SEABIRD, SHARK, AND MARINE MAMMAL RESEARCH PLANS AND PROTOCOLS FOR SOUTHEAST FARALLON ISLAND

Seabirds

Ashy Storm-Petrel:

1. ***Nest Site Maintenance*** – After 15 March, check the status and condition of all previously marked sites, and repair, clean, replace, and/or remark crevices if necessary. All sites should be clearly marked with a numbered stake and a spot of paint at the crevice entrance.

2. ***Productivity*** - Beginning 5 May, check all previously occupied breeding sites every 5 days to determine nest contents. All occupied sites are monitored for reproductive success, maintaining a minimum of at least 20 active sites each season. Sites that have not been occupied for at least 5 years will no longer be followed. Use a flashlight and/or small camera (such as the See Snake) to carefully and thoroughly examine each site. Once an egg is found or an adult has been observed in incubation posture for two consecutive checks, the site will be left undisturbed for 8 checks before returning to check for hatch. At this point, return to the site every 5 days to look for hatching. Once a chick has been confirmed, leave the site undisturbed for an additional 8 checks. After the second skip period, resume checking the site every five days until the chick fledges. The "skip" periods help to reduce potential disturbance to incubating adults and young chicks.

3. ***Site Searching*** – Between 26 April and 31 July, look for new nest sites by searching suitable ASSP habitat (rock walls and rubble piles) using call playback and visual/olfactory inspections. Walk slowly along any suitable nesting habitat, stopping every 15-20 feet to play the social attraction call. Play the call for approximately 10 seconds and then pause to listen for a response. Repeat this procedure several times, alternating between the ASSP and LHSP calls, before moving on to the next location. If a storm-petrel is heard calling back to the tape, try to locate the crevice the adult is in and mark it with some paint so that it can be followed as a potential breeding site.

4. ***Mark/Recapture*** – In order to assess population trends, capture rates, and adult survival, we will mist net birds at 2 sites (Carpshop and LHH) two times each month between 2230 – 0130 hours. Netting will only occur during optimal netting conditions (winds<10 knts and no moon) in order to maximize likelihood of capture and decrease the risk of predation on storm-petrels by Western Gulls All birds caught will be identified to species (ASSP, LHSP or rarely other), measured, examined for brood patch, banded, and released. Record the band number of any previously

banded bird (recaptures) and examine the band to be sure that it is still in good shape. Replace the band if necessary.

5. ***Predation Monitoring*** –

a) Beginning 3 March, search for Ashy wings and other remains every five days at locations on Lighthouse Hill (along trail, below wall, and around PIGU boxes) the Carp Shop, the PIGU rubble pile, catchment pad, and helo pad. Collect all wings that are found and record them on the Ashy Wing Walk datasheet and in the Dead Bird Log in the Journal. We will document areas where persistent predation occurs to identify specialist Western Gull predators. At the end of the season, tally the number of left and right wings collected to determine the total number of birds killed.

b) Twice monthly, search for Burrowing Owl pellets at rabbit cave, rabbit cave catacombs, stonewall catacombs, below the wall on LHH trail and at the gap. All pellets will be placed in individual whirl packs for later analysis.

c) We will examine the feasibility of removing specialist gulls from areas where storm-petrel remains are consistently located and/or persistent predation is documented by camera. Trapping and euthanizing of identified specialists may be conducted on an experimental basis pending USFWS and CDFG approval. Any authorized predator removal will require daily "before and after" monitoring of predation at a specialist's nest site to determine the effectiveness of predator removal for reducing storm-petrel mortality.

Black Oystercatcher:

1. ***Resighting and Productivity*** - In early spring (1 April), begin observing roosting birds at high tide in order to identify nesting territories and record individually banded birds. Nest site monitoring to determine productivity will begin 4 May, by observing nest sites around the island every 5 days from the lighthouse and other areas.

2. ***Banding*** – Attempt to band all accessible chicks when they are mostly-feathered. Banding will only occur if it can be done without causing undue disturbance to other island wildlife.

