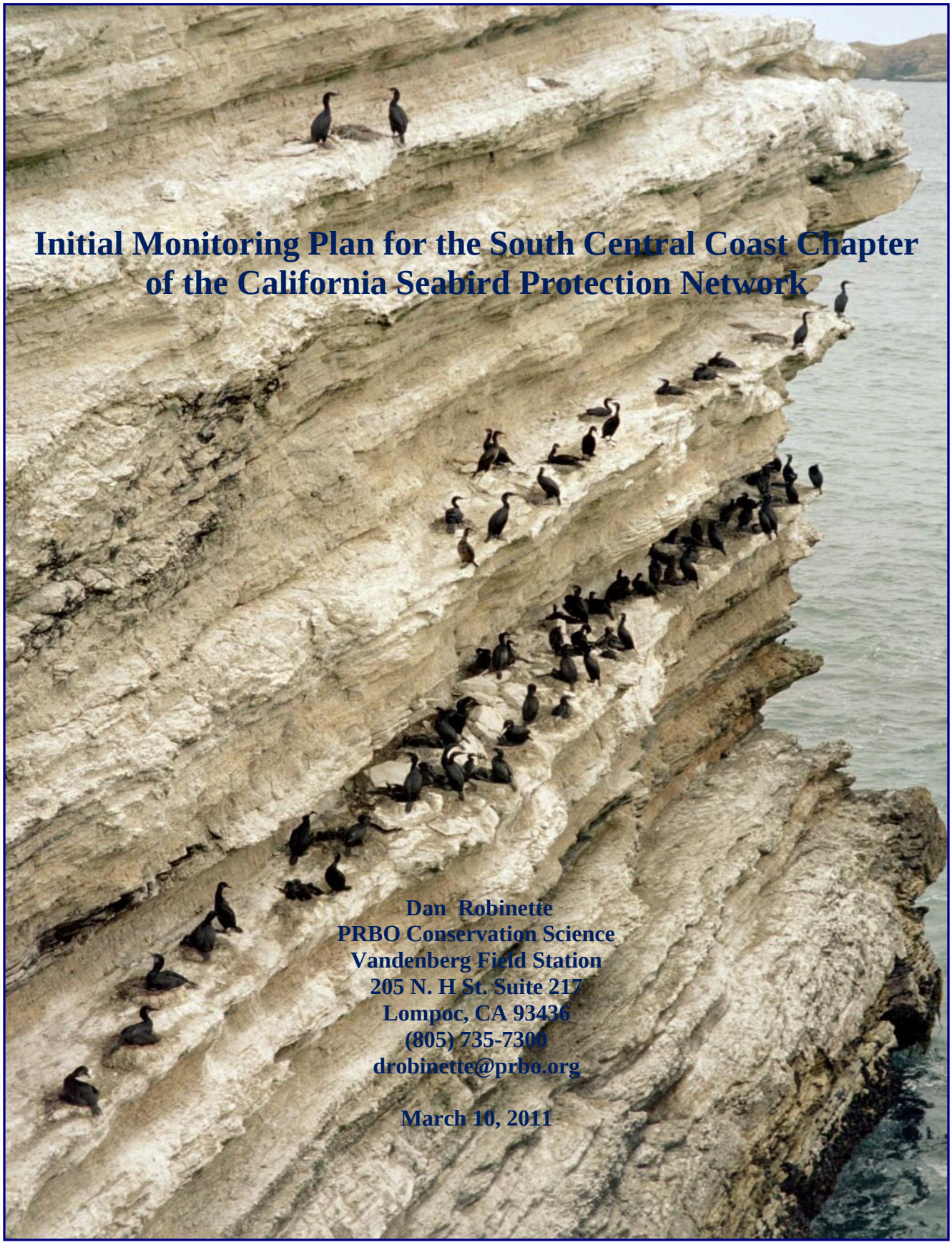

Initial Monitoring Plan for the South Central Coast Chapter of the California Seabird Protection Network

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Background

On October 24, 2007, the Torch/Platform Irene Trustee Council (hereafter referred to as the Torch Trustee Council) completed their Final Restoration Plan and Environmental Assessment (hereafter referred to as the Restoration Plan). The Restoration Plan called for, among other things, a program aimed at decreasing the detrimental effects of human-caused disturbance at seabird colonies on the central California coast. The Restoration Plan also called for collaboration with the Seabird Protection Network (SPN) established by the Gulf of the Farallones National Marine Sanctuary (GFNMS). The overreaching goal of both programs is to decrease disturbance at seabird breeding and roosting sites through education/outreach and the enforcement of existing regulations concerning seabird colonies. Both programs also recognize the need for colony monitoring to test the efficacy of their outreach and enforcement efforts. This document outlines preliminary methods to be used in achieving the monitoring goals defined in the Torch/Platform Irene Final Restoration Plan and Environmental Assessment.

The SPN and Torch/Platform Irene Restoration Plan have similar monitoring goals of 1) identifying the types and frequencies of human-caused disturbances and their impacts to seabird colonies, and 2) monitoring the efficacy of management efforts in decreasing human-caused disturbance at seabird colonies. The Bureau of Land Management, California Coastal National Monument (BLM) is implementing the Seabird Colony Enhancement Program for the Torch Trustee Council, per the Restoration Plan and per a Scope of Work (SOW) dated December 7, 2009. Part of this project with BLM includes the formation of a South Central Coast Seabird Protection Network Chapter (SCCSPNC) of the SPN. The SCCSPNC will have three components: 1) seabird and human disturbance monitoring, 2) coordinated law enforcement, and 3) information and outreach. The monitoring component will identify which areas in the study region receive the most disturbance and record the sources of disturbance. This information will be used to inform the outreach and law enforcement components to allow them to concentrate their efforts where they‟ll be most beneficial (see Figure 1 for a diagram of information flow). Both the outreach and monitoring components will inform the law enforcement component of where violations are occurring and how often. The monitoring component will also assess the efficacy of outreach and law enforcement efforts and make recommendations for the adaptive management of SCCSPNC program. The first phase of the SCCSPNC will be conducted over a five-year period. The first year will be devoted to developing the program within a core geographic area (Point Piedras Blancas to Point Arguello), while the remaining years will be devoted to expanding the program throughout the study area defined in the Restoration Plan (Point Sur to south Ventura county plus the northern Channel Islands).

In accordance with the SOW between BLM and the Torch Trustee Council, Component 1 includes seabird and human disturbance monitoring and year 1 has focused on identifying key breeding and roosting sites, analyzing existing data, identifying data gaps, developing and implementing a monitoring and surveillance plan, and prioritizing specific seabird colony habitats and human sources of seabird disturbance in the project area. This assessment is currently underway and preliminary information has been incorporated into this plan. This on-going assessment has identified many data gaps that will need to be filled by the SCCSPNC. The goal of the monitoring and surveillance plan

is to identify:

- a path forward for monitoring and surveillance to fill data gaps;
- where to target outreach and enforcement (e.g., areas with high human disturbance);
- citizen scientists interest, capabilities, and their contribution to the project;
- a methodology for data collection that will contribute to assessing whether outreach and enforcement efforts of the project are reducing seabird disturbances. (Note, it is impossible to identify where outreach and enforcement should be concentrated while data gaps exist. Therefore, these areas will be identified using Year 1 monitoring results).

This document serves as the initial working draft of the SCCSPNC monitoring and surveillance plan. It is a living document that will be updated as information is gathered. It details methods to be used in monitoring seabird populations and outlines a strategy to develop a citizen science program.

Seabird Monitoring Overview

The ultimate goal of this monitoring program is to establish causation of human disturbances so that the disturbances can be reduced. Biologists and resource managers must determine whether or not changes observed at seabird colonies are due to the success of outreach and enforcement efforts versus other co-varying factors. There are various ways to accomplish this. Some programs may take a „before-after" approach by comparing performance indicators measured before outreach and enforcement efforts are initiated to those measured afterward. If baseline or „before" data do not exist, a program may take a „control-impact" approach by comparing performance indicators at locations where outreach and enforcement efforts are concentrated to those at a control site where no outreach and enforcement take place. The more robust approach to establishing causation is to combine these into a „before-after-impact-control" (BACI) monitoring program (McDonald et al. 2000). Such a program involves measuring indicators at impact and control sites before and after the onset of outreach and enforcement efforts. There are two general approaches to BACI monitoring. If a long period of baseline data exists, then the investigator can take a time series approach, monitoring a single pair of impact and control plots. However, if a baseline time series does not exist, then multiple impact and control sites must be used.

