



ISLAND CONSERVATION

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Fall Field Trial Plan

November 27-December 17, 2012

on the Farallon National Wildlife Refuge



***Trial Plan for U.S. Fish and Wildlife Service
Farallon National Wildlife Refuge
San Francisco Bay Refuge Complex***

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EXECUTIVE SUMMARY

A field research trial is to be conducted on the South Farallon Islands of the Farallon National Wildlife Refuge from November 27, 2012 to December 17, 2012. The Farallon Islands harbor the largest island breeding seabird colony in the continental U.S., but invasive House mice (*Mus musculus*) are causing significant impacts to the IUCN-Endangered Ashy Storm-petrel (*Oceanodroma homochroa*) and other native and endemic species of the Farallon ecosystem. The USFWS is proposing to remove all introduced mice as part of the Farallon Restoration Project. Removal methods being considered include a one-time aerial application of grain-based pellets with a small amount of rodenticide. While the timing of the proposed mouse removal would occur when most resident seabirds are not present on the island, there exists a risk of rodenticide exposure to a fraction of the remaining non-breeding Western Gulls (*Larus occidentalis*) that may roost on the island during the fall and winter.

This field trial is being conducted to provide information that will aid in the operational planning of the proposed project, with a focus on measures to assess and reduce primary and secondary exposure to gulls. Avian hazing techniques have been proposed as one of several mitigation measures to reduce gull exposure to the rodenticide. Avian hazing has been successful in hazing gulls from airports, landfills and sensitive breeding areas on Refuges throughout the U.S. This avian hazing trial has been funded by the Luckenbach Trustee Council, National Fish and Wildlife Foundation, and the Oiled Wildlife Care Network (OWCN). Staffing for the hazing trial will be provided primarily by the Farallon Restoration Project Partners (U.S. Fish and Wildlife Service, PRBO Conservation Science and Island Conservation) with the assistance of professional expert hazing staff from OWCN and USDA-APHIS.

One of the primary trial goals is to determine what techniques and staffing levels might be required to effectively haze gulls from the Farallon Islands during a mouse removal operation in order to reduce exposure to gulls and other birds. The avian monitoring and hazing techniques being tested on the islands during this trial may also be of use to local and international organizations involved in the monitoring and prevention of oiled seabirds and other wildlife in the event of an oil spill or other incident where seabirds may need to be excluded from a hazardous area.

OBJECTIVES

- Establish pre-trial numbers of gulls and pinnipeds and monitor and document the effects of various avian hazing operations on gulls, seabirds and pinnipeds present on the island
- Haze a maximum number of gulls from Southeast Farallon, West End Island, and offshore islets while also assessing the relative success of various avian hazing techniques and tracking the amount of supplies and personnel hours required
- Conduct bait trials which will demonstrate how long bait pellets remains available in the environment, how feasible it is to haze gulls from placebo pellets, and how available bait products degrade in the Farallon Island environment

OVERVIEW

TIMING

The trial is scheduled to run from November 27, 2012-December 17, 2012. Two personnel change-overs will occur: on December 5 and December 12.

TRANSPORTATION & LOGISTICS

Fuel for the helicopter will be sourced at Half Moon Bay Airport, loaded into 55-gallon drums, and transported to the island via U.S. Coast Guard helicopter. This trip is scheduled for November 14-15. A strike team trip with a few personnel may be scheduled between November 12 - 25 to transport gear, establishing bait degradation cages, and sample mouse DNA.

Most personnel and equipment will initially be transported to the island via “*Outer Limits*” captained by Jim Robertson. Two personnel change-overs will be supported by an additional smaller boat charter with Captain Jody Harris on the “*Farallon*.” All personnel and gear remaining on the island at the end of the trial will return to the mainland via “*Outer Limits*.” Personnel will meet to check-in and load personal gear and equipment at the dock in Sausalito on November 26 and spend the night in hotels in the area. Personnel will depart for the island from the dock at Sausalito at sunrise on Tuesday, November 27, weather conditions permitting.

STAFFING

Staffing for the hazing trial will be provided primarily by the core Farallon Restoration Project Partners (Island Conservation, USFWS, and PRBO). Supplemental expert staff will come from Oiled Wildlife Care Network and USDA-APHIS. Each of these entities will provide two personnel weeks (two personnel for one week each). A personnel schedule can be found in Appendix 1. To ensure efforts are coordinated, an Incident Command Structure (ICS) will be utilized for the duration of the trial. The ICS can be found in Appendix 2 of the Trial Plan. In the interest of maintaining consistent personnel structure, Island Conservation will serve as the lead coordinator for trial, but recognizes that the ICS will not take precedence over USFWS or PRBO management protocols on the Refuge. It is anticipated that personnel will be working from early morning until well into the evening, though several hours each morning and afternoon will be slated for resting and other personal time and personnel are not expected to work more than 8 hours each day (See Appendix 1 for the daily schedule). It is likely that dawn and dusk will be the busiest times for hazing, with less intensive hazing being required at night and during mid-day. A proposed daily schedule and recommended rotation for hazing shifts can be found in Appendix 1.

The following staffing needs have been identified and filled:

- A Hazing Coordinator whose sole role is to coordinate island-wide hazing activities and communicate with monitoring personnel to signal to hazers when disturbance to pinnipeds is caused. The Hazing Coordinator will also coordinate with the PRBO staff lead that is not directly involved in the monitoring or hazing activities

- A minimum of four hazers whose responsibilities includes policing specific sectors of the islands
- Minimum of two personnel capable of using all pyrotechnic devices (ATF permitted) such as bird bombs, cracker shells, and CAPA launchers—one for each island. Ideally there should be four such personnel. Federal and state employees are not required to possess an ATF permit, but must abide by federal laws regarding the use of explosive pest control devices.
- Minimum of four monitoring personnel during daylight hours (one for West End, three for Southeast Farallon)

According to the schedule, as many as eleven people would be brought onto the islands for the express purposes of the hazing trial, and would be housed primarily in the USFWS (Coast Guard) house, with one or two in the PRBO house, as space permits.

BRIEFINGS AND TRAINING

Prior to departing the mainland, personnel will be asked to take part in an on-line training course on the Incident Command Structure (ICS), which is useful for those who have never been a part of an ICS in the past. Personnel will also be briefed on appropriate biosecurity for transporting gear and personal items to the island. During the boat transfer to the islands, briefings will be conducted for safety during the landing and the transport of gear and personnel to the island. Immediately upon arrival at the island, a circumnavigation of the islands will be conducted to orientate the team to the islands' geography and place names. Upon transfer of crew and equipment to the island, a team meeting will be held and an on-island orientation will occur. Training sessions will commence on the afternoon of the first day (Day I) and will likely continue onto the following day (Day II) and include the following components:

- On-island trainings:
 - General Orientation & Natural Resource Protection (USFWS/PRBO)
 - ICS for the trial (IC)
 - Radio Communications (IC)
 - Safety
 - General (Safety Officer—TBD)
 - Aviation (IC)
 - Pyrotechnics (WV)
 - Helicopter Protocols (IC + pilot)
 - GPS use (IC)
 - Data Collection/Record Keeping (PRBO)
 - Hazing Methods (deployment and general functioning) (USDA + OWCN)

Designated partners (indicated in parentheses) will be responsible for conducting each of the above components.

Throughout the course of the trial, the team will meet daily to recap the progress of the trial, as well as review overall hazing success. Daily Hazing Team and Monitoring Team assignments and individual daily work assignments will be made and distributed at this time.

PERMITS

Prior to implementing the trial, the plan will be reviewed for its concurrence with issued permits.

A Section 7 Consultation and Incidental Harassment Authorization (IHA) for Level B harassment of pinnipeds from NOAA-NMFS is currently being processed. The application was published in the Federal Register on August 27th and it is anticipated that the IHA will be issued by October 31, 2012. The result of this application will specify what degree of disturbance to pinnipeds will be tolerated and thus, which hazing activities will be permitted and how frequently pinnipeds may be incidentally harassed.

A Wilderness Determination will be obtained in order to access the Wilderness Area on West End Island. Use of these areas might include on-the-ground hazing as well as aerial monitoring and hazing.

All personnel intending to use any pyrotechnic device other than whistlers will need to be permitted by the Bureau of Alcohol, Tobacco, and Firearms. Island Conservation has applied for an ATF user permit, and expects to receive the permit in time for the trial.

Finally, a Categorical Exemption for all hazing activities will need to be issued by the USFWS manager of Farallon NWR, as well as an Overflight Permit from the Manager of the Gulf of the Farallones National Marine Sanctuary.

Any monitoring conducted using an unmanned aerial vehicle (UAV) will need to obtain a Certificate of Authorization (COA) from the FAA. At present, permits are being sought to allow for the use of NASA Ames UAVs as early as December 2012, and/or UAVs from the USGS Rocky Mountain Science Center in March 2013 to determine the use of these vehicles in the monitoring of gulls and pinnipeds. The USGS permitting process requires at least 135 business days (45 days for Spectrum Request approval from the Army, 90 days for COA approval).

SAFETY

A separate Trial Safety Plan has been written and will be distributed to personnel before leaving for the island. Based on the current certification and experience levels of personnel on-island, a Safety Officer will be assigned who will be responsible for daily implementation of this Safety Plan. The Safety Plan encompasses both general safety and aviation safety. Personnel will be requested to acknowledge having read the plan, agree to its provisions and be aware of the potential risks the island environment presents.

BIOSECURITY

As a unique island ecosystem which sees a frequent exchange of personnel and gear between the archipelago and the mainland, FNWR is at risk of experiencing future invasions by introduced species. In general, the success of biosecurity measures rests on the inspection and packaging of supplies,

equipment, and personal gear transported to the island, as well as on-island awareness. In an effort to minimize this risk to the archipelago during the course of the Fall 2012 field trial, all personnel will follow the guidelines set out when assembling and packing supplies, equipment and personal gear destined for the islands.