Brandt's Cormorant:

1. ***Resighting and Productivity*** – Beginning 15 March (or when cormorants begin arriving at colonies) resight bands of all known-age birds in the Corm Blind Hill and Sea Lion Cove colonies. Productivity monitoring will begin 31 March by observing all nest sites of banded birds at least once every five days to determine site occupation, nest condition, and nest contents. Once an egg has been laid, you may skip checking the site for

3 check periods before returning to determine final clutch size and checking for evidence of hatching. Begin checking for evidence of hatching 4 checks (20 days) after clutch initiation (when first egg was observed); then continue checking every 5 days thereafter to determine brood size and chick fates until all chicks from that site are wandering or fledged.

2. ***Sub-colony Census*** – Beginning 31 March (or whenever birds begin to set-up colonies), count the number of adults and well-built nests in each sub-colony below Cormorant Blind as well as in the sub-colonies at the Sea Lion Cove Blind. Counts will be done every 5 days at 0930 hours in order to examine phenology as well as sub-colony structure and formation.

3. ***All-Island Census*** - In late May or early June (depending on breeding phenology), census the entire population by counting the total number of well-built nests on SEFI and WE and mapping all nesting areas. The census is conducted between 0930 and 1300 from land and boat based vantage points. In poor reproductive years counts may be done earlier to assure that a population estimate can be made before nest abandonment occurs. Note all previous nest abandonment and other behaviors that might influence the count.

4. ***Banding*** - In mid-July (when most chicks are mostly-feathered and there are few eggs and small chicks remaining), band as many chicks as possible below Corm Blind and at Sea Lion Cove (up to 1000 chicks). All cormorant banding will be done at night in order to reduce disturbance and prevent predation by Western Gulls.

6. ***Diet*** - In early March (before nest initiation) and mid September (once all chicks have fledged), collect regurgitated pellets (50 minimum) from breeding and roosting areas to assess diet. These pellets will be analyzed at a later time in the lab to identify prey species from otoliths and other hard parts.

Cassin's Auklet:

1. ***Nest Box Maintenance*** - In early March, check, repair, and clean nest boxes (n=478), and replace damaged or decayed boxes as necessary.

2. ***Productivity PRBO Study*** – In order to determine breeding activity and assess breeding performance, check PRBO study sites (n = 44) at the House, North Landing, Heligoland, and EA study plots every 5 days beginning 2 March. When eggs are found, band or identify (read existing band number) both mates and collect morphological measurements (bill

depth, weight, and wing chord). Once both mates have been confirmed, leave the site undisturbed for 5 check periods (25 days), before returning to check for hatch on the 6th. After chicks have hatched, leave the site undisturbed for an additional 5 checks, before returning once again to band chicks and begin daily checks to determine fledging date.

3. ***Productivity Habitat Sculpture*** – Beginning 2 March check boxes in the Habitat Sculpture at North Landing every 5 days to determine breeding activity and reproductive performance. Monitoring will follow the same protocol as for PRBO boxes (above) except daily chick checks will not start until all adults are absent from nest boxes during the day. This will prevent disturbance to incubating/brooding adults.

4. ***Productivity Known-Age Study*** – Beginning 14 March, check all "Known-Age" study boxes every 15 days to determine occupancy and breeding activity. When eggs are found, determine if the site contains a known-age bird by reading the band number and cross-referencing it to our master list.

a) If the bird is known-age (banded as a chick) or old-age (>13 years old) place that site on 5 day check schedule, in order to follow reproductive activities as detailed for the PRBO study (above). Band its mate (if needed) and record morphological measurements. In addition, for known-age sites, measure the length and width of the egg. For KA study, we will weigh chicks every 5 days after hatching and then band the chick and begin daily checks once it has become mostly feathered (~30 days).

b) If the site does not contain any known-age birds, leave it undisturbed for 45 days, and then return to band chicks (thereby recruiting them into the known-age population).

5. ***Diet*** – Collect 10 regurgitations each week during the chick rearing period (beginning when 10% of chicks have hatched in the PRBO boxes and ending when only 10% of the chicks remain). Go out to collect samples just after dusk on the same night each week and rotate among several areas of the island so as not to sample in the same location in consecutive weeks. Attempt to obtain a minimum of 100 samples over the course of the season. If breeding failure is anticipated, focus efforts to collect more samples early in the season.

