MONITORING PROTOCOL
FOR WESTERN SNOWY PLOVER
AT VANDENBERG AIR FORCE BASE

January 2011

SUMMARY

Breeding season surveys of Western snowy plovers (*Charadrius alexandrinus nivosus*) will be conducted on Vandenberg Air Force Base (VAFB), California, from 1 March through 30 September.

The snowy plover population on base will be estimated from four base wide window surveys to be conducted bi-weekly between 4 May and 26 June.

BREEDING SURVEY METHODS

- Permitted biologists, approved by the United States Fish and Wildlife Service (USFWS) Ventura Field Office, will conduct breeding surveys on snowy plover breeding beaches in both North VAFB (Minuteman, Shuman, San Antonio, and Purisima North beaches, and Purisima Colony) and South VAFB (Wall and Surf beaches).
- All historically documented breeding habitats will be surveyed at least once weekly for breeding activity of snowy plovers. An attempt will be made to locate all nests initiated and to follow their progress and document their fate.
- Areas where breeding activity is observed or breeding is suspected will be monitored a minimum of three times weekly in an attempt to definitively determine nest fate and to document predator losses.
    - The primary means of nest searching will include behavioral cues, observation of incubating adults from afar, and tracking.
    - Monitors will maintain a minimum distance of 10 meters, when possible, from nests when ascertaining the contents and age of nests.
    - During the continued monitoring that follows discovery of a nest, an attempt will be made to confirm whether an incubating adult is present without flushing the adult in the process. In all instances, monitors will use binoculars from afar and avoid walking directly to the nest.
    - An attempt will be made to identify whether the male or female belonging to each nest is color banded.
    - If nests need to be approached during monitoring (i.e., when floating is required to estimate hatch date) a straight path will be maintained by the nest to avoid leaving clues of nest location for potential predators (Page et al. 1985). Monitors will avoid placing personal objects such as backpacks and other items on the ground in the vicinity of nests to avoid leaving scent that may attract predators.
    - During nest searching, disturbance to other nesting plovers will be minimized by moving quickly through known nesting areas, and by using behavioral cues to determine other nest site locations.
    - All banded individuals observed will be recorded daily.

- Surveying of an area will be discontinued if high winds result in substantial movement of surface sand, during periods of rainfall, extreme weather, and when surveying activities may keep an incubating adult off its nest for a prolonged period.
- In the event that an adult or chick is found dead, the VAFB Biologist will be notified immediately.

- Monitoring priorities will be set on a daily basis and will depend on nest initiations, observed breeding activity, and other monitoring needs.
  - All monitors will maintain daily field notes including daily weather information, survey start/end times, time of nest checks, and band and predator observations.
- Each nest will be assigned a unique identification code (ID) based on the beach sector and order in which it was located.
  - A master file for each nest will be maintained that will include the nest ID, the geographic coordinates (obtained by means of Global Positioning System [GPS] units), date found, number of eggs when found, estimated initiation date, estimated hatch date, full clutch size, actual hatch date, adult male and female color band combinations (if banded), nest fate, number of chicks hatched, number of chicks color banded, and chick color band combinations.
  - In the field, individual nests will be located by natural markers; no stakes or other markers will be erected to aid in the relocation of nests.
  - Photos and GPS coordinates will be taken at each nest from approximately 10 meters west of the nest.
  - The date, time, number of eggs observed, and presence of incubating adult(s) will be recorded during all subsequent nest visits.
- Nest initiation and hatch dates will be estimated by two methods:
  - For nests found at the one or two egg stage, contents will be monitored until the full clutch size is determined. Hatch date will then be projected as 27 days after clutch completion (Warriner et al. 1996).
  - For nests found with full clutches (1, 2, or 3 eggs), the eggs will be floated (Hays and LeCroy 1971) and estimated hatch date will be determined based on data collected from plovers breeding on the California coast. Eggs from each of these nests will only be floated once.
- The location of nests and broods found within or near areas open to recreational access will be evaluated and discussed with the VAFB Biologist to assess whether protective measures should be implemented.
  - Natural objects may be placed around a nest to prevent human foot traffic near the nest, while not impairing the detection of approaching predators by incubating adults or drawing attention of humans or predators to the nest.
  - Symbolic fencing may be erected around nests found in areas open to recreational access to protect from accidental trampling. Fencing will be erected only upon approval of the VAFB biologist.
  - Broods will be monitored within and near areas open to recreational access to ensure broods are not separated from adults during open access periods.
- To determine whether nests hatched, nests will be monitored more frequently near the estimated hatch dates.
  - If the nest site is vacant, an inspection of the immediate area for signs of depredation will first be done. If no evidence of depredation is found, the nest will be approached

and a search for pip fragments (very small eggshell fragments), and newly hatched broods in the vicinity will be done.

- If a nest site is found vacant well before the projected hatch date, nests will be inspected for indications of predation, such as tracks, stirred nest contents, and certain types of eggshell fragments (Mabee 1997); and evidence of other possible causes of nest loss such as flooding, burial or destruction.
- The criteria established by Point Reyes Bird Observatory (PRBO) in 2001 for determining nest fate and fate categories will be used (Appendix A).