A biosecurity checklist has been developed and can be found in Appendix 3. All personnel travelling to the island will be asked to review and sign off on the biosecurity protocol.

METHODS

A general schedule of hazing, monitoring, and bait-related activities can be found in Appendix 1.

SCOPE

The trial will encompass the extent of the Southern Farallon Islands and will aim to haze gulls from the islands for up to 14 days. Saddle Rock and other small islets might be designated as roosting refugia if adaptive management requires it. Hazing and monitoring personnel will need access to the greatest extent of the South Farallon islands, including West End Island. Personnel may require access to other such areas as: Fertilizer Flat and Shell Beach. The tools currently intended for use on the Farallon NWR for the purpose of hazing gulls are as follows:

- Human movements
- Effigies (gull and predator)
- Gas exploder or “Zon”
- Biosonics (Bird Gard, Long Range Acoustic Device—LRAD)
- Lasers (50 mW & 5 mW)
- Pyrotechnics (bangers, CAPA, cracker shells)
- Kites (Stationary & mobile)
- Mylar
- Helicopter
- As weather, staff, and permitting allow: from a boat, and government and/or civilian-owned remote-controlled aircraft (UAVS)

Background information on these bird hazing tools and methods can be found in Appendix 5.

Given the treacherous nature of the crossing between West End and Southeast Farallon and the need to monitor and haze gulls in the early morning and late evening, personnel will be required to camp for a few nights on West End island. The scheduling for these overnight deployments will be determined by gull movements and behaviors.

GULL & PINNIPED MONITORING

As monitors, PRBO staff will take the lead in documenting harassment or disturbance caused by hazing activities as required by the Section 7 IHA permit and granting agency requirements. PRBO and USFWS staff have prior experience in counting and documenting disturbances to the pinniped populations and

PRBO will develop the protocols and training necessary for other field staff to conduct the monitoring of their areas. Sample data sheets can be found in Appendix 6.

PRBO will also develop the protocols necessary to support proper documentation of gull numbers and retreat sites prior to and during hazing operations, as well as up to seven days after the cessation of hazing activities. These data will be collected by PRBO and USFWS staff who are experienced at identifying, and counting gulls, pinnipeds and other wildlife.

Monitoring of gulls and pinnipeds during the trial will take place by personnel on foot, from the air during daily dawn/dusk helicopter flights, and by using the Cal-Academy web-camera, as needed.

Areas which cannot be monitored from personnel stationed on land (blackened areas in Figure 1) will be monitored by helicopter. The helicopter will specifically be used to support the monitoring of gull roosts and congregation sites. The helicopter will mainly be used to survey these blind spots in the morning, at noon, and in the evening, weather permitting. It is possible that the helicopter will be used to support the monitoring of pinnipeds during over-flights of the island.

Pre-trial monitoring

Prior to the initiation of hazing activities, a complete gull census of areas visible from Southeast Farallon (colored blocks in Figure 1) will be conducted every morning and evening for a minimum of five days to establish a baseline population for gulls on the islands. The numbers of gulls occupying discrete areas within the islands will be recorded based on the colored blocks in Figure 1.

During the week leading up to the beginning of the trial, PRBO staff will conduct a single archipelago-wide census of pinnipeds. This visit is scheduled for November 22, in order to coincide with the weekly visit to WEI. The numbers of each species and the loafing areas being used by these animals will be recorded and a map of areas being used by pinnipeds will be generated, with an eye to identifying sensitive areas which need to be considered during monitoring and hazing operations.

A map of the islands with recognized place names can be found in Appendix 4.

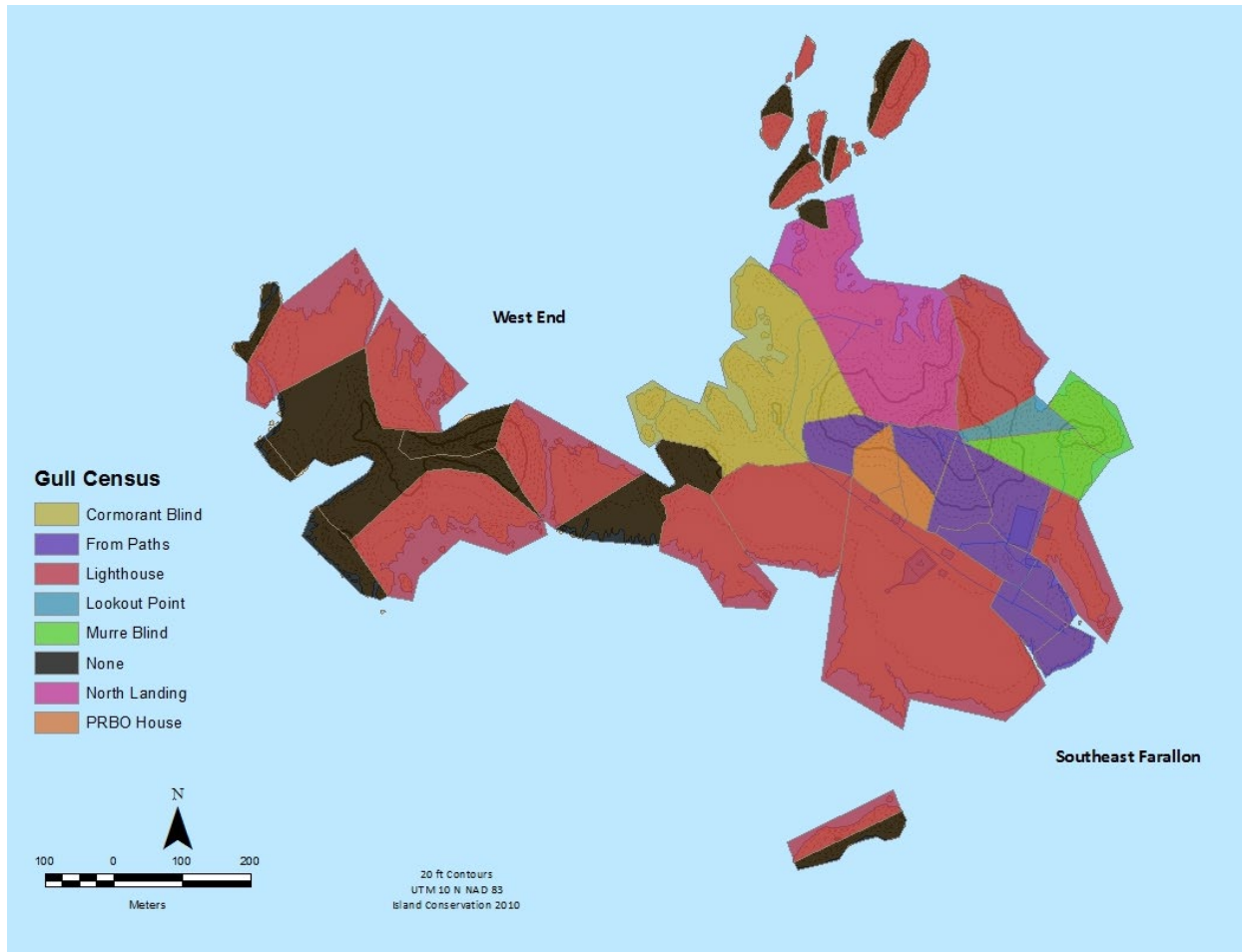


Figure 1. Gull Census Areas. The gull census encompasses all colored areas not blocked out in black. Areas in black are not visible from Lighthouse Hill or from the ground on SEFI. The gull census will document the numbers of gulls using each of the discrete delineated areas.

Monitoring: Sectors

Monitoring will require at least four individuals: one person on WEI, two personnel on foot on SEFI (one of whom may jockey between lighthouse and the ground depending on gull movements), and one person at the Lighthouse. Each monitor will be responsible for tracking the behavior and movements of gulls and pinnipeds in one of the following sectors (Figure 2):

- Ground: West End Island—western portion, excluding the eastern extreme of maintop—and Weather Service Peninsula
- Ground: Tower Point, area above North Landing, Sea Lion Cove, Corm Blind Hill and intertidal areas surrounding
- Ground/Lighthouse: southwest face of LHH, Shubrick Point, eastern Marine Terrace, Sea Pigeon Flat
- Lighthouse: Maintop, Weather Service Peninsula, western Marine Terrace, Saddle Rock, Aulon Peninsula, Fertilizer Flat, Blowhole Peninsula