6. ***Index Plots*** – In order to estimate breeding populations and population trends, count the number of burrows/crevices in the 10 (100 m^2) index plots set out in different habitats around the island. This annual census should be done during peak incubation (late May to early June depending on the phenology of the birds).

7. * ***TDR Study*** – Select 20 sites (10 during May and 10 during June) from nest boxes which do not contain known-age birds in order to examine foraging behavior using time-depth recorders. Capture one adult from each of these sites, band it, record morphological measurements and attach the TDR. Return to this site 3-5 days later (on the adult's regular incubation shift) to remove the TDR, assess the condition of the adult, and obtain a diet sample (if possible). Download the dive data from the logger when you get back to the house. In addition, monitor the chick growth and fledging success of all sites where a TDR was deployed following the same methods as for the KA study above.

Common Murre:

1. ***Productivity*** - Beginning 16 April, record reproductive data on banded and unbanded birds in Upper Shubrick Point (USP), Tower Point (TP), and Upper Upper (UU) study plots every day to determine timing of breeding and breeding success. Also collect reproductive data on all banded birds in Upper Shubrick (A - N; outside the study plot) and in the other Corm Blind sub-colonies (i.e. Ridge, Corm Flat). Map all sites on digital photos, determine band combinations and numbers (if possible) and determine the sex of banded birds by observing copulations and/or egg laying. Continue to follow all sites daily to determine the fate of all eggs and chicks and be sure to note any alloparenting, abandonment or other unusual events. If a new site has been attended for more than 5 consecutive days, assign it a new number, add it to the map, and follow as above.

2. ***Diet*** – Quantify chick diet by conducting daily 2 hour diet watches from the murre blind (USP plot) at rotating times between 0700 and 1900 hours. Diet watches will begin when there are a minimum of 25 observable chicks in the study plot and ending when 90% of chicks have jumped (~28 May-10 July). Using a Palm Pilot data computer, record the time, type of prey (to lowest possible taxonomic grouping), size of prey (measured in bill lengths from the gape), nest site, and color band combination of feeding adults. In addition, conduct three to four "all day" (0600-2000) watches during the chick-rearing period to determine feeding intervals and foraging trip duration. All-day watches will begin when approximately 80% of the chicks have hatched and occur roughly 5 days apart.

3. * ***All-Island Census*** – Between 1986 and 2006 we conducted an all island census, during which we attempted to count all individual murres present on Southeast Farallon Island, West End, and the Islets. We used a combination of ground and boat based censuses in conjunction with an

attendance correction factor in order to arrive at an estimate of the total number of breeding birds. These counts stopped in 2007. This decision was made in conjunction with USFWS management due to the large population and high density of murres on the island. Recent growth of the SEFI murre population made it impossible to accurately count all the individual birds on the island. We will continue to count the index plots and other designated areas around the island to determine population trends, but will rely on FWS aerial surveys for a complete island population. All counts will be done in late May or early June (depending on phenology and weather) from vantage points at the Lighthouse, Shubrick, Corm Blind, North Landing, and boats (when possible). At the same time, we will count the number of birds in USP, UU, and X plot in order to determine a k-correction factor to account for the proportion of the population which is not present on the island during the all-island census.

5. ***Aerial Survey Correction Factors*** - In late May or early June, coordinate and facilitate island-wide aerial censuses with USFWS. Ground truthing of aerial photo counts and correction factors will be determined by counting index plots on Fertilizer Flat, USP, UU and X-plot. Document any potential disturbance caused by aerial over flights and communicate them withthe survey crew.

6. * ***Index Plot Census*** – Conduct "type II" index plot censuses by counting adult birds in 22 index plots located around the island. Three replicate counts will be conducted for 10 days during the peak incubation period between 1000 and 1200 hours. Counts should be conducted on consecutive days when weather allows and should start when ~100% of the birds in USP and ~70% of those in UU have finished laying, but before chicks have begun to hatch.

