *Leptocottus armatus*, freshwater prickly sculpin *Cottus asper* and freshwater coastrange sculpin *Cottus aleuticus*. At some sites we encountered sculpins frequently and in large numbers. At other sites we did not encounter any sculpin or caught sculpin only infrequently (<5% of traps or seines) in small numbers. In the latter type of site, a follow-up study revealed that captured sculpin were most often juvenile marine Pacific staghorn sculpin caught during spring sampling following recent estuary breaching and were not found again in the following fall sample (B. A. Wasserman unpubl.). It is likely that sites at which we have not caught sculpin are also occasionally visited by marine accidentals in this way. Rather than distinguishing between sites where we caught sculpin and those where we did not, we think the more ecologically appropriate distinction is between two types of sites: those with resident sculpin of any species (present) and those sites with no sculpin or only accidental Pacific staghorn sculpin (absent). Sites where we caught sculpin in more than 5% of traps or seines were defined as having sculpin present. Sites where we caught sculpin in less than 5% of traps or seines were defined as having sculpin absent. Since resident sculpin and steelhead distributions overlap almost entirely (Table 2), we could not disentangle their independent effects, and we did not use them as separate predictors in the same model. We chose to use the slightly more widespread sculpin (which occurred at one additional site that did not have steelhead) as a predictor of overall predatory fish presence, though results from analyses using steelhead were qualitatively similar.

Prey traits and genotype inference

We collected stickleback using minnow traps and beach seines semiannually just after sandbar formation in the spring (usually April–June, but sometimes as late as August) and just before sandbar breaching following sufficient rain in the fall (usually November–December, but occasionally as early as September and as late as January). We attempted to collect fish from all 20 sites in 2014 and 2015, and we continued sampling at six sites during 2016 and 2017 (Table 2). Fish were euthanized with an overdose of MS-222, frozen in the field, and then stored in a freezer until they could be processed. We collected fish longer than 30 mm and targeted a sample size of 30 fish per sample. Fish shorter than 30 mm were not used because they may not have fully developed plates (Bell 1981). Our analyses only use samples that included at least ten fish.

We counted the left lateral plates of each fish under a dissecting microscope. The spring 2014 fish were part of a previous study in which a subset of 287 was genotyped for *Eda* (Paccard et al. 2018). Since our populations are polymorphic for *Eda*, plate count distributions represent mixtures of distributions based on a latent categorical variable: *Eda* genotype (Supplementary material Appendix 1 Fig. A1). We therefore quantified the relationship between plate count and *Eda* genotype using the fish with known genotype in order to infer the *Eda* genotype of all 2952 fish.

We used a Gaussian mixture model to infer the most likely *Eda* genotype for each individual based on their plate count using the R package mixtools version 1.1.0 (Benaglia et al. 2009). We fit a model with three latent states (*Eda* genotypes) using an expectation–maximization algorithm and initialized the plate count distribution of each latent state with the sample mean and standard deviations of lateral plate counts for the corresponding genotype based on data from the individuals with known genotype (Dempster et al. 1977). We assigned all individuals in the study their inferred genotype based on maximum likelihood. We calculated the inferred allele frequency of each sample from the inferred genotypes of individual fish in that sample and used these inferred allele frequencies as a response variable in our analyses.

Data analysis

We used confirmatory path analysis (Shipley 2000) to model the effects of ecosystem size on predator presence and PVA and the effects of predator presence and PVA on inferred C allele frequency. All metrics of ecosystem size were log-transformed to meet assumptions of normality. We transformed the inferred C allele frequency using the empirical logistic transformation to improve heteroscedasticity of model residuals, where $\text{logit}(C) = \log((C + \varepsilon)/(1 - C + \varepsilon))$, and where ε is equal to the minimum non-zero value of inferred C allele frequency (Warton and Hui 2011). We conducted the analysis using the R statistical environment ver. 4.0.0 (<www.r-project.org>) using the packages lme4 ver. 1.1-23 (Bates et al. 2015) and piecewiseSEM ver. 2.1.0 (Lefcheck 2016) which accommodates complex model structures such as random effects and generalized linear models in the structural equation modeling framework (Shipley 2009, Lefcheck 2016). The effect of ecosystem size on predatory fish presence was modeled with logistic regression. The effect of ecosystem size on PVA was modeled using a linear regression. We then modeled the effect of predator presence and PVA on inferred C allele frequency using linear mixed models with a random effect of site. In piecewiseSEM we specified that there was no causal relationship, but allowed for the possibility of correlated error, between predator presence and PVA (Lefcheck 2016).