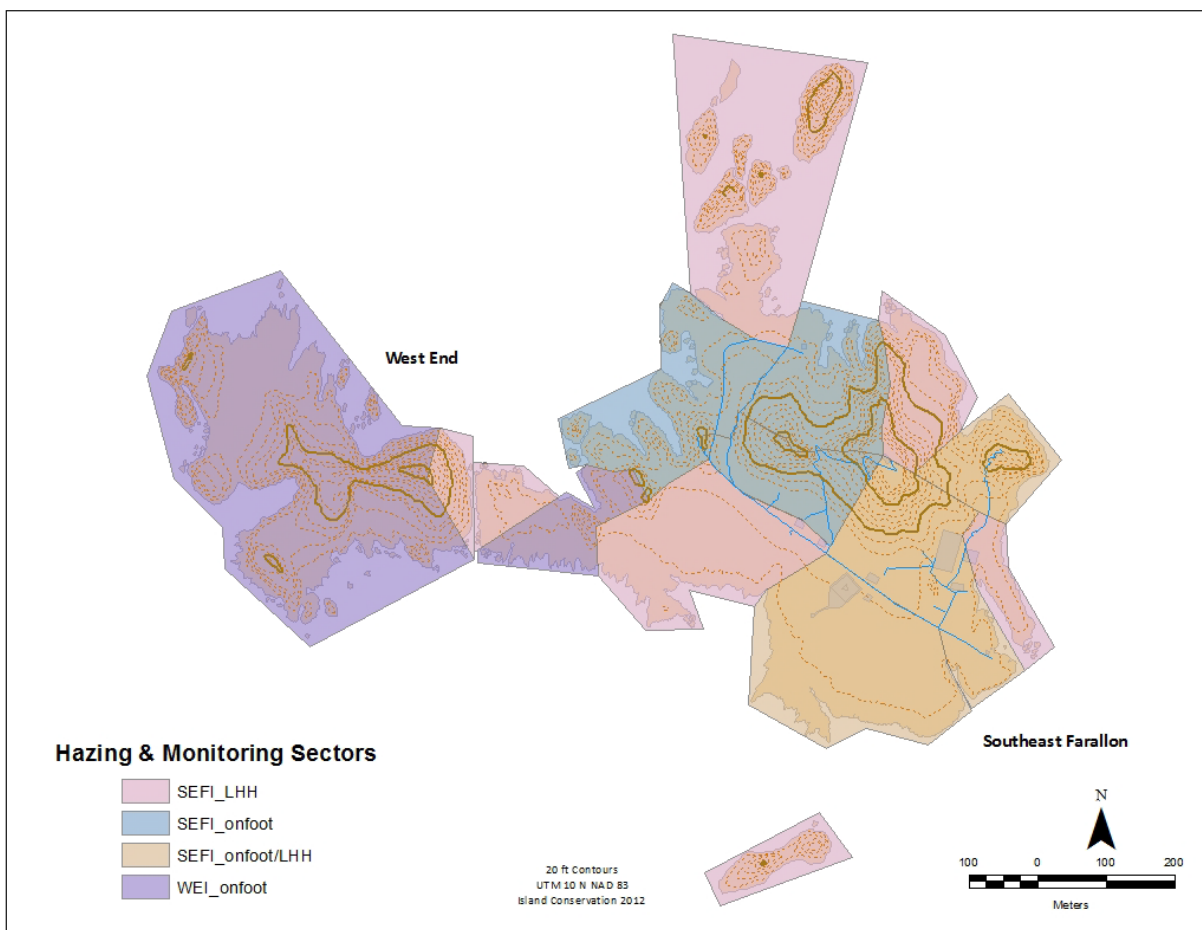


Figure 2. Proposed Hazing and Monitoring Sectors. The island has been broken down into 4 sectors for the purposes of hazing and monitoring gulls and pinnipeds on the Farallon NWR during the 2012 Fall Field Trial.

Monitoring: Phase 1—Stationary Methods

The hazing portion of the trial will begin on Day III (see Appendix 1 for trial schedule). At the beginning of the trial, early morning (pre-dawn) and dusk hazing sessions will consist of the use of lasers and human activity. Hazing and monitoring personnel will work as a team, travelling within their sector to haze and record gull numbers.

Prior to morning twilight, with low levels of light, it will be difficult to accurately count the number of gulls using the islands or being impacted by hazing. In this case, monitors will use spotlights to estimate the numbers of gulls flushing up into the air in response to laser use. Monitoring during the daytime will consist of monitors accompanying hazing personnel in checking on the efficacy of stationary methods.

In the evening, upon initiating hazing with human activity and lasers, monitors will again work with hazers to determine the numbers of birds leaving the island. Nighttime patrols will take place between the hours of 20.00 and 22.00. A minimum of one hazer and one monitor would conduct the patrol and would not need to patrol for the full two hours, but simply walk the perimeter of the island, ensuring that primary roost sites are clear of gulls, documenting the numbers of gulls encountered and hazing as

needed. Information on gull behavior learned during these periods will be used to adaptively manage hazing operations.

Monitoring personnel have the following responsibilities during Phases 1 & 2:

- Work with designated hazer to quantify numbers of gulls responding to early morning and evening laser treatments
- Participate in assessing stationary hazing tools during daylight hours
- Participate in nighttime gull surveys/hazing

Monitoring: Phase 2—Combined methods

Early morning, daytime, and evening monitoring activities will continue as before.

Monitoring: Phase 3—Pyrotechnics

The monitors are integral to the safe, successful, and legal use of pyrotechnics on the islands. When pyrotechnics are first used, hazers will deploy pyrotechnics at decreasing distances from pinnipeds while monitors closely observe pinnipeds for any signs of harassment in these animals. This will inform future hazing operations as to the tolerance of pyrotechnics by these animals. Monitors must have a sufficient amount of light to observe and document pinniped responses to pyrotechnics. If monitors cannot see pinnipeds, hazers will not proceed with pyrotechnic use.

During this phase of the trial, each monitor is expected to communicate with their designated hazer in order to:

- Ensure they are ready to document animal responses
- Ensure that sufficient personnel is available to record any responses to hazing
- Document the number of pinnipeds prior to hazing activities, quantify those responding to activities, and categorize their responses to hazing activities
- Characterize the responses of gulls to hazing activities and quantify the percentage of gulls responding

GULL HAZING

A hazing strategy was developed with an eye to evaluating specific techniques in isolation, beginning with some of the more passive/stationary techniques during the day, in conjunction with more intensive hazing at dawn and dusk. It is hoped that this approach will effectively haze a substantial portion of gulls on WEI and SEFI, although habituation is expected to occur within a few days, at which point hazers will resort to combined hazing methods and finally moving on to pyrotechnics. The whole trial has been broken down into three phases. The general scheme of the three phases can be found below in Table 1.

Table 1. Phased hazing strategy.

	Time of Day	Early Morning	Day	Dusk	Night
	Phase				
Least Aggressive ↓ Most Aggressive	Stationary Methods	Humans Lasers	Effigies Zon Stationary Kites Biosonics	Humans Lasers	Humans Lasers
	Combined Methods	Humans Lasers	Humans Effigies Zon Stationary Kites Biosonics Mobile Kites Mobile Effigies Helicopter	Humans Lasers	Humans Lasers
	Pyrotechnics	Humans Lasers Pyrotechnics	Humans Effigies Zon Stationary Kites Biosonics Ambulatory Kites Ambulatory Effigies Helicopter Pyrotechnics	Humans Lasers Pyrotechnics	Humans Lasers

Hazing: Sectors

Hazing of gulls on the islands will require four personnel with assignments identical to monitoring assignments. Each hazer will be responsible for tracking and responding to the behavior of gulls in one of the following areas:

- Ground: West End Island—western portion, excluding the eastern extreme of maintop—and Weather Service Peninsula
- Ground: Tower Point, area above North Landing, Sea Lion Cove, Corm Blind Hill and intertidal areas surrounding
- Ground/Lighthouse: southwest face of LHH, Shubrick Point, eastern Marine Terrace, Sea Pigeon Flat
- Lighthouse: Maintop, Weather Service Peninsula, western Marine Terrace, Saddle Rock, Aulon Peninsula, Fertilizer Flat, Blowhole Peninsula

The sectioning of the islands will likely evolve over time as gulls respond to hazing efforts and adapt their loafing and roosting behavior.

During all hazing periods, a Hazing Coordinator will be responsible for:

- Ensuring hazers coordinate hazing efforts to maximize the effect of hazing
- Identifying where gulls are retreating to and communicating this information to relevant hazers
- Particularly in Phase 3: Relaying incidences of pinniped harassment from monitors to teams whose activities have affected animals in a different sector

Hazing: Phase 1—Stationary Methods

Hazing will begin on Day III (see Appendix 1 for trial schedule). At the beginning of the trial, early morning and dusk hazing sessions will consist of the use of lasers and human activity. In the hazing trial conducted in January 2011, lasers were effective 30 minutes after sunset until about 15 minutes before sunrise. The sunrise and sunset times for the islands on November 27, 2012 are at 0703 and 1651, respectively. Hazing and monitoring personnel will work as a team, travelling within their sector to haze and record gull numbers. Hazers will use either a red or green laser to haze gulls off the island.

After hazing gulls off the island during the dawn session using lasers, several passive and stationary hazing methods will be installed across the islands (See Figure 3), including a helikite, zons, effigies, and bioacoustic systems. When visual devices (such as effigies and kites) are deployed, the hazer will fire a single cap towards nearby loafing or roosting gulls in an effort to draw their attention to these tools.

These hazing tools will be assessed 3-4 four times per day for signs of habitation and gull encroachment. Personnel will determine the effective radius of tools based on distance markers placed at a standard distance from each installed method. Gulls persisting in or around these tools will be tolerated for a maximum of two days, at which point, an additional method may be added or the original method may be swapped out for another tool. Visual stimuli (such as effigies) which prove ineffective after two days will likely be complemented by an audio-based stimulus (such as a zon), and vice versa.

It is anticipated that with daytime hazing tools in place, daytime hazing activities will largely involve personnel walking around and inspecting loafing sites and checking on the condition of hazing tools. In this phase of the trial, gulls found loafing around hazing methods shall be tolerated until Phase 2 is initiated (On Day V or VI).

Dusk hazing will again consist of the use lasers in an effort to prevent gulls from accessing nighttime roost sites. Gulls persisting on loafing sites not targeted during daytime hazing activities should be subject to laser treatment at this time, allowing monitors to record the number of gulls using loafing sites. After nightfall, a single hazer-monitor team will be sent out to target groups of gulls which might have returned to roosts since sunset. Lasers will be used at this time to haze them from the island.

During phases 1 & 2, hazing personnel have the following responsibilities:

- To record and assess the effectiveness of stationary hazing methods.
- To “police” their respective sector in the early morning and early evening hours, working to keep a maximum of gulls off their sector at dawn and dusk.
- To work with the monitor to determine the number the number of gulls responding to laser treatments
- During nighttime surveys, to work with a monitor to haze a maximum number of gulls off the island which persist beyond sunset.