Currently, PRBO Conservation Science"s (PRBO) seabird monitoring program at Vandenberg Air Force Base (VAFB) is the most robust long-term study within the Torch/Platform Irene impact area. PRBO has been monitoring seabird breeding and roosting colonies at VAFB since 1999 (see Robinette and Howar 2010). There are six seabird species breeding at VAFB (pelagic cormorant [*Phalacrocorax pelagicus*], Brandt"s cormorant [*Phalacrocorax penicillatus*], pigeon guillemot [*Cepphus columba*], black oystercatcher [*Haematopus bachmani*], Western gull [*Larus occidentalis*], and the federal and state endangered California least tern [*Sterna antillarum browni*]) and the base supports some of the largest mainland breeding populations for these species

between Monterey Bay and Point Conception, California (see Carter et al. 1992). Data from these populations will be fundamental in establishing the „before-after" component of the BACI approach. Continued monitoring of these colonies will be crucial for comparing population trends before and after law enforcement and outreach efforts begin.

While PRBO"s monitoring program will be necessary for establishing long-term population trends, seabird colonies at VAFB are for the most part isolated from human activities and will not be a major focus of outreach and law enforcement efforts. In order to identify disturbance impacts within the study area, other colony locations will need to be monitored. Thus, the „impact-control" component of the BACI approach will require establishing monitoring programs at sites where seabird colonies are susceptible to human-caused disturbance (see Focal Colonies for BACI Monitoring below). These areas will serve as impact sites for comparison with the VAFB control site.

To date, BLM has proposed using citizen scientists to monitor some of the seabird colonies. We endorse the use of citizen science for the proposed monitoring program as it is an effective means to bridge the gap between scientific discovery and community education. However, not all sites within the study area are easily accessible by citizen scientists and data necessary to answer specific questions about disturbance effects will require collection by trained biologists. We will therefore use citizen science to monitor accessible impact sites where public attendance is likely to be high. This approach will allow citizen scientists record immediate impacts of disturbance while educating the public at the same time.

The majority of monitoring will be conducted by trained biologists using two overarching approaches: 1) aerial surveys to determine baseline abundance and distribution of focal species throughout the study area, and for potential detection of human disturbance in Torch/Platform Irene regions not monitored with ground surveys (Gerry McChesney"s surveys; part of a separate SOW with BLM, Appendix II); 2) BACI monitoring to determine the efficacy of outreach and law enforcement activities on population size, reproductive success, and levels of human disturbance at focal colonies. Aerial surveys provide a cost-effective means by which to census broad areas for population size and distribution of colonial surface nesters, but only provide limited data on the occurrence of disturbances needed to assess the efficacy of outreach and law enforcement. Furthermore, aerial surveys do not provide estimates of annual productivity or rates of human disturbance. Thus, on-the-ground monitoring will need to be conducted to fill these data gaps. The analysis of aerial survey data will guide the expansion of the monitoring program throughout the SCCSPNC study area. The first three years of BACI monitoring will be used to establish a baseline of population abundance and distribution, breeding productivity, and levels of human disturbance. The information gained from monitoring will at the same time guide the development of outreach and law enforcement programs. Continued monitoring after the initial three years will be used to gauge the efficacy of and adaptively manage the outreach and law enforcement programs.

Focal Colonies for BACI Monitoring

The most recent and comprehensive studies on seabird breeding colony and roosting site distribution and disturbance were conducted by Carter et al. (1992) and Jacques and

Strong (2002). Additionally, McChesney and Capitolo will be analyzing 14 years of population data on Brandt‟s and double-crested cormorants within the study area. These studies will serve as a starting point for targeting important colonies and anticipating sources of disturbance. Jaques and Strong (2002) showed that kayakers, small boats and shoreline user groups were the most common source of seabird disturbance while helicopters caused the most disturbance per event. Monitoring efforts will focus on areas with differing potentials for these types of disturbance.

Using data from Carter et al. (1992), five areas have been selected to serve as impact and control sites for the BACI approach (Figure 2). All five areas will be monitored extensively by trained biologists who will collect data on annual population size and breeding performance and document disturbance events. Additionally, two areas will be monitored by citizen scientists who will be trained by biologists to record disturbance events. Citizen scientists will also engage the public, providing outreach material that educates the public on how to minimize such events. Of the five areas, four will serve as impact sites and have been selected such that varying degrees of potential disturbance are represented.

Areas for BACI Monitoring. The following four criteria were used to select areas for extensive monitoring:

1) The area contains significant numbers of breeding and roosting seabirds.
2) The area contains either a high, moderate, or low degree of potential disturbance by the sources identified in Jaques and Strong (2002). Selecting areas with varying degrees of potential disturbance is important for the BACI design of the monitoring program. Areas with moderate to high potential for disturbance will serve as impact areas, while the area with low potential will serve as the control.
3) The area is accessible, though may require coordination with land managers.
4) The areas are distributed throughout study region.

Three additional criteria were used to select areas for Citizen Science monitoring:

1) Site is easily accessible and safe for volunteers.
2) Site is close to a large, organized Audubon chapter.
3) Site receives regular use by the public.

<u>Areas selected for monitoring exclusively by biologists include</u>:

1) <u>Point Piedras Blancas to Point San Simeon</u>. This area has limited coastal access for the public. The area receives a considerable amount of commercial and recreational fishing, though this has been recently limited by the creation of a state marine reserve. It therefore has a moderate potential for human-caused disturbance.

2) <u>Point Buchon Promontory</u>. The northern portion of this area is within a state park and receives considerable use by the public. The southern portion of this area is on private property controlled by Pacific Gas and Electric (PG&E). While PG&E maintains trails for the public to use, coastal access is limited. It therefore has a moderate to high potential for human-caused disturbance. Including this area in the monitoring plan has the added benefit of engaging PG&E, a major stakeholder within the study area. One goal of the SCCSPNC is to increase the number of stakeholders vested in the program through partnerships. To facilitate this process, all monitoring activities at Point Buchon

will be coordinated with biologists at PG&E and PG&E will be invited to participate in disturbance monitoring.

3) Point Arguello Promontory. This area is part of VAFB and access is very limited. It is also centered in the Vandenberg State Marine Reserve, so there is no commercial or recreational fishing allowed. It therefore has a low potential for human-caused disturbance and will serve as the control for the BACI approach.

Areas selected for monitoring by both biologists and citizen scientists include:

1) Morro Bay, including Morro Rock and breakwater. This area is at the entrance of a major port for central California. It has a high level of commercial and recreational boat traffic. It is also a popular tourist site, with many visitors exploring the base of the rock. It therefore has a high potential for human-caused disturbance and many opportunities for public engagement.

2) Shell Beach Rocks. This area has a high level of public access and is immediately adjacent to a residential area. There is a moderate level of recreational activities including kayaking and fishing. It therefore has a high potential for human-caused disturbance and many opportunities for public engagement.

Monitoring Approach to Be Used

Aerial Photographic Surveys

Aerial photographic surveys were conducted annually throughout the SCCSPNC study area from 1996 to 2010, but counts from photographs have only been determined for 2003 (Capitolo et al. 2004). The *Apex Houston* Trustee Council funded aerial surveys from the Oregon border to Point Conception from 1996 to 2007, but did not fund any photograph-counting in the Torch/Platform Irene region. In 2008 and 2009 Department of Fish and Game, Office of Spill Prevention and Response funded surveys in the project area. Focal species for aerial surveys are Brandt‟s cormorants, double-crested cormorants (*Phalacrocorax auritus*), and brown pelicans (*Pelecanus occidentalis*). Brandt‟s and double-crested cormorants breed within the SCCSPNC while Brown Pelicans are migrants that use the SCCSPNC study area as important post-breeding roosting grounds. Whole-colony counts will be determined from these past archived photographs and these data will be analyzed using protocols developed by McChesney et al. (1998) and Capitolo et al. (2008). A scope of work for this analysis is attached as Appendix I and this assessment is expected to be completed in early 2012. Additionally, aerial photographic surveys of the SCCSPNC study area were conducted in 2010 and will be conducted again in 2011 to guide the selection of focal colonies for BACI monitoring. A scope of work for the 2011 surveys is attached as Appendix II.