We used two different methods to test whether the effect of ecosystem size on inferred C allele frequency acted primarily through the predator presence or habitat-mediated pathways. First, we used Shipley's test of directed separation to determine whether a simpler path analysis, which dropped the effect of PVA on inferred C allele frequency, was adequate to explain the data. In Shipley's test of directed separation the included causal links are a sufficient description of the data if the calculated value of Fisher's C could have easily occurred by chance ($p > 0.05$) (Shipley 2000). Therefore, if the simpler model has a probability of $p > 0.05$, it is considered a sufficient explanation and the more complex model is rejected. As a second way of evaluating through which causal pathway ecosystem size influenced inferred C allele frequency, we performed this path analysis separately for each of the four metrics of ecosystem size and compared the results (Post et al. 2007).

Results

Predatory fish were more likely to be found in larger ecosystems regardless of the ecosystem size metric used (Fig. 2). The standardized regression coefficient (β_s) for the effect of ecosystem size on predator presence was strongest for total stream length ($\beta_s = 0.8914$, $p < 0.0001$) and channel area ($\beta_s = 0.7185$, $p < 0.0001$), intermediate for permanently flooded area ($\beta_s = 0.6004$, $p = 0.0003$), and weakest for total wetland area ($\beta_s = 0.3044$, $p = 0.0271$) (Fig. 3).

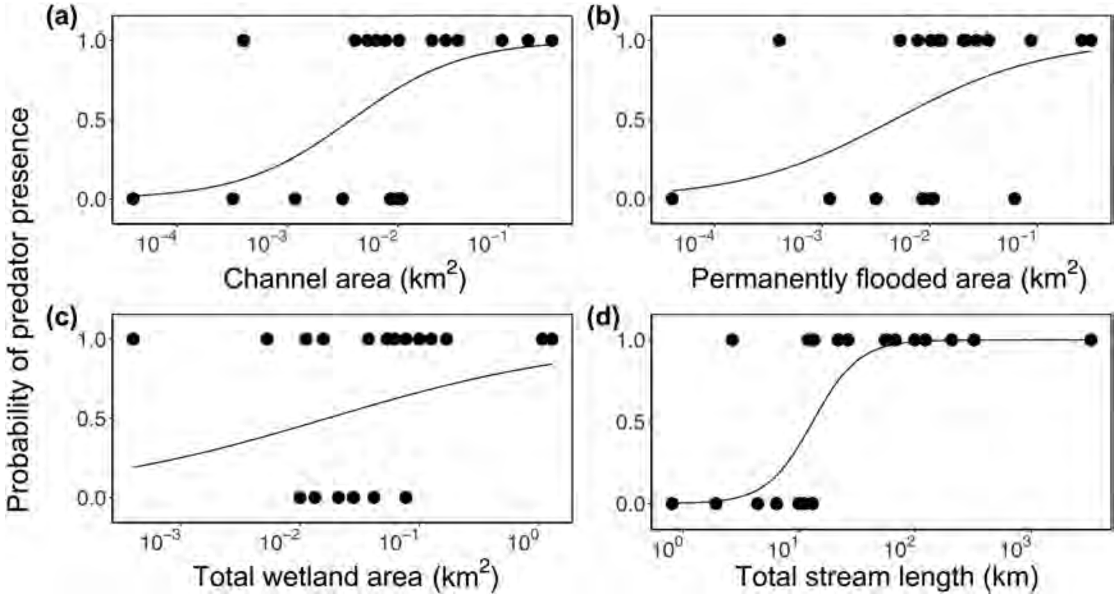

Figure 2. Predatory fish presence as a function of ecosystem size. Points show the raw data as a binary: either present (1) or absent (0), and lines show the fits of the logistic regressions. Ecosystem size measured as (a) channel area (km^2), (b) permanently flooded area (km^2), (c) total wetland area (km^2) and (d) total stream length (km).