- To track the amount of effort spent in hazing gulls

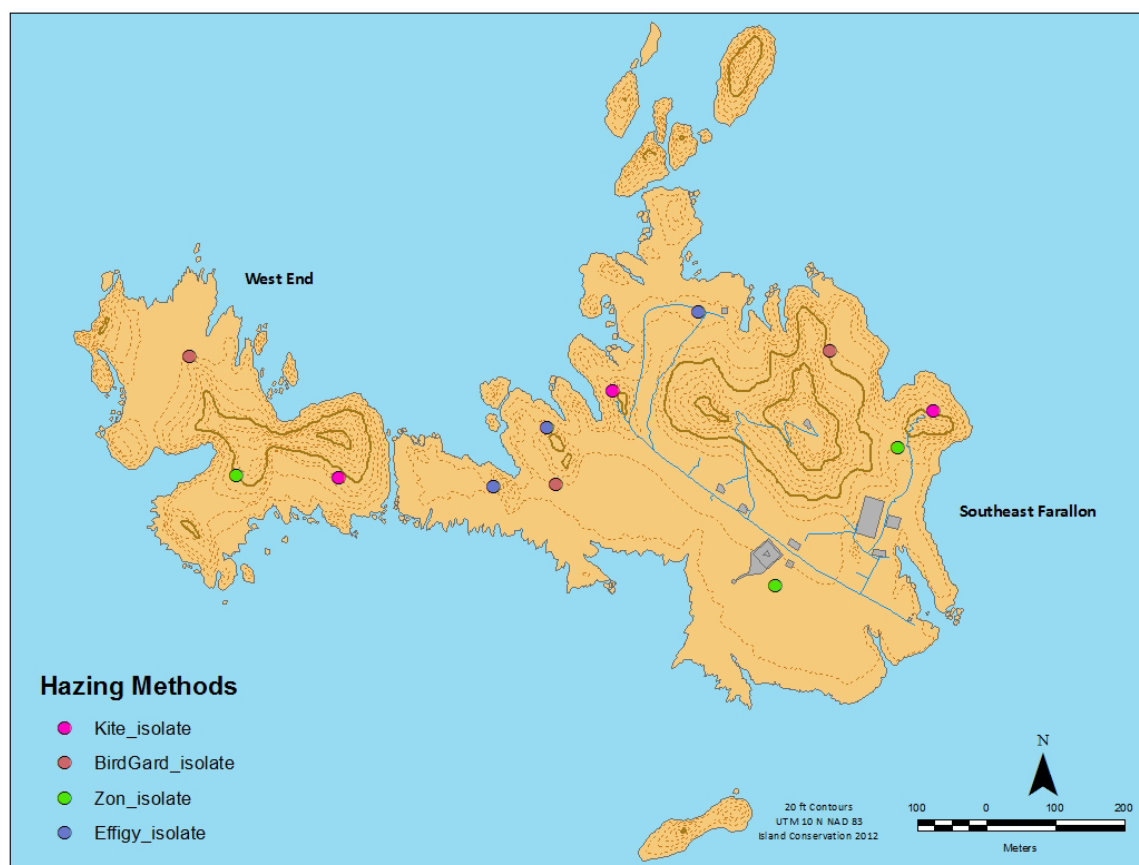


Figure 3. Phase 1—Isolated Hazing Methods. Tools will be placed in isolation during Phase 1 of the trial. This map indicates where specific tools will initially be trialed.

Hazing: Phase 2—Combined Methods

The second phase of the trial will involve combining methods to cover the entirety of the islands as effectively as possible. Gulls will not be allowed to loaf or roost anywhere on the islands at this point in the trial. The efficacy of combined methods will be assessed, where possible, and methods will be moved or changed as gull behavior requires. Additional daytime hazing tools used might include personnel walking around the islands with effigies on poles or guiding kites. Figure 4 illustrates where certain methods might be effectively employed across SEFI and WEI, though actual locations are subject to change according to on-the-ground requirements.

Early morning and evening hazing (lasers) and monitoring activities will continue as before. The responsibilities of hazing personnel during Phase 2 are unchanged from the expectations for them during Phase 1.

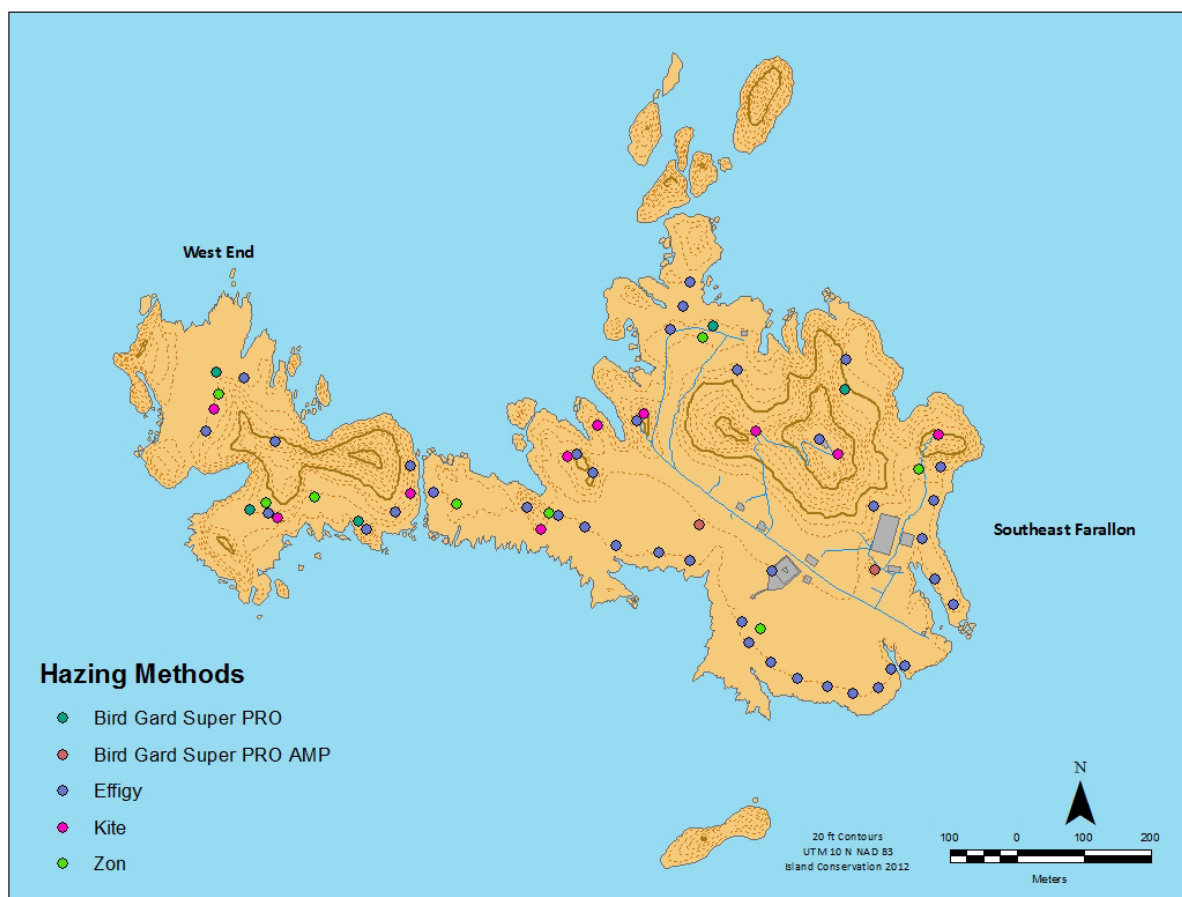


Figure 4. Phase 2—Combined Hazing Methods. Effigies, kites, biosonics, and zons will be trialed in combination across the islands in Phase 2.

Hazing: Phase 3—Pyrotechnics

The focus of Phase 3 is to introduce the use of pyrotechnics as a hazing tool, once other methods have been ineffective in achieving 100% clearance of gulls from the islands. Personnel will rely mainly on simple bird bombs and whistlers (fired from a pistol-style record launcher), though cracker shells and CAPA charges will likely also be employed in an effort to reach more distant groups of gulls. It is anticipated that at this point in the trial, gulls will have retreated to isolated pockets where they cannot be flushed by any other means.

On the first day of pyrotechnic use, hazers will attempt to gauge the tolerance of pyrotechnics by pinnipeds. Hazers will use pyrotechnics at decreasing distances from pinnipeds, using a range finder to determine proximity and while the monitor assesses the response of the animals. Pyrotechnics will primarily be used at dawn and dusk, but will also be employed during the daytime, as needed. Pyrotechnics will only be employed in the morning once personnel can see well enough to document any incidences of pinniped harassment. Prior to that time of day, lasers will continue to be used. This is also true for evening pyrotechnic use; pyrotechnics will only be used for as long as monitors are able to observe pinniped behavior.

Hazers will need to work closely with their designated monitor to track pinniped responses to pyrotechnics and ensure that their efforts lead to successful data collection and hazing. Hazers may be required to take monitoring data if the monitor cannot adequately record animal responses.

During this phase, hazers have the following responsibilities:

- To track the number and variety of supplies used while carrying out hazing activities.
- To track personnel effort needed to haze gulls
- When using lasers and pyrotechnics, communicate with designated monitor to ensure that:
 - the monitor is prepared to record animal responses to hazing
 - the monitor is managing to record gull behavior
 - the monitor is managing to record pinnipeds responses/harassment incidents

Additional hazing methods

On those days where a vessel has been chartered to come out to the island, at least one hazer and one monitor will be transported to the vessel for a trip around the island. The monitor will record any congregations of gulls which cannot be seen from the island as well as the effects of hazing from the boat. The hazer will use pyrotechnic devices to flush any gulls detected on these areas, especially offshore and northern islets, and the backside of the Great Arch.

Depending on weather, sea conditions, and staff availability, certified personnel may also use the USFWS Safeboat to perform some avian hazing and/or monitoring from this vessel.