For much of the Torch/Platform Irene region (i.e., Point Sur to Point Piedras Blancas, and the northern Channel Islands), most surface-nesting seabird colonies cannot be readily monitored with ground-based surveys because they occur in relatively inaccessible coastal regions. For these areas, aerial photographic surveys will remain the single best method for determining annual distribution and population estimates of Brandt‟s and double-crested cormorant colonies. Many surface-nesting colonies in the Point Piedras Blancas to Point Conception region that will be monitored with ground surveys also are

more completely viewed from aircraft. Additionally with aerial photographic surveys, human disturbance: 1) is occasionally detected directly in aerial photographs (e.g., people climbing on rocks); 2) is potentially indicated by observations of abandoned nests or human activities close to nesting colonies (e.g., boaters or kayakers in close proximity to breeding colonies); and 3) can be inferred by analyzing seabird colony use patterns over time (Carter et al. 1998). While aerial photographic surveys cannot be used to assess disturbance rates, they remain an important component of monitoring restoration efforts in the Torch/Platform Irene region and these aerial photographic surveys can provide important baseline data for future spills.

All aerial survey data will be incorporated into the greater SCCSPNC program and will help guide outreach and law enforcement efforts.

BACI Monitoring by Trained Biologists

Beginning in April (when seabird nest initiation is typically well under way), breeding and roosting colonies around Point Piedras Blancas, Point Buchon, and Point Arguello will be monitored on a weekly basis through August. The focal species will be those identified in the SOW: brown pelicans, Brandt‟s cormorants, double-crested cormorants, pelagic cormorants, black oystercatchers, Western gulls, and pigeon guillemots. Common murres (*Uria aalge*) were also identified as a focal species in the SOW, but are not found breeding south of the Point Sur area. Therefore, murres will not be a focal species for the initial monitoring approach, but will be included as the monitoring program expands into the northern portion of the SCCSPNC study area. Trained biologists will conduct three types of surveys at each location: transect surveys, nest monitoring, and disturbance monitoring. The approaches are briefly described below with detailed methodology outlined in Appendix III.

Transect Surveys. Trained biologists will conduct weekly coastal transects within each of the three extensive monitoring areas. The proposed transects are shown in Figure 2. Biologists will stop at several pre-determined observation points along each transect. The observation points will be used to divide the transect into counting blocks. The biologists will record all roosting and breeding seabirds observed within each counting block. This information will be used to estimate breeding and roosting population size and to identify important roosting and nesting areas for nest and disturbance monitoring.

Nest Monitoring. During the transect surveys, biologists will identify nests that can be monitored for breeding productivity (i.e., nests for which contents can be observed from observation points). For these nests, adult attendance and nest contents (i.e., the numbers of eggs, chicks, and fledglings) will be recorded each week. This information will be used to estimate annual productivity for each area.

Disturbance Monitoring. Important roosting and nesting areas identified during the transect surveys will be monitored for three hours each week to record human disturbance. Observations will be made during one of the following 3-hour blocks each week: 0600-0900, 0900-1200, 1200-1500, and 1500-1800. Time blocks will be rotated weekly to determine whether patterns of disturbance change with time of day. Additionally, observations will be made during weekdays and weekends to determine whether patterns of disturbance change throughout the week. All potential disturbances (both human-caused and natural) will be recorded as well as the reaction of both nesting

and roosting birds to these disturbances. Data that will be collected will include species disturbed, numbers of birds disturbed, type of disturbance (e.g., aircraft, boat), altitude/distance of disturbing party, identification of disturbing party (if possible), and photo documentation (if possible). This information will be used to estimate rates of human and natural disturbance.

Citizen Science Monitoring – Disturbance Monitoring

The citizen science monitoring program will be coordinated with California Audubon and will utilize volunteers from Audubon chapters throughout the SCCSPNC study area. The initial chapter to be trained will be the Morro Coast Audubon Society (MCAS). This chapter is large and organized and located within the center of the initial SCCSPNC monitoring plan area. Citizen scientists from MCAS will monitor the Morro Rock and Shell Beach Rocks focal areas. They will be trained on the same protocol as trained biologists for disturbance monitoring (one of the three types of surveys listed above) and will engage the public with information about the SPN. The collaboration with MCAS will serve as a model for expanding the citizen science program to other Audubon chapters throughout the SCCSPNC study area.

Reporting Disturbance Events to Outreach and Law Enforcement

During the first year of the monitoring program, PRBO will work with California State Parks (outreach entity) and BLM (law enforcement entity) to develop a strategy for reporting disturbance events. The strategy will build off that developed by the GFNMS and will include the use of the GFNMS disturbance reporting form. Additionally, PRBO plans to distribute monthly email reports to outreach, law enforcement, the Trustees, and other interested parties summarizing disturbances recorded during surveys. Finally, an annual workshop will be held to discuss results of monitoring efforts and highlight areas of concern within the study area. The workshop will provide an opportunity to amend the communication strategy and prioritize areas to target for outreach and law enforcement during the following year.

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Figure 1. Schematic of information flow among the three main components (Monitoring, Outreach, and Law Enforcement) of the SCCSPNC.

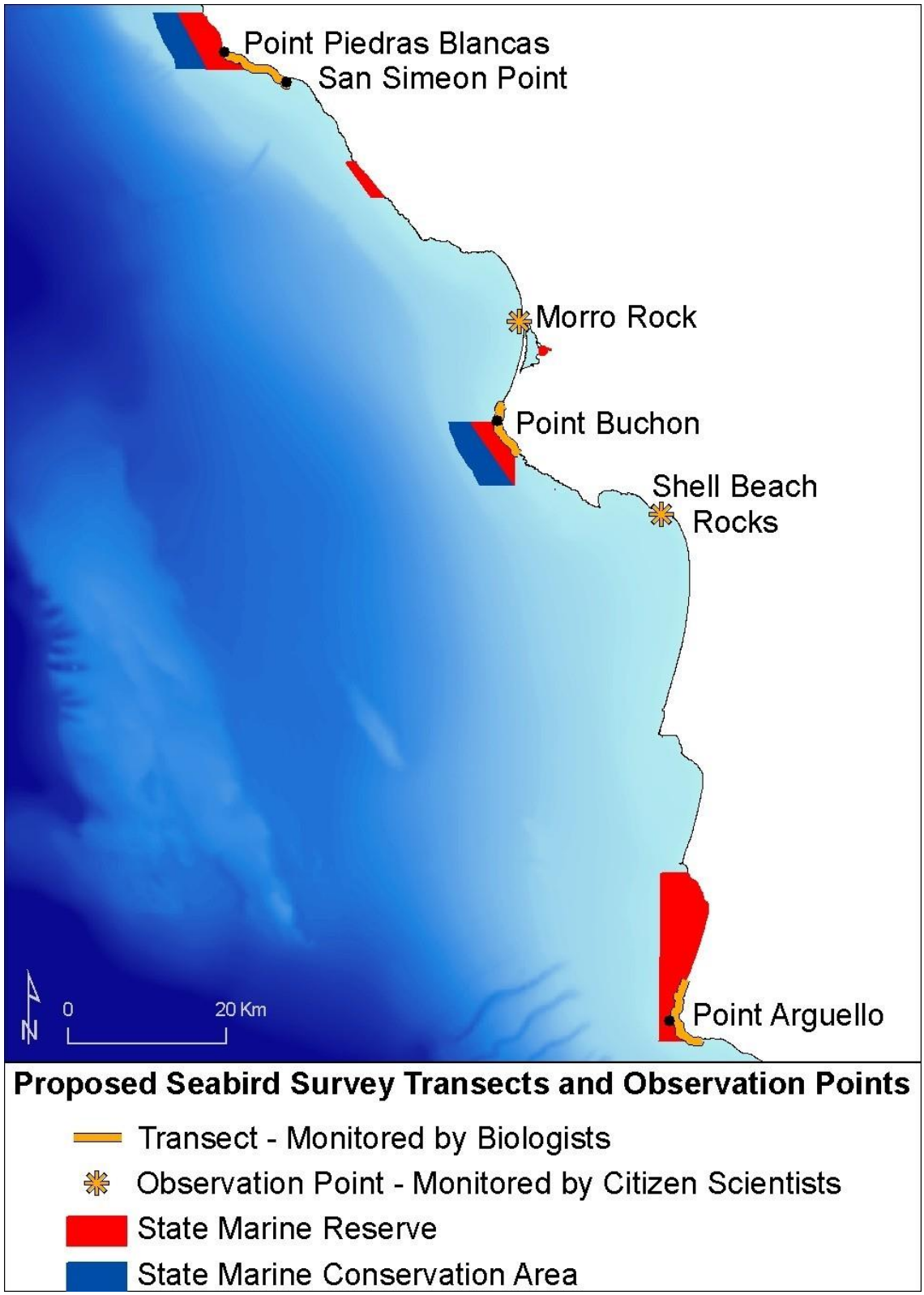

Figure 2. Map of initial SCCSPNC focal areas showing transects to be monitored by trained biologists and points to be monitored by citizen scientists.