The degree to which estuary area measurements were correlated to PVA varied as expected (Fig. 4). The standardized regression coefficient (β_s) for the effect of ecosystem size on PVA was largest for log total wetland ($\beta_s = 0.4261$, $p = 0.0001$), intermediate for permanently flooded area ($\beta_s = -0.3280$, $p = 0.0023$) and channel area ($\beta_s = -0.2243$, $p = 0.0402$), and not significant for total stream length ($\beta_s = 0.1308$, $p = 0.2356$) (Fig. 3). Unexpectedly, PVA decreased with channel area and permanently flooded area (Fig. 3).

The mixture model classified fish with plate counts of 3–8 as LL homozygotes, those from 9 to 21 as CL heterozygotes, and those from 22 to 28 as CC homozygotes (Supplementary material Appendix 1 Fig. A1). The overall misclassification rate for the fish with known genotypes was 19.9%. LL and CC fish were correctly matched to their known genotype 93% and 96% of the time, respectively (Supplementary material Appendix 1 Table A1). CL fish were harder to classify: they were only correctly classified 46% of the time (Supplementary material Appendix 1 Table A1). Both the overall and the genotype-specific classification rates are in line with other estimates of the causal effects of *Eda* on plate counts (Colosimo et al. 2004, Paccard et al. 2018). Taken together, these misclassification rates mean that our inferred genotypes likely underestimated the number of CL fish but overestimated the number of CC fish. They also underestimated the number of LL fish, but only slightly. There were differences in the genotype frequencies by site, but no clear seasonal pattern across time (Supplementary material Appendix 1 Fig. A2).

Inferred C allele frequency was higher in sites with predatory fish than in sites without them ($\beta_s = 0.7067$, $p = 0.0006$, Fig. 5) but the effect of PVA on inferred C allele frequency was small ($\beta_s = -0.0355$, $p = 0.8218$) (Fig. 3). Shipley's test of directed separation indicated that the simpler model, with only the predator presence pathway, was a sufficient explanation of the data for channel area (Fisher's $C = 3.085$, $df = 4$, $p = 0.544$), for permanently flooded area (Fisher's $C = 6.41$, $df = 4$, $p = 0.171$), and for total stream length (Fisher's $C = 6.107$, $df = 4$, $p = 0.191$), but not for total wetland area (Fisher's $C = 11.698$, $df = 4$, $p = 0.02$). Indeed, the full model with both paths was not a sufficient explanation of the data for total wetland area (Fisher's $C = 9.688$, $df = 2$, $p = 0.008$). So, we re-ran that model and included the only other possible path, a direct effect of total wetland area on inferred C allele frequency. In this saturated model of the effects of total wetland area on inferred C allele frequency, the effect of predator presence was even stronger ($\beta_s = 0.8522$, $p < 0.0001$); the effect of PVA on inferred C allele frequency was still not significant, though it was now positive ($\beta_s = 0.2247$, $p = 0.1694$); and the direct effect of total wetland area on inferred C allele frequency was negative ($\beta_s = -0.4257$, $p = 0.0079$) (Fig. 6). The magnitude of the predator presence pathway (calculated by multiplying $\beta_{sTWA\text{->}PP} \times \beta_{sPP\text{->}C} = 0.2594$) was smaller than the magnitude of the direct pathway ($\beta_{sTWA\text{->}C} = -0.4257$).

Discussion

Predatory fish can have an important evolutionary effect on their prey, and yet they are often absent from the smallest ecosystems (Tonn and Magnuson 1982, Stanley et al. 1994, Sabo et al. 2010). Our results show that the presence of top predators is correlated with ecosystem size in bar-built estuaries in central California. Further, threespine stickleback populations sympatric with predatory fish are more armored and have higher frequencies of the *Eda* C allele than those