BAIT TRIALS

Two placebo (non-toxic) versions of two registered bait pellets will be tested during the trial:

- ~1.1g (3/8" diameter) Bell Laboratories, Inc. Conservation Dry Formulation pellet (placebo version of 25D)
- ~1 g Hacco, Inc. Ramik Green® pellet (placebo version of D50)

Both products are designed to mimic exactly the toxic forms of these bait products. Both products will also be infused with 0.2% pyranine, a non-toxic food-grade biomarker (also known as Solvent Green 7). The presence of this biomarker can be detected with an ultraviolet light.

Targeted Bait Test

In an effort to determine if gulls can be successfully hazed off a plot of land which has had a placebo bait broadcast at an established and uniform density, three areas across West End and Southeast Farallon have been chosen for close monitoring for the consumption of bait pellets by gulls. These small plots (≤ 1.5 ha) have been chosen for the ease of hand broadcasting bait pellets and monitoring subsequent gull behavior at these sites.

Prior to hazing activities—on Day II or III—three plots (see Figure 5) will be demarcated using pin flags. Once hazing has begun—on Day V or VI of the trial—these three plots will be hand-broadcast with one

of the two bait types. The bait product manufactured by Bell Laboratories, Inc. will be broadcast at a density of 18 kg/ha, as per the label registration limit. The bait product manufactured by Hacco, Inc. will be broadcast at a density of 48 kg/ha.

The boundaries of these areas will be clearly marked with pin flags so that observers can monitor the area from a distance. The monitoring team will track gull activity within these plots during regularly-scheduled surveys.

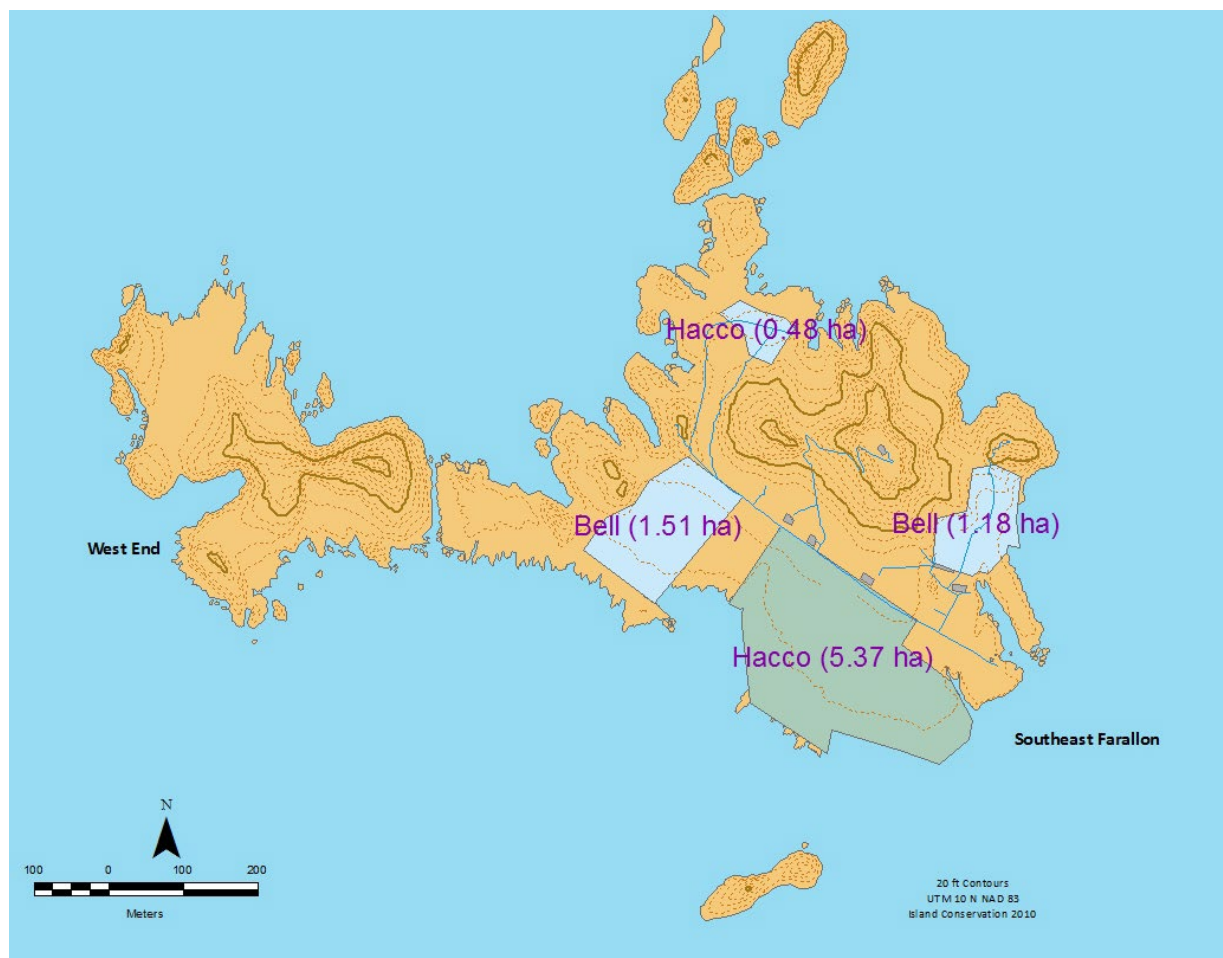


Figure 5. A map of areas to be baited by hand-broadcast. Areas in blue represent plots which will be subject to the targeted bait tests, while the area in green will be used for the bait availability study. The types of bait (referred to by name of manufacturer) and the areas of these plots are indicated.

Bait Degradation

A bait degradation (weathering) trial will be conducted using placebo versions of the two types of bait pellets. Bait cages of wire hardware cloth will be used to prevent the pellets from being consumed or disturbed by mice or birds. Each cage, which has 16 compartments, will have eight pellets of each formulation placed in each cage. Two cages will be placed in each of three locations: the Water tank at the saddle on the lighthouse trail, the cisterns on the Marine Terrace, and North Landing (See Figure 6.) Cages will be tested on bare soil, rock, and vegetated substrates. The establishment of bait degradation

cages will likely occur in November during a 1-day strike team visit to the island to transfer supplies to the island.

Cages will be sampled every seven days after deployment by PRBO staff until April 1. Each pellet in each cage will be inspected for signs of degradation and classified on a scale ranging from 1-6.

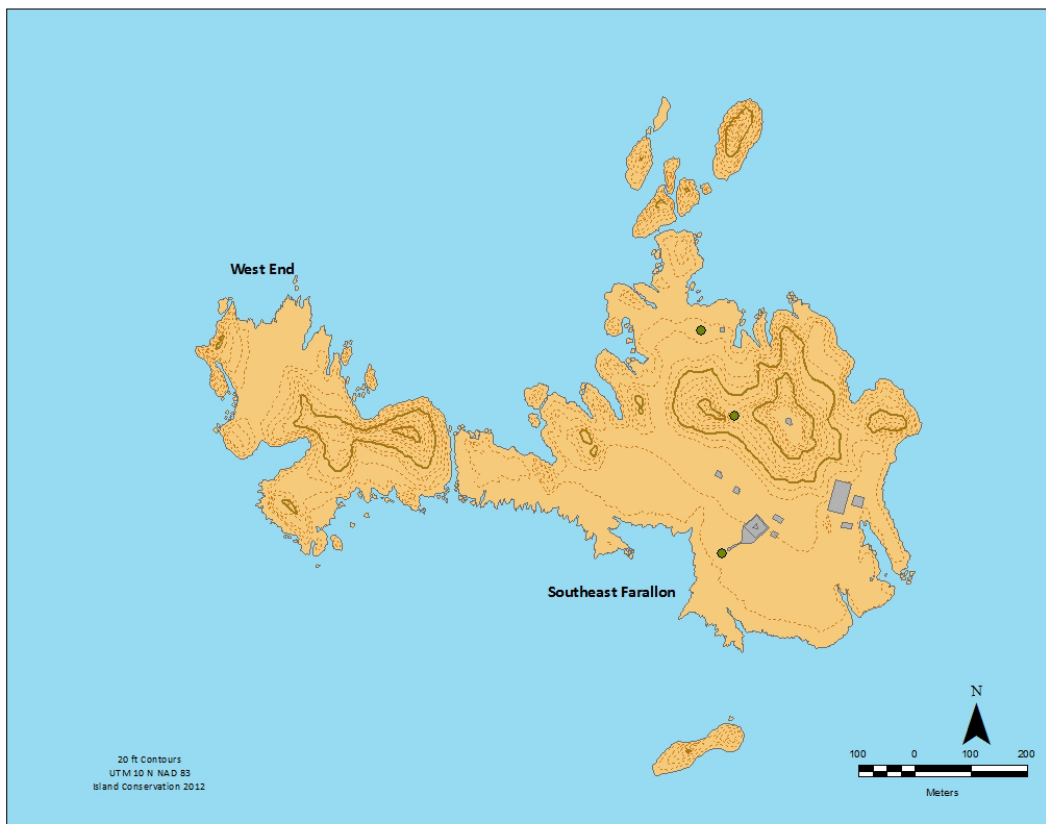


Figure 6. Location of Bait Degradation Cages (green dots)

Bait Availability

In November 2010, a bait availability study was conducted using the Bell Laboratories, Inc. placebo pellet. A similar trial will be conducted during this trial, using the ~1 g Hacco, Inc. Ramik Green placebo pellet.

Prior to any hazing, ten bait availability plots (measuring 1m x 10m) will be established on the Marine Terrace. Once hazing activities have been initiated, a ~5-hectare portion of the Marine Terrace (see Figure 5) will be hand-broadcast with the Hacco, Inc. bait at a density of 48 kg/ha. Immediately following the bait broadcast, these plots will be calibrated to contain a representative number of pellets for a bait application of 48 kg/ha. The availability of pellets within these plots will be monitored every day for a total of seven days.