Appendix I – Scope of Work for Aerial Photograph Analysis

SCOPE OF WORK

ANALYSES OF AERIAL PHOTOGRAPHIC SURVEYS OF BRANDT'S AND DOUBLE-CRESTED CORMORANT COLONIES, POINT SUR TO POINT CONCEPTION, CALIFORNIA, 1996-2009

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Introduction

Aerial photographic surveys have been used to monitor breeding population sizes of colonial Brandt's Cormorants (*Phalacrocorax penicillatus*), Double-crested Cormorants (*P. auritus*), and Common Murres (*Uria aalge*) throughout their ranges in California since mid- to late 1970s (e.g., Sowls et al. 1980; Takekawa et al. 1990; Carter et al. 1992, 1996, 1998, 2000, 2001, 2003; McChesney 1997; McChesney et al. 1998; 2000; Capitolo et al. 2004, 2006; 2008, 2010; USFWS, unpubl. data). Aerial photographic surveys have become the preferred method of monitoring breeding populations of these species because: 1) aerial surveys provide broad coverage over vast portions of their ranges; 2) they nest on the land surface in dense, clustered colonies that allow for easy identification from the air and complete photographic coverage. Other surface-nesting seabird species, such as Pelagic Cormorants (*P. pelagicus*), Western Gulls (*Larus occidentalis*), and Black Oystercatchers (*Haematopus bachmani*), nest at lower densities which usually do not allow for easy identification and complete colony coverage from the air. Yet other species nest underground in rock crevices or burrows, such as Pigeon Guillemots (*Cepphus columba*); their nesting colonies cannot be seen from the air.

Annual aerial photographic surveys have provided valuable information on distribution, abundance, trends, and impacts to these populations from both natural and anthropogenic sources. In some cases, human disturbance to colonies has been documented or inferred from large-scale nest abandonment or observations of human activities at colonies. Because of their susceptibility to human impacts and environmental changes, trends of these focal species have served to describe the general conditions of seabird populations in California. Very importantly, these data have been used to monitor the success of efforts to restore Common Murre populations in central California (e.g., McChesney et al. 2007).

Carter et al. (1998) provided a summary of aerial photographic surveys of south central California (Monterey to Point Conception) cormorant colonies from 1979 to 1995. In that report, the authors noted several changes in cormorant distributions over time and identified seven

colonies or colony complexes that may have been affected by human disturbance during that period. They recommended analyzing other years of available data to further assess populations and potential impacts from human disturbance.

In this study, we propose to analyze archived, uncounted, 1996-2009 aerial photographs of Brandt's and Double-crested cormorant colonies in the Point Sur to Point Conception region of the Torch/Platform Irene Oil Spill Restoration Plan area to: 1) provide updated, baseline data on cormorant distribution and abundance; 2) assess population trends; and 3) identify potential impacts from human disturbance at colonies. These data will be of great value for identifying focal colonies for initial restoration efforts and to serve as baseline for monitoring overall success of restoration efforts geared towards reduction of human disturbance.

Methods

Aerial photographic surveys from Point Sur to Point Conception were conducted by U.S. Fish and Wildlife Service (USFWS) in 1996-2007 and by U.C. Santa Cruz (UCSC) and USFWS in 2008-2009. Digital SLR cameras were used beginning in 2007, 35mm cameras and slide film in prior years. Slides from 1996-2006 surveys are archived at the USFWS San Francisco Bay NWRC. Digital images from 2007-2009 surveys are archived by both UCSC and USFWS.

Photograph analyses will be conducted by trained, experienced personnel. For each colony and each year, the best photographs for counting will be selected. For 1996-2006, best photographs will be scanned to high resolution digital images. Then, all Brandt's and Double-crested cormorant nests, territorial sites, and birds will be counted following standardized protocol (e.g., McChesney et al. 1998) and using image analysis software (Capitolo et al. 2008) In addition, roosting Brown Pelicans (*Pelecanus occidentalis*) will be counted when they occur at a cormorant colony. Counts will then be entered into a standardized database.

Products

A report summarizing cormorant and pelican counts at each colony from 1996 to 2009 will be provided. The report will also contain details of methods, descriptions of important colonies, population trends, and potential impacts of human disturbance such as large-scale nest abandonment, colony abandonment, or observed human activities at colonies.

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ESTIMATED BUDGET

CATEGORY		ESTIMATED COST
U.S. FISH AND WILDLIFE SERVICE - SAN FRANCISCO BAY NWRC		
Salaries/benefits		
Project Manager (GS-12): 0.375 months (project oversight, report review)	$	3,750
Travel	$	500
High resolution, batch slide scanner	$	2,000
Misc. supplies	$	250
subtotal SAN FRANCISCO BAY NWRC	**$**	**6,500**
USFWS Regional Office Indirect Cost (17%)	$	1,105
TOTAL SAN FRANCISCO BAY NWRC	**$**	**7,605**
COOPERATIVE AGREEMENTS/CONTRACTS		
Salaries/benefits		
Biologists, colony counting (Pt. Sur to Pt. Conception)	$	69,840
Biologist, Data analysis and report preparation	$	16,200
Travel	$	500
Supplies and Equipment maintenance	$	250
subtotal Cooperative Agreements/Contracts	**$**	**86,790**
Indirect cost (17.5%)	$	15,188
Total Cooperative Agreements/Contracts	**$**	**101,978**
USFWS Regional Office Indirect Cost for Pass-Through Funds (6%)	**$**	**6,119**
Total Project Cost	**$**	**115,702**

Appendix II – Scope of Work for Aerial Photographic Surveys

SCOPE OF WORK

AERIAL PHOTOGRAPHIC SURVEYS OF BRANDT'S, DOUBLE-CRESTED, AND PELAGIC CORMORANT COLONIES IN SOUTH CENTRAL CALIFORNIA, 2011

Prepared by Gerard J. McChesney[1] and Phillip J. Capitolo[2]

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3 January 2011

Introduction

Aerial photographic surveys have been used to estimate breeding population sizes of Brandt's (*Phalacrocorax penicillatus*) and Double-crested Cormorants (*P. auritus*), and Common Murres (*Uria aalge*) throughout coastal California since the mid to late 1970s (e.g., Sowls et al. 1980; Takekawa et al. 1990; Carter et al. 1992, 1995, 1996, 1998, 2000, 2001, 2003; McChesney 1997; McChesney et al. 1998; 2001; Capitolo et al. 2004, 2006; 2008a, 2010; USFWS, unpubl. data). They are the recommended method for monitoring breeding populations of these surface-nesting species because: 1) they provide coverage of extensive portions of breeding ranges; and 2) colonies are easily detected from aircraft and readily photographed completely. In contrast, most Pelagic Cormorant (*P. pelagicus*) colonies require boat- or land-based surveys for best viewing, though certain colonies can be surveyed well with aerial photographs. Western Gulls (*Larus occidentalis*) nest at lower densities than cormorants and murres, but with additional focused effort their colony sizes also can be estimated with aerial photographs (Capitolo et al. 2008b, 2009). Black Oystercatchers (*Haematopus bachmani*) and Pigeon Guillemots (*Cepphus columba*) are occasionally detected in aerial photographs but their populations are not surveyed effectively with this method.