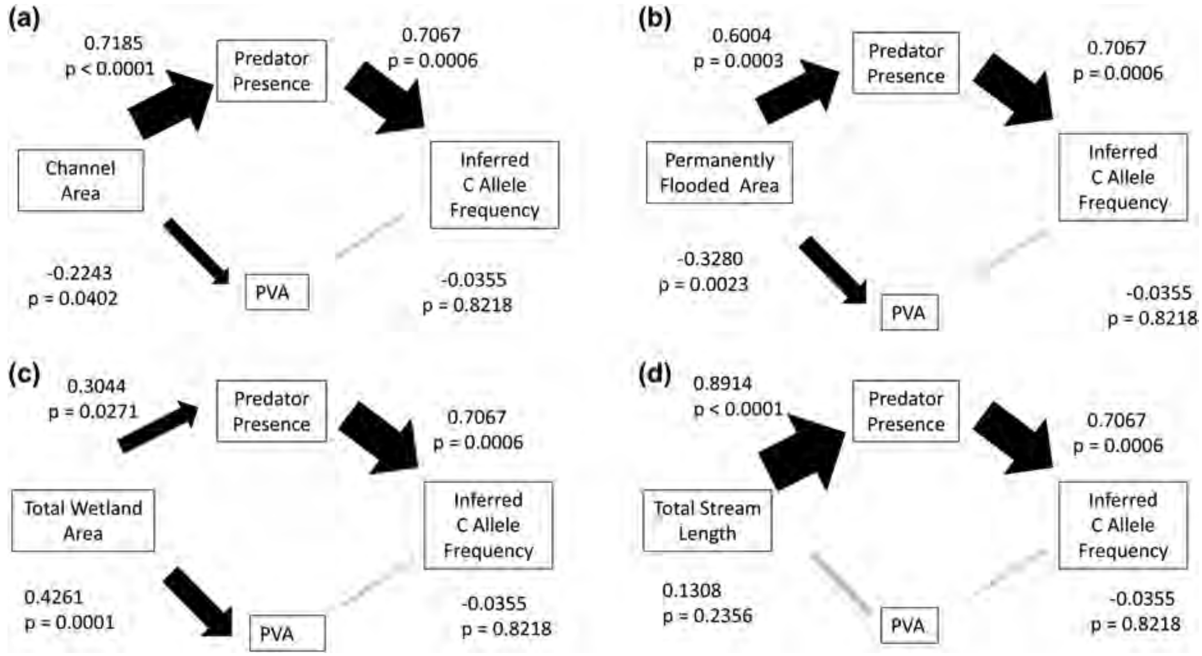

Figure 3. The results of the path analyses for empirical-logistic transformed C allele frequency, predatory fish presence, proportion vegetated area (PVA) and log-transformed ecosystem size. The widths of the arrows are scaled to the standardized coefficients which are also reported with the corresponding p-values next to each arrow. Significant relationships are shown in black, while non-significant relationships are shown in gray. Ecosystem size measured as (a) channel area (km^2), (b) permanently flooded area (km^2), (c) total wetland area (km^2), (d) total stream length (km).

that occur in the absence of predators. Therefore, in our study system, there is an effect of ecosystem size on the evolution of prey traits which occurs primarily through predator presence. Meanwhile, habitat complexity did not have a significant effect on inferred *Eda* C allele frequency. Indeed, PVA wasn't even consistently related to ecosystem size across different metrics.

A growing number of studies describe a positive effect of ecosystem size on predator presence and food chain length, especially in freshwater ecosystems (Tonn and Magnuson