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DRAFT

APPENDICES

APPENDIX 1: STAFFING & SCHEDULING

Staff On-island Schedule

This Gantt chart indicates which staff will be on-island for the hazing trial between November 27 and December 17, 2012. The “B” in the transport row indicates dates of staff change-overs. Scheduled transportation is subject to sea conditions and weather. The days outlined in heavy black represent the extent of the 14-day hazing period.

Transport	B			B															PRBO					B		B				
Trial Day	0	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI								
Date	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	5-Dec	6-Dec	7-Dec	8-Dec	9-Dec	10-Dec	11-Dec	12-Dec	13-Dec	14-Dec	15-Dec	16-Dec	17-Dec								
Personnel																														
1 Dan Grout (IC)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
2 Madeleine Pott (IC)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
3 Tommy Hall (IC)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
4 Jonathan Shore (USFWS)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
5 Gerry McChesney (USFWS)										x	x	x	x	x	x	x	x													
6 Russ Bradley (PRBO)	x	x	x	x	x	x	x	x	x	x																				
7 Pete Warzybok (PRBO)										x	x	x	x	x	x	x	x													
8 John Warzybok (PRBO)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
9 Liz Ames (PRBO)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
10 Winston Vickers (OWCN)	x	x	x	x	x	x	x	x	x	x																				
11 Paul Gorenzel (OWCN)										x	x	x	x	x	x	x	x													
12 Valerie Burton (USDA-APHIS)	x	x	x	x	x	x	x	x	x	x																				
13 Derek Millsaps (USDA-APHIS)										x	x	x	x	x	x	x	x													
14 Chris Gularte (Specialized Aviation)				x	x	x	x	x	x	x	x	x	x																	
Hazing personnel:	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4													
Monitoring personnel:	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4													
Total personnel:	9	9	9	10	10	10	10	10	10	10	11	11	11	10	10	10	5	5	5	5	5	5								
	Red type font indicates personnel who are currently allowed under federal law to use EPCDs																													
	Blue type font indicates personnel who have been included under Island Conservation's ATF User permit application																													

Trial Activity Schedule

Transport	B						B			PRBO			B			B						
Personnel change-over/departure							x						x			x						
Trial Day	0	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI
Date	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	5-Dec	6-Dec	7-Dec	8-Dec	9-Dec	10-Dec	11-Dec	12-Dec	13-Dec	14-Dec	15-Dec	16-Dec	17-Dec
Activity																						
Meet & check-in Sausalito	x																					
Depart for islands		x																				
Training/orientation		x	x																			
Mark baiting zones			(x)	(x)	x																	
Helicopter arrives on-island				x																		
Gull and pinniped monitoring				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Hazing: stationary methods				x	x	(x)																
Hazing: combined methods						(x)	x	x	x	x	(x)	(x)										
Hazing: pyrotechnics											(x)	(x)	x	x	x	x	x					
Hand-broadcast bait						x	(x)															
Calibrate availability plots						x	(x)															
Monitor bait availability						x	x	x	x	x	x	x	(x)									

Activities in parentheses indicate that the timing of the activity will depend on personnel availability or gull behavior and may be pushed to another day.

Daily Schedule

Schedule Below has been designed to ensure that staff assignments do no amount to more than an 8-hour workday.

Working hours	Time	Tasks	Personnel participating
2	0530-0730	Dawn Hazing	All
1.5	0730-0900	Breakfast break	All
2	0900-1100	Daytime Hazing	2 2-person teams
2	0900-1100	Daily Tasks*	All others
1	1100-1200	Team Meeting	All
2	1200-1400	Lunch break	All
2	1400-1600	Daytime Hazing	2 2-person teams†
2	1600-1800	Dusk Hazing	All
2	1800-2000	Dinner break	All
2	2000-2200	Nighttime patrol	1 2-person team†

*Daily Tasks are not anticipated to take more than 1 hour. Daily tasks include: cleaning pyrotechnic launchers, maintaining pyrotechnics records, tallying IHA harassment incidents, charging radios, entering bait availability data, entering monitoring and hazing data, downloading GPS data...

†Personnel not assigned to these shifts may use this time as personal time

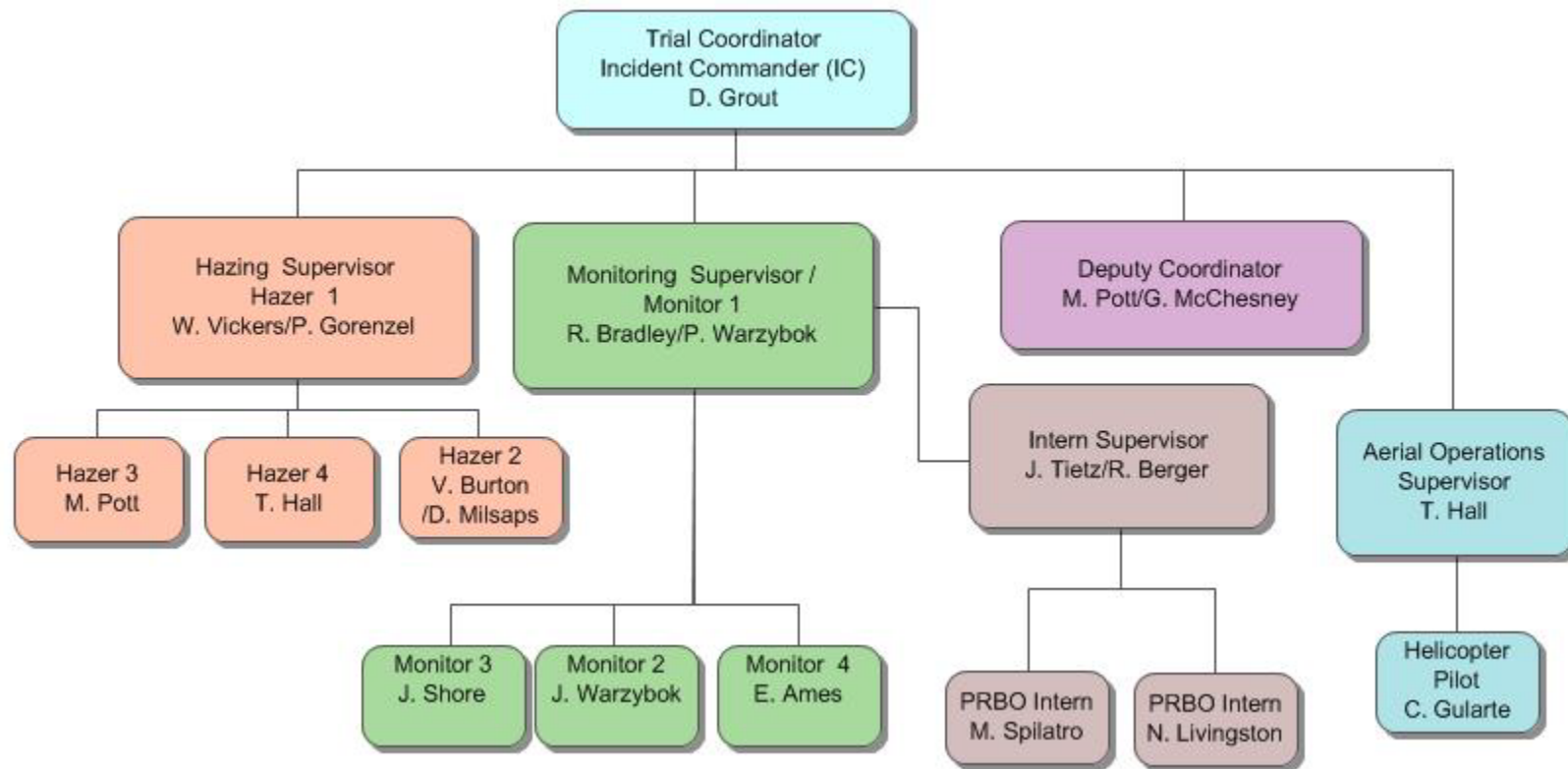
Sample Staff Rotation

A sample staff rotation has been developed for those work shifts which do not require all trial personnel to participate.

The numbers indicate individual personnel participating in each hazing shift.

Hazing Shift	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
0900-1100	1	3	5	7	9	1	2
0900-1100	2	4	6	8	10	3	4
0900-1100	3	5	7	9	1	5	6
0900-1100	4	6	8	10	2	7	8
1400-1600	5	7	9	1	3	9	10
1400-1600	6	8	10	2	4	2	1
1400-1600	7	9	1	3	5	4	3
1400-1600	8	10	2	4	6	6	5
2000-2200	9	1	3	5	7	8	7
2000-2200	10	2	4	6	8	10	9

APPENDIX 2: INCIDENT COMMAND STRUCTURE



APPENDIX 3: BIOSECURITY PROTOCOL

Packing for the island

- All gear will be inspected and cleaned (if necessary) before being brought to the island. This includes clothes and boots. Carefully inspect any items with Velcro.
- All food will be packed in rodent-proof containers (hard sided, closed tightly).
- As much gear as possible will be packed in rodent-proof containers. If rodent proof containers are limited or too small, items will be packed in dry bags or contractor bags (thick trash bags) and sealed tightly.
- Gear will be cleaned and packed in a location that is free of insects and seeds, preferably indoors.
- If possible, soft gear (tents, boots, clothing, tarps, etc.) should be frozen for 48 hours prior to going out to island.
- Corrugated cardboard will not be used.
- When packing, we will be wary of leaving containers open/exposed for extended lengths of time. Containers should only be open when they are being packed or something is being taken out.

Transportation to Island:

- We will contract with vendors who agree to allow us to inspect their vessel and/or require necessary preventative measures be in place.