7. * ***Banding/Resighting*** –

a) Corm Blind – In the past, we have banded adults and chicks in Upper Upper and other Corm Blind sub-colonies when appropriate (late June/earlyJuly depending on phenology). However, due to a reduction in the size of this colony, high rates of Peregrine Falcon predation, and the potential for disturbance, no banding has occurred at this site since 2001. There are currently no plans to resume banding at this site..

b) Murre Blind – In an effort to maintain a population of known-age and individually marked birds, 230 adults were banded with individual color band combinations at the Upper Shubrick Plot during the pre-breeding season early in 2005. Resight all banded birds regularly throughout the winter and spring in order to determine adult survival, site and mate fidelity.

Double-crested Cormorant:

1. *__Productivity__ – Beginning 26 April, monitor population size and productivity of DCCO by counting adult birds, pairs, well-built nests, and chicks at the Maintop colony every 5 days from the Lighthouse. Note all major phenology events (first nest sites, first incubating birds, first big chicks, and first fledglings). Counts will continue every 5 days through July or until the chicks are large and become difficult to separate from adults.

2. ***All-Island Census*** – Attempt to conduct a boat census (weather permitting) in late May/early June to determine the number of sites not visible from the Lighthouse, and add these sites to our population estimate.

Leach's Storm-Petrel:

1. ***Productivity*** – LHSP are much less common on the island than ASSP and no specific studies are planned for this species. If LHSP nest sites are found during the course of Ashy Storm-petrel monitoring, we will monitor their productivity following the procedures listed for Ashy Storm-Petrel (above).

2. ***Banding*** – Band all LHSP captured during ASSP mark/recapture netting sessions (see above).

Pelagic Cormorant:

1. *__Productivity__ - Beginning 5 April (or earlier depending on phenology) observe nest sites around the island every fifteen days until 50% of all occupied nests have adults in incubation posture (indicating likely breeding). Once this occurs, begin following all nests every 5 days throughout the rest of the season. Most sites are difficult to see, so egg laying dates and clutch size will be determined only for those sites with an unobstructed view. For all other sites, determine the total number of chicks fledged. Attempt to follow a minimum of 40 active sites each year.

2. ***All-Island Census*** – Between mid-May and mid-June, determine the breeding population by counting the number of active nest sites visible on SEFI and West End. In poor reproductive years counts may be conducted earlier in the season in order to estimate adult population prior to nest abandonment.

3. ***Diet*** – From late August to mid-September (or when all chicks have fledged), visit accessible sites and collect regurgitated pellets to assess diet.

Pigeon Guillemot:

1. ***Site Maintenance*** – Beginning in late March, locate and inspect all followed sites (crevices and nest boxes), determine the condition of crevices (collapsed, buried etc.) and repaint, repair, or replace boxes as necessary.

2. ***All-Island Census*** - Beginning in late March (or when birds first begin rafting) count the number of guillemots observed on water surrounding island. daily at dawn (0600-0800) in order to estimate total population size. Continue these raft counts through April or until rafting numbers decline and adults are attending nest sites on Lighthouse Hill. , we will

3. ***Productivity*** - Starting 27 April check nest boxes and previously occupied crevices on Lighthouse Hill and Garbage Gulch every 5 days to determine breeding activity and monitor reproductive performance. When an egg is found, mark it with a sharpie to indicate egg order (i.e. 1,2, A or B), then return on the next check to look for a second egg. Once the clutch is complete, leave site undisturbed for 3 checks after the first egg was laid, then check for hatch on the 4th. Mark chicks with dye to indicate chick order and weigh them every 5 days between 1300 and 1700 hours. When chicks become mostly feathered (~ 30 days) l band them and begin checking them daily until fledging.

4. * ***Diet*** – Conduct 4 hr diet watches (0700 to 1100 hrs) every third day throughout the chick rearing period, alternating between Lighthouse Hill and Garbage Gulch. Diet watches begin when 10 followed sites on LHH and 5 sites at GG have hatched and end when 10 followed sites have yet to fledge (~mid June through mid August). Using a Palm Pilot data computer, record the time, type of prey (to lowest possible taxonomic level), size of prey (measured in bill lengths from the gape), nest site, and color band combination. Also record incidental prey information (gathered from observations of birds with fish seen outside of standardized diet watches) and enter these data in a separate database.