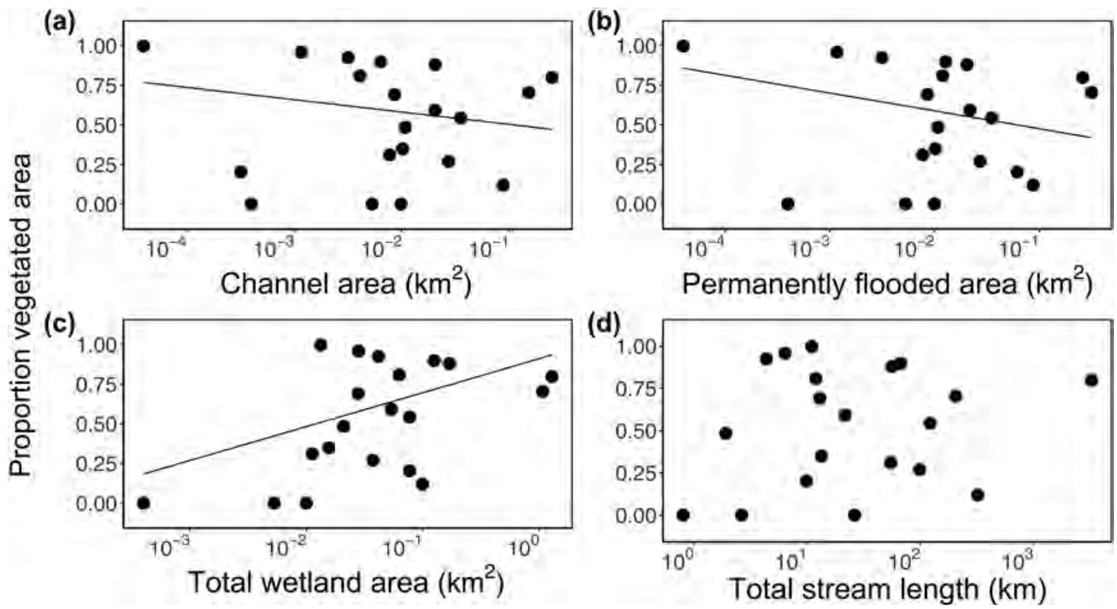

Figure 4. Proportion vegetated area (PVA) as a function of ecosystem size. Points show the raw data. Only significant regression lines are shown. Ecosystem size measured as (a) channel area (km^2), (b) permanently flooded area (km^2), (c) total wetland area (km^2) and (d) total stream length (km).

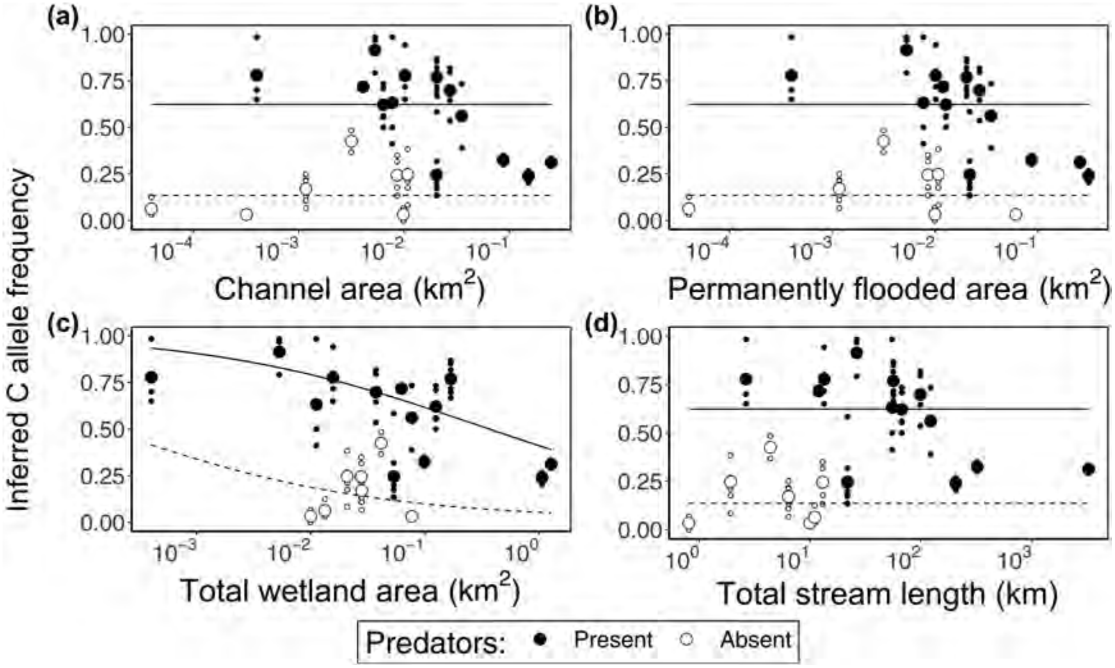

Figure 5. Inferred C allele frequency as a function of ecosystem size and predatory fish presence with ecosystem size measured as (a) channel area (km^2), (b) permanently flooded area (km^2), (c) total wetland area (km^2), (d) total stream length (km). Small points represent the C allele frequency of an individual temporal sample; large points represent the mean of all samples from a given site. Solid regression lines represent the predicted value of inferred C allele frequency for estuaries of a given size with predators present, and dashed lines the predicted values of estuaries of a given size with predators absent. We fit the model in each panel that is best supported by Shipley's test of directed separation. Therefore panels (a) channel area, (b) permanently flooded area and (d) total stream length show model fits with only the indirect effect of ecosystem size (via predator presence) on inferred C allele frequency, whereas panel (c) total wetland area, shows the full model fit with a direct effect and an indirect effect (via predator presence) of ecosystem size on inferred C allele frequency.