While on Island:

- All gear will be unpacked in the Coast Guard House. All doors and closets will be kept shut during unpacking.
- A can of bug spray will be available to deal with any invertebrates that may be found while unpacking.
- Prior to each entry into a Wilderness Area (all of West End and the restricted area on SEFI) the soles of boots (especially mud), laces, and the pockets and hems of clothes/equipment will be carefully inspected and cleaned. Any seeds will be removed and bagged in a ziplock for incineration.

APPENDIX 5: BACKGROUND INFORMATION

The vast majority of information available on gull hazing methods comes from those individuals and groups attempting to haze gulls from airfields, agriculture, aquaculture and landfill facilities, and chemical hazard sites. There are a wide range of techniques available, including lethal and nonlethal methods, those requiring substantial manpower and those requiring relatively little. For succinct descriptions of advantages and disadvantages of these techniques, see: Gorenzel & Salmon 2008 and Harris & Davis 1998.

There are many cases where the greatest efficacy in hazing gulls is achieved through integrating a number of methods into the hazing program. Harris and Davis (1998), in their report to the Canadian Government, list pyrotechnics, falconry, distress and alarm calls, and shooting (lethal removal) as key components of any effective hazing program, citing the use of effigies as a possible supplementary technique. The use of multiple audible and non/lethal techniques were more effective than multiple visual deterrents such as mylar & balloons (Cook et al. 2008). On-demand systems or those systems responsive to changes in animal behavior, as opposed to continuous or randomly activated systems, were also found to be most effective in dispersing problem birds (Ronconi and St. Clair 2006).

Lasers & lights

Lasers are concentrated light beams used in low lighting conditions to disperse or deter roosting & feeding birds. They remain one of the most effective tools for dispersing birds at night, when most other techniques are ineffective. Lasers emit either green or red light and are highly portable (Gorenzel and Salmon 2008). Lasers are not effective on all bird species, but there is considerable evidence that lasers can be used to effectively deter gulls (Blackwell et al. 2002, Baxter 2007). All-night control of gulls at a reservoir found that lasers could be used to disperse a population of 5,000 gulls, with no individuals remaining at daybreak. Researchers also observed an additive effect, whereby fewer and fewer gulls attempted to return to roost once hazing had begun. No habituation to the laser was seen for the duration of the 26-day trial and gull response to the laser was always immediate (Baxter 2007).

A study conducted on geese reduced use of the treated area by 34-93%, but prior use of the laser did not deter geese from using the treated area during the daytime. Researchers suggested that geese which were most responsive (populations which saw greatest reductions) were those exposed to little human disturbance and accustomed to very little ambient light during the night (Sherman and Barras 2004). There has been some use of moving spotlights or beacons to disperse or deter birds. In one instance, the intermittent use of a spotlight to deter waterfowl from contaminated bodies of water cut the number of birds using ponds by 90% and reduced bird mortality to less than one-third of that recorded the previous year. During the second year of operation, the beacon further reduced bird mortality to one-sixth of that seen during the first year (Read 1999). Gorenzel & Salmon (2008) also recommend the use of spotlights or strobes, though they suggest that efficacy is variable and other methods may need to be used to supplement spotlight use.

Biosonics (Bird Gard & LRAD)

Biosonics, or bioacoustics, as a hazing method, involves using animal alarm or distress calls to alter the behavior or behavioral patterns of target species, typically causing them to vacate or avoid an area. The vocalizations used are usually those emitted by a predator of the target species or the alarm or distress call of the target species (or a closely related species). Vocalizations are typically broadcast from

commercially available units or can be assembled from their component parts. (Gorenzel and Salmon 2008). Biosonics have often been used to haze a variety of seabirds at locations such as: landfills, in association with airfields, at aquaculture facilities, and contaminated ponds (Gosler et al. 1995, Mott and Boyd 1995, Stevens et al. 2000, Cook et al. 2008).

The efficacy of biosonics has been found to be highly variable from one situation to the next. In studies specifically concerned with gulls, the numbers of gulls are typically reduced significantly within the first few weeks (Gosler et al. 1995, Baxter et al. 1999, Baxter 2000). Stout et al. (1975) found that distress calls were more effective at dispersing gulls than alarm, mew, trumpet, or choke type calls. In one study at a UK landfill where distress calls were the only method used, the numbers of gulls observed was reduced by 66-83% (Baxter 2000). Gosler (1995) observed that distress calls can be effective at dispersing and deterring gulls from returning, if there are alternate sites available to these individuals. Habituation to this method has been observed in a number of gull species and starts within one to four weeks of initiating hazing by this method (Baxter 2000, 2001, Soldatini et al. 2008).

When using distress calls, Gorenzel & Salmon (2008) recommend using distress calls from the target species, preferably from individuals inhabiting the same region as target individuals. Montoney & Boggs (1995) found that Laughing Gulls (*Leucophaeus atricilla*) are responsive to the distress calls of other species, although Baxter (1999) found conspecific bird calls to be significantly more effective than congeneric calls in dispersing birds. Interviews conducted by Harris & Davis (1998) indicated that distress calls enhanced by the use of pyrotechnics were more effective than calls alone. There has been only limited research into the effect of predator calls on target species. Harris & Davis (1998) reported that Gunn (1973) found gulls to be responsive to Peregrine Falcon calls.

Effigies

Typically, human effigies or models (scarecrows) or predator models are recommended as a bird hazing technique (Curtis et al. 1996, Gorenzel and Salmon 2008). However, the use of dead bird effigies (gulls and vultures) has been shown to be effective in scaring birds (Stout et al. 1975, Seamans 2004). Stout et al. (1975) conducted a comprehensive study which found that effigies positioned on their sides (with wings folded) or effigies with wings outstretched elicited the greatest response from gulls. Taxidermy gulls were more effective at dispersing gulls than other imitation (fiberglass molded & partial taxidermy mounts) models, but these specimens often deteriorated in wet weather. They also showed that the greatest effect was seen in groups of gulls exposed to both effigies and distress calls, with no habituation in individuals. In the presence of food, however, gulls resisted dispersal. The combination of distress calls and effigies was the most effective method when food was available, yet still not successful in completely dispersing birds. Stout & Schwab (1979) found that by using very life-like models of Ring-billed Gulls (*Larus delawarensis*), Herring Gulls (*Larus argentatus*), and Laughing Gulls, that they were able to reduce the number of loafing gulls by 80% in a popular loafing area. In another study, effigies placed in loafing areas achieved similar results (gulls retreated to alternative sites), whereas effigies placed in areas of nesting or food sources had little effect (Seamans et al. 2007). Habituation to this technique was seen after as little as four weeks and as long as eight months after deploying effigies (Stout and Schwab 1979, Seamans et al. 2007).

Mylar tape

Mylar flags or tape have frequently been prescribed as a stimulus used to deter birds from cropland or contaminated areas (Littauer 1990, Gorenzel and Salmon 2008). Mylar is a reflective plastic ribbon with

one side colored either red or yellow. It is often tied to poles or suspended from overhanging lines, where its motion in the wind creates a humming or crackling sound and it reflects sunlight. It has been shown to be of variable efficacy in preventing passerines from feeding on food crops (Gilsdorf et al. 2002). Belant & Ickes (1997) conducted an experiment on Herring Gulls and showed that mylar was 50% effective in reducing the number of gulls using loafing areas, but was totally ineffective in deterring populations of nesting birds.

Pyrotechnics

Pyrotechnics describe a wide variety of tools which can be used to non-lethally haze birds. Pyrotechnics are primarily an auditory stimulus, creating a loud bang or report, but many charges also produce bright flashes or spiraling light. Pyrotechnic charges are fired from a handheld pistol-style or shotgun-style launcher (Gorenzel and Salmon 2008). Pyrotechnics are used by a majority of airport control programs throughout North America (Harris and Davis 1998). When trialed individually against other techniques (taste deterrents sprayed on refuse) at a landfill, pyrotechnics were effective at reducing the number of foraging gulls from 2,000-2,500 gulls to between 40-50 gulls (Curtis et al. 1995). A study at another landfill in Denver, CO reflected similar findings of 90-95% reduction in gulls—sometimes 100% (Barnes et al. 1999). Habituation to this method can occur, if pyrotechnics are not used sparingly to disperse groups of gulls (Harris and Davis 1998). Some of the frequently cited advantages to this method are: relatively low cost, highly portable, and simple to execute (Curtis et al. 1995, Harris and Davis 1998, Gorenzel and Salmon 2008).

Trained Dogs

Trained dogs—typically border collies—are commonly used to haze or “run off” problem birds (including gulls and geese) from urban areas such as golf courses, often achieving 100% hazing success in treated areas (Castelli and Sleggs 2000, Holevinski et al. 2007). Outside of the urban environment, border collies have been used to a limited degree at air force installations. At airfields (with mixed bird species, including some gulls), clearance rates ranged from 40% to 99.9% within a 2 kilometer radius (Carter 1999, Patterson 2000). In another instance, a 57% reduction in bird strikes was observed at an airfield (Froneman and van Rooyen 2003). It was noted, however, that as soon as dogs were removed from a treated area, birds returned, even over the course of just a weekend (Carter 1999). The success of border collie programs are largely dependent upon skilled handlers and properly trained dogs (Froneman and van Rooyen 2003). Carter (1999) suggests that a single dog and handler can maintain an area of 50 square kilometers (usually runways, and thus flat ground) free of unwanted animals. Collies are not bred or trained to harm wildlife and can be used to safely disperse birds or mammals.