Aerial photographic survey data have been used to: 1) monitor population trends over time, including identification of major population changes (Carter et al. 1996, 2001; Gibble et al. 2010; Capitolo et al., in prep.; McChesney et al., in prep.); 2) monitor the success of efforts to restore Common Murre populations in central California (e.g., McChesney et al. 2007, in prep.); 3) document the need for restoration actions, such as because of colony decline/extirpation (Takekawa et al. 1990; Carter et al. 1998, 2001; Thibault et al. 2010), or potential habitat removal (see Capitolo et al. 2008a); and 4) document colonies in need of special conservation actions, such as for the design of marine protect areas. Annual surveys provide valuable information on the distribution, abundance, and trends of cormorants and murres, as well as impacts to them caused by both natural and anthropogenic sources. Because of their sensitivity to environmental changes, cormorants (especially Brandt's) and murres also excellent indicator species for interpreting annual marine conditions. This information, in turn, assists interpretation of human impacts.

In the past, annual aerial photographic surveys of seabird colonies in California have been conducted cooperatively by several agencies, including U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), Humboldt State University, and University of California Santa Cruz (UCSC), with funding from various sources.

It is critical for best understanding of seabird population trends in California that aerial photographic surveys continue annually for all coastal regions of California. Because they are broad in geographic scope, monitor multiple species, useful in identifying and assessing seabird restoration projects, and cost-effective, we suggest that agencies with management responsibilities for seabirds and seabird habitats should consider these surveys a high priority for funding.

Proposed Work

We propose to conduct aerial photographic surveys of all Brandt's and Double-crested Cormorant colonies, and a small sample of Pelagic Cormorant colonies, in the Torch/Platform Irene Oil Spill Restoration Plan area (Point Sur to Ventura plus the northern Channel Islands) in 2011. In addition, photograph analyses will be conducted to provide: 1) annual estimates of breeding birds at each colony on the mainland between Point Sur and the Ventura-Los Angeles County border; 2) information on potential human disturbance and other impacts to cormorant colonies; and 3) additional baseline data to assess the success of cormorant restoration efforts in the region.

Methods

Surveys in 2011 will be conducted jointly by USFWS and UCSC personnel in a CDFG fixed-wing Partenavia aircraft out of Sacramento. Survey personnel will include two photographers and one data recorder. Photographs will be taken with high resolution digital SLR cameras and saved to external hard drives. Because of extremely asynchronous and variable timing of breeding, Channel Islands surveys must be conducted three times between mid April and mid June. Colonies between Point Sur and Point Conception will be surveyed once in late May to early June.

Counts will be obtained from all active colonies along the mainland from Point Sur to the Ventura-Los Angeles count line. Counts of certain Channel Islands colonies may be conducted if funds allow. Photograph analyses will be conducted by trained and experienced personnel. For each colony, the best photographs for counting will be selected. Then, all active cormorant nests, abandoned cormorant nests, territorial sites, and birds will be counted following standardized protocol (e.g., McChesney et al. 1998) and using image analysis software (Capitolo et al. 2008a). In addition, roosting Brown Pelicans (*Pelecanus occidentalis*) will be counted when they occur at a cormorant colony. Counts will be entered into a standardized database.

Products

A brief report summarizing counts of breeding cormorant and roosting pelicans at each colony in 2011 will be provided and submitted by 31 March 2012. A summary of potential human disturbance to colonies will be included, such as observations of abandoned nests or human activities close to nesting colonies.

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U.S. FISH AND WILDLIFE SERVICE ESTIMATED BUDGET

CATEGORY	ESTIMATED COST
U.S. FISH AND WILDLIFE SERVICE - SAN FRANCISCO BAY NWRC	
Salaries/benefits	
Salaries/benefits (surveys, project oversight)	$ 2,870
Travel	$ 500
Supplies and Equipment maintenance	$ 300
Refuge Administration	$ 624
Credit for FY2010 Aircraft charter costs	$ (2,112)
subtotal SAN FRANCISCO BAY NWRC	**$ 2,182**
USFWS Regional Office Indirect Cost for Inhouse Funds (11%)	$ 240
TOTAL SAN FRANCISCO BAY NWRC	**$ 2,422**
COOPERATIVE AGREEMENTS/CONTRACTS	
Survey Crew	
Salaries/benefits	
Survey Crew, Pt. Sur to Pt. Conception: 2 person days @ $360/day	$ 720
Survey Crew, southern California: 10 person days @ $360/day	$ 3,600
Survey prep and post-survey data handling: 10 person days @ $360/day	$ 3,600
Colony counting, Pt. Sur to Ventura, 19 person days @$360/day	$ 6,840
Travel	$ 800
Supplies and Equipment maintenance	$ 300
subtotal Survey Crew (direct costs)	**$ 15,860**
Indirect cost (17.5%)	$ 2,776
subtotal Cooperative Agreements/Contracts	**$ 18,636**
USFWS Regional Office Indirect Cost for Pass-Through Funds (6%)	$ 1,118
TOTAL COOPERATIVE AGREEMENTS/CONTRACTS	**$ 19,754**
Total Project Cost	**$ 22,176**

CALIFORNIA DEPARTMENT OF FISH AND GAME ESTIMATED BUDGET

CATEGORY	FY 2011 ESTIMATED COST
CALIFORNIA DEPARTMENT OF FISH AND GAME	
Flight time, Pt. Sur to Pt. Conception surveys (2 days x 8 hrs/day x $350/hr)	$ 5,600
Flight time, Northern Channel Islands (3 days x 8 hrs/day x $350/hr)	$ 8,400
TOTAL CALIFORNIA DEPARTMENT OF FISH AND GAME	**$ 14,000**

TOTAL BUDGET: $36,176

Appendix III – Scope of Work for Seabird Colony Monitoring

SCOPE OF WORK

SEABIRD COLONY MONITORING WITHIN THE SOUTH CENTRAL COAST NETWORK CHAPTER STUDY AREA, 2011-2013

Prepared by Daniel P. Robinette

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November 19, 2010

Background

Seabirds are long-lived species (often living >20 years; Clapp et al. 1982) that produce few offspring and provide a large amount of parental care compared to most marine species. During the breeding season, seabirds are central place foragers, returning to the nesting colony throughout the day to incubate eggs and provision young. Though most "true" seabirds come to land only to breed, many coastal species in North Central California rely on land throughout the year to rest, dry wetted plumage, and defend breeding sites.

As upper level predators, seabird populations are regulated primarily from the bottom up (see Ainley et al. 1995). Prey availability has been shown to affect coloniality (whether birds form large or small colonies), the timing of reproduction, clutch sizes, chick growth, non-predator related chick mortality, and reproductive success (Anderson and Gress 1984, Safina and Burger 1988, Pierotti and Annetti 1990, Massey et al. 1992, Ainley et al. 1995, Monagham 1996, Golet et al. 2000). Though top-down regulation does occur, it is often exacerbated by human activities that disturb breeding and resting sites. The impacts of human disturbance tend to be most pronounced when humans enter the immediate area (see Carney and Sydeman 1999). Intrusions often result in most, if not all, birds fleeing from the immediate area, leaving eggs and chicks vulnerable to predators such as gulls and ravens. While some birds return to nests once an intruder has gone, others will abandon nesting efforts. For example, Brandt's Cormorants have been observed to abandon nests en masse from even single events of human intrusion to the colony (McChesney 1997). Although often not as easily identified, activities such as close approaches (e.g., by boats, surfers, etc.) to colonies and roosts can evoke responses similar to direct human intrusions (Jaques et al. 1996, Carney and Sydeman 1999, Jaques and Strong 2002). Several studies have shown reductions in breeding success or population sizes as a result of close approaches (e.g., Wallace and Wallace 1998, Carney and Sydeman 1999, Thayer et al. 1999, Beale and Monaghan 2004, Bouton et al. 2005, Rojek et al. 2007).

For this study, we will expand on the monitoring program initiated by PRBO Conservation Science at Vandenberg Air Force Base in 1999 (see Robinette and Howar 2010). We will assess baseline 1) seabird breeding population size and distribution, 2) seabird breeding productivity at

multiple colonies within the SCCNC study area, and 3) levels of human disturbance at important seabird breeding colonies and roost sites.