5. ***Resighting*** – In order to determine survivorship of individually banded PIGU, resight color-banded birds on LHH and GG every 5 days between 0700 and 1000, starting when birds begin attending the colony (mid to late April). Band resights will also be recorded opportunistically during nest checks, diet watches or other observation periods. When possible, determine the sex of banded birds (by noting the position during copulations) as well as the nearest breeding site.

6. ****Banding*** – Band chicks at all breeding sites on LHH and GG with FWS metal bands when they are mostly feathered.

Rhinoceros Auklet:

1. ***Nest Box Maintenance*** - In early March (before site prospecting begins), inspect all nest boxes and clean, repair, and/or replace nest boxes as necessary.

2. ***Productivity 5-Day Check Sites*** - Starting on 1 April, check all nest boxes and natural sites every 5 days to determine breeding activity and monitor reproductive performance. When an egg is found, identify and/or band both mates and take a series of morphological measurements from the adults (bill depth, wing cord, weight). After confirming both mates, leave the site undisturbed for 6 checks before returning on the 7th to check for hatch. Once chicks hatch and are left alone during the day, begin recording feathering status and weight every 5 days until they are mostly feathered. When they become mostly feathered, band the chicks and begin daily checks until fledging.

3. ***Productivity Camera Sites*** - Starting on 2 April, select a sample of 30 natural burrows and crevices to monitor using an infrared burrow camera. Once breeding occupancy has been confirmed (either an adult with an egg or an adult in incubation posture for two consecutive checks), leave the site undisturbed for 6 checks before returning on the 7th to check for hatch. When a chick has been confirmed, leave the site alone for an additional 5 checks, and then begin monitoring every 5 days until fledging.

4. ***Diet*** – Mist-net adult birds as they return to the colony at dusk to provision waiting chicks in order to assess diet. Conduct netting during the peak hatching period (starting when ~50% of occupied sites have hatched) at four locations around the island (Rabbit Cave catacombs, CG catacombs, PRBO house and Stonewall catacombs). Net at each location 3 to 4 times during the season, with an interval of 10 days between sessions. All prey items brought in by the birds will be collected, identified, weighed, and measured.

5. ***Mark/Recapture*** – During mist-net sessions for diet collection, band all adults as part of an ongoing mark/recapture study to examine fidelity and survivorship of RHAU. In addition, take all the same morphological measurements as on adults captured from nest boxes and assess breeding status by looking for a brood patch.

6. * ***Index Plots*** – In 2003 a series of 6 (20m x 20m) index plots were established in known Rhinoceros Auklet breeding areas around the island. In late May or early June (depending on phenology), count the number of burrows and crevices present in each plot and measure the entrance dimensions to determine species (CAAU or RHAU). In addition, every three years, determine the proportion of burrows and crevices which are occupied using a burrow camera.

Tufted Puffin:

1. ***All-Island Census*** -

a) **Early season census** – In order to determine the total number of adults present at the Farallones, conduct daily observations of all known sites and likely TUPU breeding habitat around the island during a week-long survey in late May (or when birds become active at site entrances). Record all TUPU observed along with site number, number of birds, and any relevant behavior; add new sites to photographic maps as they are found. Sites will be considered as active if birds are observed at a site at least 2 times during the survey or are seen bringing in nest material.

b) * **Late season census** – Conduct daily observations of all known sites during a week-long survey in mid-August, paying particular attention to those sites which were "active" during the early season census. A site will be considered as a confirmed breeding site if a fish delivery was observed or if a site which was active in the early season is still being attended during the late season survey. This census may be extended into September if the phenology suggests late breeding in a particular season.