Kites/balloons

Kites in the shape of predators or painted with predators have been used in the past to deter birds from feeding at aquaculture and agriculture facilities. These stimuli typically take the form of a traditional kite or consist of a kite held aloft by a Helium-filled balloon—a Helikite® (Harris and Davis 1998). The unpredictable movement of a kite in the wind serves to slow the habituation of gulls to this method, while not disturbing pinnipeds. There has been limited research conducted to fully evaluate this technique, but one study indicated that the use of Helikites® had no effect on gulls persisting at a landfill site (Baxter 2001). A report to Transport Canada indicated that the usefulness of kites “is limited by habituation [and] are recommended only for situations where short-term and local control is sufficient” (Harris and Davis 1998).

Gas exploder or “Zon”

Gas exploders, also called propane cannons or “Zon guns,” produce a loud, directional blast similar to that emitted by a cracker shell from a 12-gauge shotgun (D. Milsaps, pers. Comm.). They are easily and readily moved, can be automated and used with an on/off timer, firing either regularly or randomly. Some models can also be placed on a stand and programmed to rotate after each blast (Gorenzel and Salmon 2008). Unless zons are moved frequently and blasts randomly fired, gulls readily habituate to this method, often within a few days (Harris and Davis 1998). Hazing with zons has been found to have an effect, but a study by Washburn et al. (2006) indicated that zons did not significantly alter gull behavior at an airport, even when reinforced with lethal control methods.

Literature Cited

- Barnes, N., R. Christie, and S. Kruse. 1999. Private Industry Initiative at Bird Control: A Success Story. Bird Strike Committee USA/Canada, First Joint Annual Meeting, Vancouver, BC.
- Baxter, A. 2000. Use of Distress Calls to Deter Birds from Landfill Sites near Airports. *in* International Bird Strike Committee. IBSC25/WP-AV9.
- Baxter, A. 2001. Bird control on landfill sites--Is there still a hazard to your aircraft? Pages 48-55 Bird Strike Committee USA/Canada Proceedings, Third Joint Annual Meeting, Calgary, AB.
- Baxter, A. 2007. Laser dispersal of gulls from reservoirs near airports. Bird Strike Committee USA/Canada Proceedings, 9th Annual Meeting, Kingston, ON.
- Baxter, A., J. Bell, J. Allan, and J. Fairclough. 1999. The Interspecificity of Distress Calls. Bird Strike Committee USA/Canada, First Joint Annual Meeting, Vancouver, BC.
- Belant, J. and S. Ickes. 1997. Mylar Flags as Gull Deterrents. Pages 73-80 *in* C. Lee and S. Hygnstrom, editors. Great Plains Wildlife Damage Control Workshop Proceedings.
- Blackwell, B., G. Bernhardt, and R. Dolbeer. 2002. Lasers as Nonlethal Avian Repellents. *The Journal of Wildlife Management* **66**:250-258.
- Carter, N. 1999. The Use of Border Collies in Avian and Wildlife Control Programs. Pages 265-282 *in* Proceedings of the International Seminar on Flight Safety and Birds in the Middle East. International Center for the Study of Bird Migration.
- Castelli, P. and S. Sleggs. 2000. Efficacy of border collies to control nuisance Canada Geese. *Wildlife Society Bulletin* **28**:385-392.
- Cook, A., S. Rushton, J. Allan, and A. Baxter. 2008. An Evaluation of Techniques to Control Problem Bird Species on Landfill Sites. *Environmental Management* **41**:834-843.
- Curtis, K., W. Pitt, and M. Conover. 1996. Overview of Techniques for Reducing Bird Predation at Aquaculture Facilities. Jack H. Berryman Institute, Department of Fisheries and Wildlife.
- Curtis, P., C. Smith, and W. Evans. 1995. Techniques for reducing bird use at Nanticoke Landfill, near E.A. Link Airport, Broome County, New York. Pages 67-78 *in* Eastern Wildlife Damage Control Conferences, Asheville, NC.
- Froneman, A. and M. van Rooyen. 2003. The Successful Implementation of a Border Collie Bird Scaring Program at Durban International Airport, South Africa. International Bird Strike Committee, Warsaw, Poland.
- Gilsdorf, J., S. Hygnstrom, and K. VerCauteren. 2002. Use of frightening devices in wildlife damage management. *Integrated Pest Management Reviews* **7**:29-45.
- Gorenzel, W. and T. Salmon. 2008. Bird Hazing Manual Techniques and Strategies for Dispersing Birds from Spill Sites. University of California, Davis, CA.

- Gosler, A., R. Kenward, and N. Horton. 1995. The effect of gull deterrence on roost occupancy, daily gull movements and wintering wildfowl. *Bird study* **42**:144-157.
- Harris, R. and R. Davis. 1998. Evaluation of the Efficacy of Products and Techniques for Airport Bird Control. Aerodrome Safety Branch, Transport Canada.
- Holevinski, R., P. Curtis, and R. Malecki. 2007. Hazing of Canada geese is unlikely to reduce nuisance populations in urban and suburban communities. *Human-Wildlife Conflicts* **1**:257-264.
- Littauer, G. 1990. Avian Predators: Frightening Techniques for Reducing Bird Damage at Aquaculture Facilities. Southern Regional Aquaculture Center, Cooperative State Extension Service, Mississippi State, Mississippi.
- Montoney, A. and H. Boggs. 1995. Effects of a Bird Hazard Reduction Force on Reducing Bird/Aircraft Strike Hazards at the Atlantic City International Airport, NJ Pages 59-66 *in* Eastern Wildlife Damage Control Conferences, Asheville, NC.
- Mott, D. and F. Boyd. 1995. A review of techniques for preventing cormorant depredations at aquaculture facilities in the Southeastern United States. *Colonial Waterbirds* **18**:176-180.
- Patterson, B. 2000. Wildlife Control at Vancouver International Airport: Introducing Border Collies. *in* International Bird Strike Committee. IBSC25/WP-A6, Amsterdam.
- Read, J. 1999. A strategy for minimizing waterfowl deaths on toxic waterbodies. *Journal of Applied Ecology* **36**:345-350.
- Ronconi, R. and C. St. Clair. 2006. Efficacy of a radar-activated on-demand system for deterring waterfowl from oil sands tailing ponds. *Journal of Applied Ecology* **43**:111-119.
- Seamans, T. 2004. Response of Roosting Turkey Vultures to Vulture Effigy. *Ohio Journal of Science* **5**:136-138.
- Seamans, T., C. Hicks, and K. Preusser. 2007. Dead bird effigies: A nightmare for gulls? Bird Strike Committee USA/Canada Proceedings, 9th Annual Meeting, Kingston, ON.
- Sherman, D. and A. Barras. 2004. Efficacy of a Laser Device for Hazing Canada Geese from Urban Areas of Northeast Ohio. *Ohio Journal of Science* **3**:38-42.
- Soldatini, C., Y. Albores-Barajas, P. Torricelli, and D. Mainardi. 2008. Testing the efficacy of deterring systems in two gull species. *Applied Animal Behaviour* **110**:330-340.
- Stevens, G., J. Rogue, R. Weber, and L. Clark. 2000. Evaluation of a radar-activated, demand-performance bird hazing system. *International Biodeterioration & Biodegradation* **45**:129-137.
- Stout, J., W. Gillett, J. Hayward, and C. Amlaner. 1975. Dispersal of Seagulls in an Aerodrome Environment. Air Force Weapons Laboratory.
- Stout, J. and E. Schwab. 1979. Behavioral control of seagulls at Langley Air Force Base. Bird Control Seminars Proceedings.
- Washburn, B., R. Chipman, and L. Francoeur. 2006. Evaluation of Bird Responses to Propane Exploders in an Airport Environment. *in* 22nd Vertebrate Pest Conference.

Appendix 6: SAMPLE DATA SHEETS

Stationary/Passive Hazing Tools: Deployment data

Hazing Sector	Treatment Area	Hazing Treatment	Install Date	Installed By	Removal Date	Removed By	GPS Coordinates		Notes
							Northing	Easting	

Stationary/Passive Hazing tools: Efficacy Assessment

[illegible]

Active Hazing: Pinniped monitoring conducted by monitor

Date					Hazer		Hazing Sector		
Start Time			End Time		Monitor				
Date	Time	Treatment Area	Hazing Treatment	Species	Initial Count	Reponse (number responsive)			Notes
				Mirounga		Alert	Move > 1 m	Flush	
				Phoca					
				Eumatopias					
				Zalophus					
				Callorhinus					
				Mirounga					
				Phoca					
				Eumatopias					
				Zalophus					
				Callorhinus					
				Mirounga					
				Phoca					
				Eumatopias					
				Zalophus					
				Callorhinus					
				Mirounga					
				Phoca					
				Eumatopias					
				Zalophus					
				Callorhinus					

Active Hazing: Gull monitoring data recorded by monitor

Date				Hazer		Hazing Sector			
Start Time		End Time		Monitor					
Date	Time	Treatment Area(s)	Hazing Treatment	Initial gull count	Gull Response	Percent responsive	Flight reponse	Percent responsive	Notes (Other species response, other gull roosts affected, etc)
					none		departed		
					alert		to other area		
					flush		circled & returned		
					none		departed		
					alert		to other area		
					flush		circled & returned		
					none		departed		
					alert		to other area		
					flush		circled & returned		
					none		departed		
					alert		to other area		
					flush		circled & returned		
					none		departed		
					alert		to other area		
					flush		circled & returned		
					none		departed		
					alert		to other area		
					flush		circled & returned		
					none		departed		
					alert		to other area		
					flush		circled & returned		

Active Hazing: Data recorded by hazer

	Date					Hazer		Hazing Sector	
	Start Time			End Time		Monitor			
Date	Time	Treatment Area	Passive hazing present	Hazing Treatment	# Used	Supplies used	Notes		
						caps			
						banger			
						screamer			
						CAPA			
						Cracker			
						Other			
						caps			
						banger			
						screamer			
						CAPA			
						Cracker			
						Other			
						caps			
						banger			
						screamer			
						CAPA			
						Cracker			
						Other			
						caps			
						banger			
						screamer			
						CAPA			
						Cracker			
						Other			