1982, Post et al. 2000, Sabo et al. 2010). We too found that increasing ecosystem size is correlated with an increased chance of predator presence (Fig. 2, 3). The ecosystem size metric most strongly correlated with predator presence was Total stream length, as we predicted (Fig. 2, 3). Salmonids and sculpins in the genus *Cottus* require adequate amounts of freshwater habitat for breeding in order to maintain viable populations (Moyle 2002, Williams et al. 2016). Total stream length would appear to account for this requirement well. Channel area and permanently flooded area also reflect this habitat requirement, whereas the total wetland area metric includes a great deal of marginal habitat that is not necessary for the breeding of these predators.

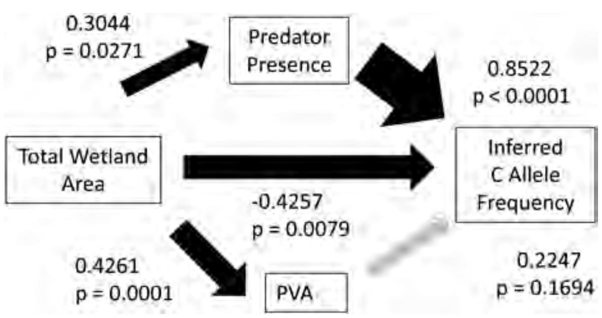

Figure 6. The results of the saturated path analyses for empirical-logistic transformed C allele frequency, predatory fish presence, proportion vegetated area (PVA) and log-transformed ecosystem size. The widths of the arrows are scaled to the standardized coefficients which are also reported with the corresponding p-values next to each arrow. Significant relationships are shown in black, while non-significant relationships are shown in gray.

The presence of these predators is correlated with increased inferred frequency of C alleles and associated armor phenotypes in bar-built estuary stickleback populations (Fig. 3). This concurs with previous studies of these populations (Paccard et al. 2018). Stickleback armor traits have been shown to evolve in response to a wide range of predator selection regimes (Bell et al. 1993, Reimchen and Nosil 2002, Barrett et al. 2008, Spence et al. 2013). While we do not have direct evidence of selective predation by steelhead and sculpins in these estuaries, it has been shown elsewhere. Freshwater stickleback populations in British Columbia that live in sympatry with sculpins have two more plates, on average, than those that are allopatric to sculpin, and they have higher survival in mesocosms with sculpins present (Ingram et al. 2012, Miller et al. 2015, but see Maccoll and Chapman 2011). Stickleback from predominately low-plated populations in lakes in Washington state survived predation attempts by rainbow trout (the same species as our steelhead, *Oncorhynchus mykiss*) better with the modal 7-plated phenotype than with either fewer or more plates (Hagen and Gilbertson 1973). Other trout species have also been shown to cause higher mortality of stickleback with fewer plates (Reimchen 1991, 1992, 2000). It is therefore likely that predation by one or more of the predators in our system is causing natural selection on *Eda*. This selection may derive either from predators intentionally targeting prey based on plate phenotypes or because more heavily plated stickleback are more likely to survive unsuccessful predator attacks (Reimchen 1991).

The correlation of stickleback armor to predator presence represents a proximate driver of armor evolution, but ecosystem size appears to be one of the ultimate drivers. Our path analyses show that the strongest effect of ecosystem size on stickleback armor was the predator-presence mechanism (Fig. 3). For three out of four ecosystem size metrics, the predator-presence pathway was a sufficient explanation of C allele frequencies, as demonstrated with Shipley's test of directed separation. Only in the path analysis utilizing the fourth metric of ecosystem size, Total wetland area, was predator presence insufficient to explain the effect of ecosystem size on prey traits (Fig. 3). However, to our surprise, PVA still was not significant, and Shipley's test of directed separation instead revealed that a direct effect of total wetland area was worth including (Fig. 6). The largest direct effect on allele frequency in this model was the effect of predator presence. However, since total wetland area so poorly predicted predator presence, the negative effect of total wetland area was the stronger pathway (Fig. 6).