Focal Species

The scope of work for the SCCNC identifies eight species that would benefit from decreased human disturbance: Common Murres, Pelagic Cormorants, Brandt's Cormorants, Double-Crested Cormorants, Western Gulls, Black Oystercatchers, Pigeon Guillemots, and California Brown Pelicans. Common Murres do not breed in the focal region identified within the SCCNC Initial Monitoring Plan. We will therefore focus on the remaining seven species. Six of these species breed within the initial focal region. Though Brown Pelicans do not breed within this region, the coastal habitats provide important roosting areas during their post-breeding migration and overwintering. Important life history information for each species is presented below.

Pelagic Cormorant. Pelagic Cormorants typically breed on rocky seacoasts and island cliffs. This species attempts only one successful brood per season. If the first nesting attempt fails (the chicks do not survive to fledging), subsequent "relay" nesting attempts may be undergone. Relay attempts will take place at the same nest site, usually in the original nest. Nests are located on high, steep, inaccessible rocky cliffs facing water. Nests are of the platform type, and are made of sticks, seaweed and grass, debris, or only moss. Pelagic Cormorants lay 3-7 eggs (3-5 eggs is most common) during a single nesting attempt. Both sexes incubate the eggs for 26-35 days. Fledging occurs in 40-50 days.

Brandt's Cormorant. Brandt's Cormorants typically breed on open ground in rocky areas along seacoast cliff tops or grassy slopes. Nests have occasionally been found inshore on brackish bays. This species attempts only one successful brood per season. If the first nesting attempt fails (the chicks do not survive to fledging), subsequent "relay" nesting attempts may be undergone. Relay attempts occur at the same nest site and usually in the original nest. Brandt's Cormorants avoid building nests on the steep cliffs which Pelagic Cormorants favor. Nests are composed of seaweed and other marine vegetation (sticks are not used to form nests). Brandt's Cormorants lay 3-6 eggs (4 eggs is most common). Incubation lasts 29-30 days. Fledging occurs in 30-40 days.

Double-Crested Cormorant. Double-Crested Cormorants typically breed on ground or cliffs, in trees or shrubs. This species typically attempts only one successful brood per season. Second broods have been reported but are extremely rare. If the first nesting attempt fails (the chicks do not survive to fledging), subsequent "relay" nesting attempts may be undergone. Double-Crested Cormorants lay 1-7 eggs (5 eggs is most common) during a single nesting attempt. Both sexes incubate the eggs for 25-28 days. Fledging occurs in 40-50 days.

Western Gull. Western Gulls typically nest on rocky islets and coastal cliffs. This species attempts only one successful brood per season. If the first nesting attempt fails (the chicks do not survive to fledging), subsequent "relay" nesting attempts may be undergone. Nests are perennial and are usually located on cliff ledges, grassy hillsides, or sometimes on human built structures. Western Gulls lay 1-5 eggs (3 is the

most common number). Western Gulls are colonial and have been known to share nesting sites with other seabirds. Incubation ranges from 25-29 days (26 days is the average length). Chicks fledge in 42-49 days, yet often don't disperse from the colony until after 70 days.

Black Oystercatcher. Black Oystercatchers typically breed on rocky coasts and islands, although nests have been occasionally found on sandy beaches. This species attempts only one successful brood per season. If the first nesting attempt fails (the chicks do not survive to fledging), subsequent "relay" nesting attempts may be undergone. Black Oystercatchers are monogamous, and have long-term pair bonds. They are also year round residents who continually defend their feeding territories. Nests are of the scrape form, and are usually built above the high tide line in weedy turf, beach gravel, or rock depressions. Black Oystercatchers lay 1-3 eggs (2 eggs is most common). Incubation lasts 24-29 days. Chicks are precocial at hatching, but highly dependent on their parents for an extended period of time. Chicks rely on parents to show them food, and to teach them about appropriate food selection. Chicks fledge in approximately 35 days.

Pigeon Guillemot. Pigeon Guillemots typically breed in burrows in coastal cliffs or caves. This species attempts only one successful brood per season. If the first nesting attempt fails (the chicks do not survive to fledging), subsequent "relay" nesting attempts may be undergone. Guillemots typically nest in small colonies. Nests are perennial, with high nest site fidelity. Pigeon Guillemots lay 1-2 eggs (2 is the most common number). Both the male and female incubate the eggs, for a period of 25-38 days (with 29 days being average). Young fledge in 29-54 days, with 38 days being the average fledging time. During the breeding season, guillemots raft in small groups on the water adjacent to their nesting crevices. This behavior is most common in the early mornings.

California Brown Pelican. California Brown Pelicans breed on the northern Channel Islands and migrate north along the California coast after breeding. Brown Pelicans breeding in Mexico also migrate north after breeding. During the post-breeding season, pelicans rely on coastal habitats as important roosting sites. Pelicans typically begin to appear within the SCCNC in May and June, with numbers increasing, but variable, through August and September. Peak roosting numbers are typically reached in December and January.

Methods to Be Used

Transect Monitoring

Goals. The goals of transect monitoring are three-fold: 1) to document the size and distribution of annual breeding and roosting populations for each focal species within the SCCNC study area, 2) to identify nests that can be followed for estimating annual productivity, and 3) indentify areas of dense breeding and roosting populations to monitor for disturbance.

Areas to Survey. We have selected three general areas for transect monitoring: Point Piedras Blancas (Figure 1), Point Buchon (Figure 2), and Point Arguello (Figure 3). For each area, we will define a transect that can be traveled by foot and car within four hours. We will divide each

transect into counting blocks viewable from predetermined observation points. We have monitored breeding colonies at Point Arguello since 1999 and have already divided the coast into counting blocks based on the observation points in Figure 3. The counting blocks and observation points shown in Figures 1 and 2 are proposed and will be finalized once work begins in the spring of 2010.

Methods. Beginning the week of April 1, we will conduct one transect survey per week at each of the areas identified above. Surveys will be conducted between the hours of 0600 and 1000 as this is the peak time for Pigeon Guillemot rafting activity and roosting activity by non-breeding birds. For each survey, we will begin at one end of the transect and visit each observation point. We will alternate starting points between the north and south ends of the transect on a weekly basis to minimize time bias on guillemot raft counts. From each observation point, we will scan the adjacent count blocks using binoculars and a spotting scope. We will record the number of nesting, roosting, and rafting (for guillemots only) birds observed within each counting block(s). We will do this for each of the focal species identified above. Additionally, we will use a detailed map of the study area to mark 1) individual rocks within a given counting block that have high abundances of breeding and/or roosting birds and 2) the specific location of Black Oystercatchers. The former information will be used to identify rocks for disturbance monitoring while the latter will be used to estimate territories of breeding oystercatcher pairs.

Nest Monitoring

Goals. The overarching goal of nest monitoring is to record annual nesting phenology and estimate annual colony productivity. Both phenology and productivity are good indicators of the underlying oceanographic conditions affecting annual population size. Recording phenology requires weekly checks on individual nests within a given colony. Productivity can be calculated as either 1) the number of fledglings produced per adult breeding pair or 2) the percentage of total eggs laid that hatched and successfully grew into fledglings. The first calculation requires only knowledge of the number of fledglings produced within a given nest. The second requires more detailed knowledge of how many eggs were laid, how many of those eggs hatched, and how many of those chicks fledged. For each focal area possible, we will follow 30 nests of each focal species.

Methods. We will identify monitorable nests during our transect surveys of each focal area. A monitorable nest is one for which eggs, chicks, and fledglings can be clearly viewed and enumerated without disturbing the nesting adults. Once nests are identified, they will be monitored every 7 days. During each monitoring visit, we will record 1) nest condition, 2) number of adults attending the nest and whether one is in incubating posture, 3) number of eggs, 4) number of chicks, 5) the feather condition of chicks, 6) number of fledglings and 7) if nest fails, the reason for nest failure.

Disturbance Monitoring

Goals. The goals of disturbance monitoring are 1) to identify human activities that cause disturbance, 2) to identify human activities that do not cause disturbance, 3) to estimate rates of human-caused disturbance at individual colonies, and 4) to estimate rates of natural (e.g., predator-caused) disturbance at individual colonies. Disturbance is defined as any event that results in one or more of the following:

1) Birds flushing (birds flying off the rock).
2) Birds displacing (moving from their nest or resting site).
3) Eggs or chicks being:
    a. exposed (adult moves away from the egg or chick),
    b. displaced (egg or chick moves from nest site), or
    c. taken (egg/chick is depredated).
4) Birds becoming visibly agitated.