Western Gull:

1. ***Productivity OLD/LRS*** – As part of a long-term study of the lifetime reproductive success of WEGU on the island, monitor all surviving OLD/LRS study birds in gull plots A-L. This study includes all birds from the 1977 cohort or earlier (OLD birds) as well as known-age individuals from the 1979, 1980 and 1983 cohorts (LRS birds). Beginning 22 April, check nest sites every three (3) days for site occupation and to determine nest contents. Once the clutch is complete, leave the nest undisturbed for 7 checks after the first egg was recorded before returning on the 8th to check for hatch. Determine the number of chicks hatched at each nest and mark chicks with dye in order to keep track of which nest they are from once they have started wandering. Once all chicks have hatched, leave the site undisturbed for an additional 3 checks before returning to band them (approximately 12-15 days old). Continue to monitor chicks (through band reading) until fledging to determine ultimate breeding success.

2. ***Productivity C, H, K*** - Re-mark plot boundaries at the start of each season using rebar and flagging as needed. Readband numbers of all individually marked birds and map their nest sites in order to obtain information on age-structure. We will then follow reproductive activities of all banded breeders in these plots (see methods for OLD/LRS).

3. ***Index Plots*** - In late May or early June, count all nests in selected plots (C, H, J, and K) as well as in 10 (100 m^2)index plots to estimate nesting density.

4. ***All-Island Census*** - In late May/early June, count all adults present on SEFI and WE. Determine the k-correction factor, representing the number of mates not present at the time of the census based on the ratio of adults to nests in the three main study plots (C, H, and K). Also count the number of adults and sub-adults in roosting areas to determine breeding and non-breeding population size.

Pinnipeds:

1. ***All-Island Census*** – Once each week throughtout the year (typically on Thrusdays, but as weather permits), census all pinniped species (Harbor Seal, California Sea Lion, Steller Sea Lion, Elephant Seal, and Northern Fur Seals) present at haul out locations around the island. The census is to be conducted from the lighthouse and other vantage points between 1100 and 1500 hrs.

2. ***Resighting*** – In order to examine survival, fidelity and movement of pinnipeds, read all elephant seal tags and sea lion brands/tags once every 3 days at accessible haul-out areas (NL, GG, MB, and SF).

Elephant Seal:

1. ***Productivity/Survival*** – In order to determine phenology, breeding success and survival of Mirounga on SEFI, read tags, mark cows, pups, and bulls during the breeding season (December – March). All young of the year in NL, GG, MB, and SF sub-colonies will have two flipper tags placed on them before they leave the colony (one in each hind flipper). We will also do a complete census bulls and cows twice a week (Sunday and Wednesday) during the breeding season.

2. ***Daily counts -*** Each day throughout the Elephant seal breeding season, count the number of adult males, cows, pups, and weaners in order to monitor breeding effort and reproductive success.
3. ***West End Monitoring*** – We will census animals and read tags every 2 weeks in January, and once each week during February to assess breeding success and survival of Mirounga at breeding beaches on West End. We will double-tag as many young of the year as possible (see above) in order to monitor their movement and breeding in future years. All trips to WE will be carefully planned so as to avoid causing disturbance to Steller Sea Lions or Common Murres.

Steller's Sea Lion:

1. ***Productivity*** – In order to estimate the number of young produced each year, check all Steller's breeding areas for fetuses (mid-March through May) and pups (June-August). When possible, monitor mother-pup pairs throughout the season to determine breeding success.

2. ***Aerial Survey*** – In late June or early July, coordinate with the National Marine Fisheries Service and Gulf of the Farallones National Marine Sanctuary to facilitate aerial surveys of the population.

Northern Fur Seal:

1. ***Census*** – Beginning in June (as part of the weekly pinniped census) check Northern fur seal areas on West End and record age-classes, behaviors, and locations of animals observed. In addition, a survey excursion will be made to West End in early September (once seabirds have finished breeding) in order to count animals, resight tags, and determine pup production for areas which are not visible from the Lighthouse.

White Sharks:

1. ***Shark watch*** – Beginning in mid September, initiate all-day watches at the LH to observe shark attacks in order to estimate population size and feeding activity. Record the number of sharks involved, prey species, location of the feeding event, duration of event, and other behavioral notes.