We did not find evidence that habitat complexity (as measured by PVA) was inversely correlated to the number of lateral plates in stickleback. This is in contrast to a recent survey of stickleback throughout California, which found climate-driven habitat change to be an important driver of platedness (Des Roches et al. 2020). Our sites are all at similar latitude and so do not vary widely in climate. Despite not finding evidence for an effect of PVA on inferred C allele frequency, perhaps other ecological changes associated with increased total wetland area explain the decrease in C allele frequency. For example, total wetland area may influence predator density or the relative importance of predators with different selectivities, such as grappling invertebrate predators, which preferentially consume stickleback with complete plates (Marchinko 2009), as opposed to the predatory fishes studied here which preferentially consume stickleback with low plates (Reimchen 2000). This could be due to differences in the relative abundance of the two types of predators, differences in stickleback space use as a function of total wetland area if the two predators are primarily active in different habitats, or a combination of the two. Stickleback armor polymorphisms have previously been shown to reflect a balance between alternative forms of predation (Reimchen 1997, Reimchen and Nosil 2002).

Ecosystem size can also influence non-adaptive evolutionary processes such as genetic drift and gene flow. Genetic drift is unlikely to have created the correlation between mean C allele frequency and ecosystem size. If genetic drift strongly affects C allele frequencies, it should affect the variance of C allele frequency as a function of effective population size (which should increase monotonically with ecosystem size) but not the mean C allele frequency as we show here. Gene flow between sites is substantial; analysis of microsatellite markers suggests that there is not much divergence between our focal populations (Paccard et al. 2018). If estuary size predicts the amount of time an estuary stays connected to the ocean because higher winter flows keep larger river mouths open longer, then it is possible that ecosystem size affects the opportunity for gene flow (Paccard et al. 2018). However, an analysis of neutral microsatellite loci reveals that individuals which are homozygous for the complete allele are well mixed into the local population rather than being associated with marine fish; therefore, gene flow from marine stickleback is not likely to be meaningfully altering C allele frequencies (Paccard et al. 2018).

When, more generally, might we expect adaptive evolutionary responses to variation in ecosystem size? We might expect evolutionary effects when abiotic and biotic correlates of ecosystem size alter the selective landscape. Broadly, we expect ecosystem size may influence trait evolution when it alters the presence (Nosil and Reimchen 2005, this study), the diversity (Recknagel et al. 2017) or the relative importance (Bolnick and Ballare 2020) of selective agents. Those sources of natural selection on the focal species might include resources, natural enemies, abiotic stressors or the relative importance of the three (Hiltunen et al. 2014, Lawrence and Barraclough 2016).

In this study, we measured multiple mechanisms to determine how ecosystem size affects antipredator trait distributions in prey. Our results suggest that ecosystem size can affect the evolutionary consequences of predator–prey interactions as well as those of competitive interactions (Nosil and Reimchen 2005, Lucek et al. 2016, Recknagel et al. 2017, Doenz et al. 2019, Bolnick and Ballare 2020). As in the competition examples, ecosystem size acts indirectly on trait evolution by altering the community structure. In the case of competition, resource diversity is correlated to ecosystem size and therefore impacts competitor trait evolution. Here ecosystem size affects prey traits primarily by determining predator presence. Many of the ecological consequences of ecosystem size are due to indirect effects on community structure or material and energy processing (Spencer and Warren 1996, Wardle et al. 2003). Future work investigating the selective impacts of these indirect effects of ecosystem size could give us a greater understanding of their potential for affecting adaptive evolution.

Data availability statement

Data are available from the Dryad Digital Repository: <https://doi.org/10.7291/D1Z08B> (Wasserman et al. 2020).

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Author contributions – BAW, TMA, RDHB, APH and EPP conceived the study. BAW, TMA and EPP designed the study. BAW, TMA, SD collected the data. AP and RDHB contributed the molecular genetic data. BAW analyzed the data with help from SD and EPP. BAW wrote the first draft of the manuscript. All authors contributed critically to editing and gave final approval for publication.
Conflicts of interest – We declare we have no competing interests.
Permits – Animal handling protocols were approved by the Univ. of California, Santa Cruz IACUC under protocols Palke-1306 and Palke-1310. Collections were made pursuant to California Scientific Collector's Permit SC-12752.

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