Methods. We will identify a minimum of one important nesting/roosting colony to monitor per focal area. Colonies will be selected based on their size and ease of viewing from a land-based observation point. We will monitor each selected colony once a week during one of the following 3-hour blocks: 0600-0900, 0900-1200, 1200-1500, and 1500-1800. Time blocks will be rotated weekly to determine whether patterns of disturbance change with time of day. Additionally, observations will be made during weekdays and weekends to determine whether patterns of disturbance change throughout the week. At the beginning and end of each survey, we will record the number of breeding and roosting birds present for each species. Throughout the three-hour period, we will record all land-based human activity and boat traffic within 1,500 feet, and aircraft flying at altitude of $\leq$1000 feet and within 1,500 horizontal feet of the colony, regardless of whether disturbance occurred or not. Additionally, we will record all natural events (e.g., predatory bird flying over, large waves crashing) that cause disturbance. If disturbance occurs, we will record the following information:

1. Number of nesting and roosting birds present for each species.
2. Number of birds disturbed and reaction type for each species.
3. Number of nests with eggs and chicks exposed for each species.
4. Source of disturbance.
5. Source altitude and distance from nesting area affected
6. Activity of disturbance source
7. Identification information (e.g., type of vessel or aircraft and any identifying information like license number).
8. Direction of travel/Duration
9. Photographic or video evidence

Products

All data collected will be housed within PRBO's California Avian Data Center (CADC). CADC is an in-use, secure, and well-tested platform that provides a powerful cost-effective solution to the data consolidation and management needs of Seabird Protection Network. Utilities made available through this online portal will enable data collected in the past and future to be

integrated to provide managers information on the effectiveness of outreach and law enforcement efforts.

We will produce annual reports that 1) summarize data collected on population size and disturbance, annual productivity, and disturbance rates and 2) provide recommendations to guide the expansion of outreach, law enforcement, and scientific monitoring efforts throughout the SCCNC study area

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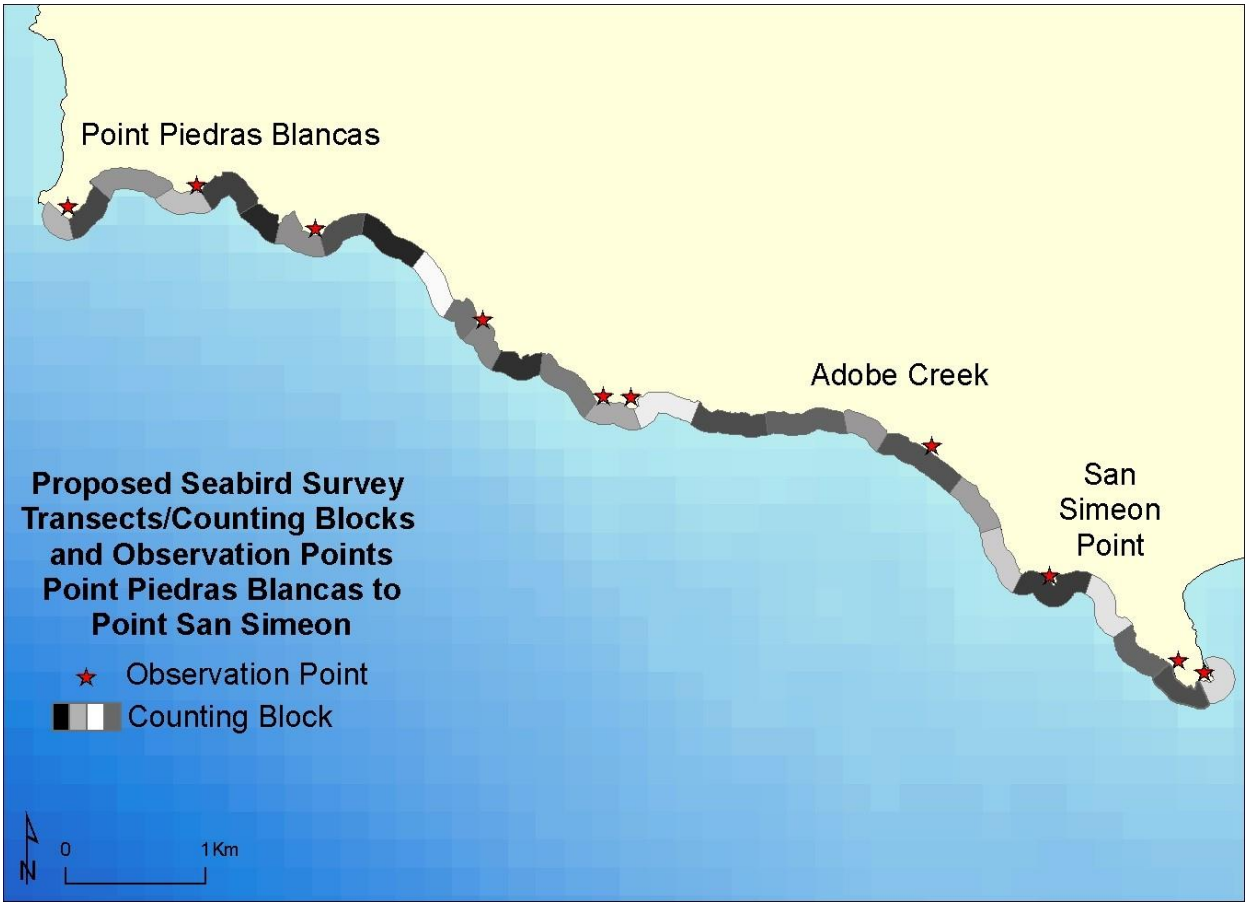

Figure 1. Proposed observation points and counting blocks along the Point Piedras Blancas to San Simeon Point transect.

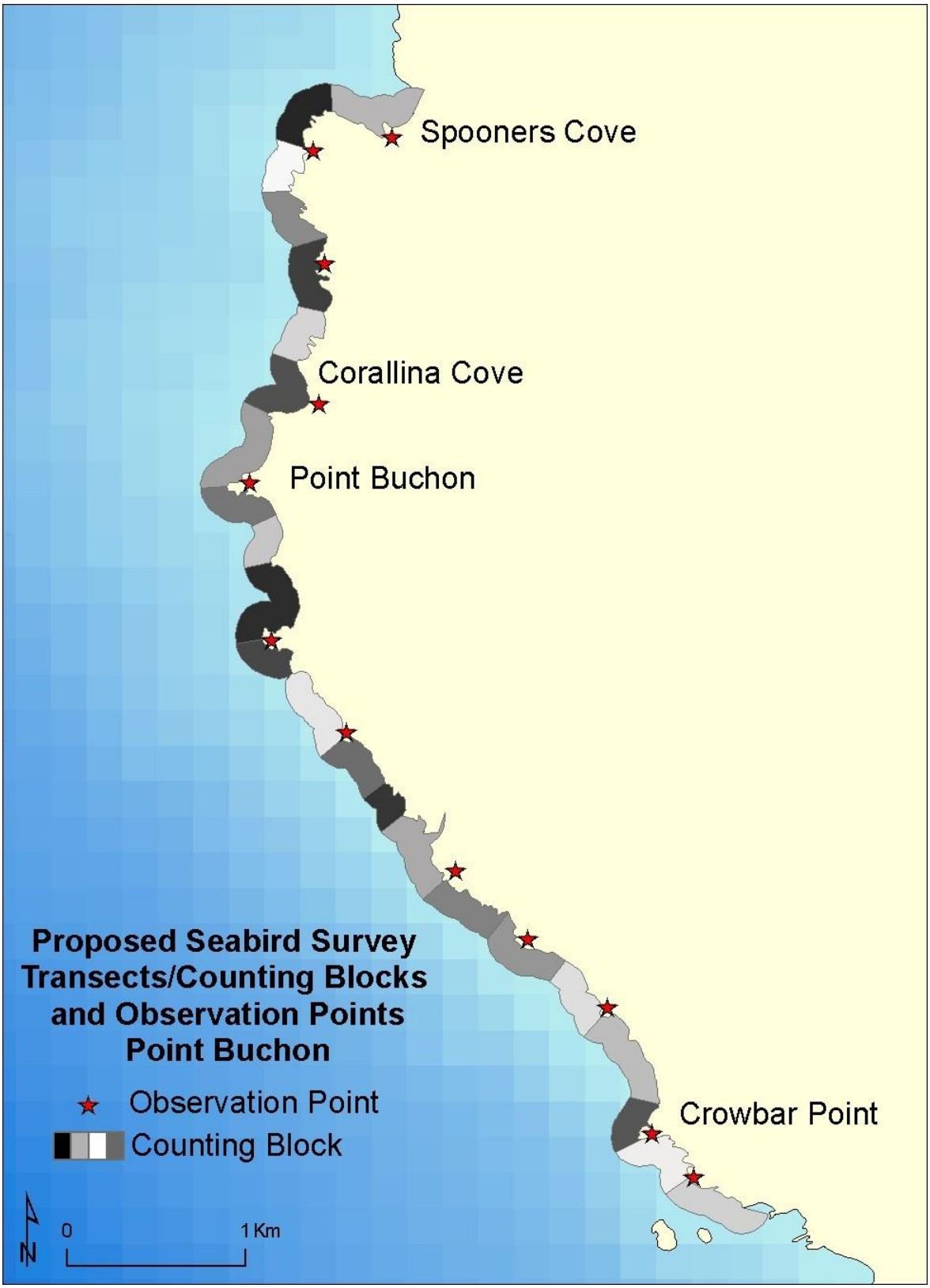

Figure 2. Proposed observation points and counting blocks along the Point Buchon transect.

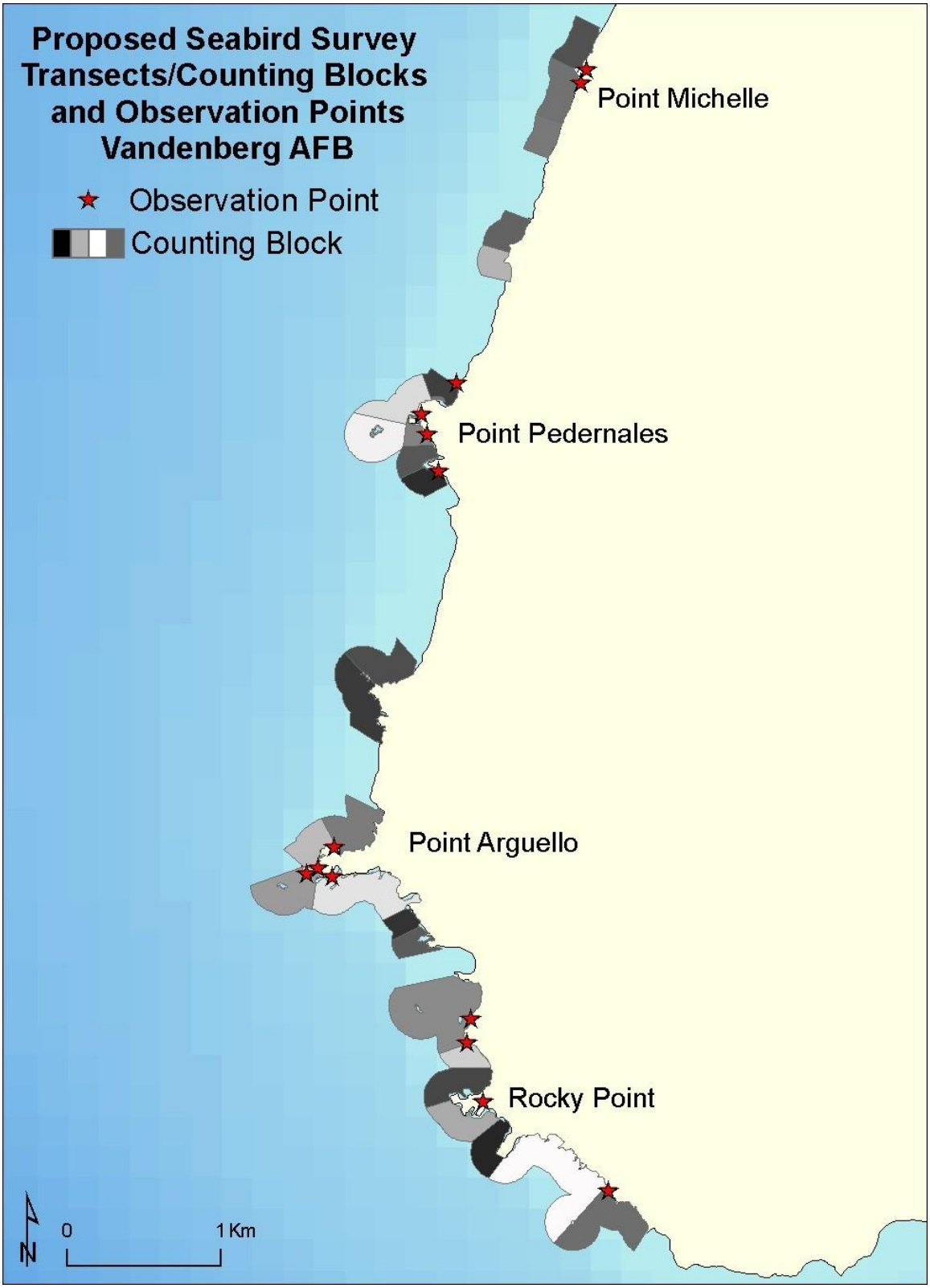

Figure 3. Observation points and counting blocks currently used along the Point Arguello transect.

Estimated Costs

Year 1 Cost Estimate	
Personnel	
Science Director salary + benefits (0.25 months @ $13,335)	$3,333.75
Principal Investigator salary + benefits (2.75 months @ $9,965)	$27,403.75
Field Coordinator/Data Manager salary + benefits (3 months @ $8,043)	$24,129.00
Field Tech/Citizen Science Coordinator salary + benefits (5 months @ $5,791)	$28,955.00
Field Tech salary + benefits (3 months @ $5,791)	$17,373.00
Intern monthly stipend (1 intern for 3.5 months @ $1,869)	$6,541.50
Equipment and Supplies	
Field Equipment	$4,000.00
Misc. supplies (e.g., field books, data forms)	$650.00
Travel	
Field Mileage	$6,875.00
Meeting Travel	$2,670.00
Total Year 1 Costs	***$121,931.00***
Year 2 Cost Estimate	
Personnel	
Science Director salary + benefits (0.25 months @ $14,000)	$3,500.00
Principal Investigator salary + benefits (1 month @ $10,463)	$10,463.00
Field Coordinator/Data Manager salary + benefits (1.5 months @ $8,445)	$12,667.50
Field Tech/Citizen Science Coordinator salary + benefits (5 months @ $6,080)	$30,400.00
Field Tech salary + benefits (3 months @ 6080)	$18,240.00
Intern monthly stipend (2 interns for 3.5 months @ $1,869)	$13,083.00
Equipment and Supplies	
Field Equipment	$2,000.00
Misc. supplies (e.g., field books, data forms)	$650.00
Travel	
Field Mileage	$6,875.00
Meeting Travel	$2,670.00
Total Year 2 Costs	***$100,548.50***
Year 3 Cost Estimate	
Personnel	
Science Director salary + benefits (0.25 months @ $14,700)	$3,675.00
Principal Investigator salary + benefits (1 month @ $10,986)	$10,986.00
Field Coordinator/Data Manager salary + benefits (1.25 months @ $8,867)	$11,083.75
Field Tech/Citizen Science Coordinator salary + benefits (5 months @ $6,384)	$31,920.00
Field Tech salary + benefits (3 months @ $6,384)	$19,152.00
Intern monthly stipend (2 interns for 3.5 months @ $1,869)	$13,083.00
Equipment and Supplies	
Misc. supplies (e.g., field books, data forms)	$650.00
Travel	
Field Mileage	$6,875.00
Meeting Travel	$2,670.00
Total Year 3 Costs	***$100,094.80***
Total Cost Over 3 Years	**$322,574.30**