- The main objective of banding chicks upon hatching is to facilitate estimating fledging rates. In addition, banding provides a means of assessing population trends and site fidelity.
    - For estimating fledge rates, the sample size needs to be statistically valid. Based on published literature (Bartlett et al. 2001) relating to adequate sample size in survey research for statistically significant results, approximately 42 percent of all clutches hatched within a breeding season should be banded.
    - VAFB will attempt to band a statistically valid sample size (42% of hatched nests) to the maximum extent practicable. An attempt will be made to balance the numbers of clutches banded between North VAFB and South VAFB.
    - To accurately assess hatch date of clutches targeted for banding, and to minimize overall disturbance to adult plovers by the banding process, eggs will be closely monitored for signs of hatching starting 2 days prior to the estimated hatch date.
    - Each individual brood will be banded with a unique color band combination, issued by PRBO Conservation Science, and each chick will have a serially numbered band issued by the United States Geological Survey Bird Banding Laboratory.
    - Color bands will be secured with a battery-powered soldering tool and covered with automotive pin-striping tape.
        - To differentiate between chicks of the same brood, each chick's metal band (within each brood) will be covered with color pin striping in such a manner that either the top 1/3, bottom 1/3, or none of the metal band will be visible.
    - For the purpose of determining chick fledging rate, a search for color-banded chicks will be done during every survey after the first chicks are banded. Brood locations will be entered into a database to assist in tracking brood movement.

BASE WIDE CENSUS METHODS

- A base wide census of breeding adults will be conducted during the period of 4 May and 26 June.
- The census will consist of four bi-weekly counts of all adults within nesting habitat on North VAFB and South VAFB.
- The numbers and locations of plovers, as well as age, sex, color band combination (if banded), and the number and size of accompanying chicks for individual plovers, will be recorded during each of the counts.
- Breeding population size will be estimated from these four censuses.

OTHER MONITORING AND REPORTING

- Evidence or observations of unauthorized human intrusion into nesting areas will be reported to VAFB Security Forces and the VAFB Biologist as soon as practicable.
- Predator activity within nesting habitat will be recorded for purposes of predator management.
    - Predator activity observed within nesting habitat that is considered an imminent threat to the nesting effort will be communicated and discussed with the VAFB Biologist to assess the need for immediate action.
- Monthly summary tables reporting numbers of nests within each sector and their status will be provided to the VAFB biologist.
- Plover eggs that have remained on the beach a minimum of 2 weeks past the estimated hatch date and which are determined to be abandoned or unattended, will be collected to discourage predation. The collected eggs will be sent to the Santa Barbara Natural History Museum Vertebrate Collections.
- A final report will be generated presenting results of base-wide censuses, total number of nests within each sector and their fates, demographic information for the population including hatching and fledging rates, and management recommendations for future management.

LITERATURE CITED

Bartlett II, J.E., J.W. Kotrlik, and C.C. Higgins. 2001. Organizational Research: Determining Appropriate Sample Size and Survey Research. Information Technology, Learning, and Performance Journal 19:1:43-50.

Hays, H. and M. LeCroy. 1971. Field criteria for determining incubation stage in eggs of the Common Tern. Wilson Bulletin 83:425-429.

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Appendix A. Criteria and evidence for determining fate of Snowy Plover clutches (PRBO 2001).

*The criteria below apply when monitors are permitted to handle and float eggs for estimation of hatch date.

Hatched

Eggs missing close to estimated hatch date, predator tracks would be evident in substrate yet no obvious tracks to or at nest, along with one or more of the following:

- Flattened scrape and pip fragments located in scrape, or
- Tapping or cracks observed in eggs on recent visit to nest, or
- Indication of presence of newly hatched brood in immediate vicinity (e.g. direct observation, broody behavior exhibited by nearby adult, ideally by banded adult previously associated with nest).

Depredated - Unknown Predator

- Direct evidence that eggs were destroyed, including:
  - substrate cemented together by egg contents, or
  - eggshell fragments or intact but damaged eggs found well before estimated hatch date.
- Eggs missing well before estimated hatch date, no predator tracks to nest, but weather would not have destroyed nest. Evidence may include:
  - scrape intact or still discernible, or
  - substrate stable or level enough such that wind would not cause clutch to be buried or eggs to roll out of scrape, or
  - substrate too firm for imprint of predator tracks.
- Unidentified potential predator tracks directly to and at nest site (if potential predator tracks are observed leading towards nest site but gait is unchanging directly past nest site, that predator is not associated with clutch loss).

Depredated - Identified Predator

- Identified predator tracks directly to and at nest site, and
- Timing of lain predator tracks coincides with nest loss, as indicated by substrate conditions. If two or more potential predator species are identified to and at nest site, and timing of visits can be determined, first predator to nest site associated with nest loss.

Lost to Tide

Tide had washed over original nest location, and:

- Eggs gone well before estimated hatch date, or
- Eggs gone close to estimated hatch date, but no indication of a newly hatched brood in the immediate vicinity, or
- Eggs located near original nest location but no indication eggs being incubated, or
- Eggs located near original nest location, eggs being incubated by adults well past estimated hatch date.

Non-viable Eggs
Intact eggs of full clutch remain well after estimated hatch date along with evidence that there is consistent adult activity at nest location.

Abandoned
Intact eggs of clutch remain but evidence of adult activity at nest ceased well before the estimated hatching date. No evidence nest was washed over by tides or ever buried by wind blown sand or other debris.

Wind
Eggs not being incubated and one of the following:

- Intact eggs located outside of scrape, eggs not being incubated, and no indication that any other species may have moved eggs, or
- Eggs in scrape and covered by wind-blown sand or other debris.

***Note: Distinction between the above three categories (non-viable eggs, abandoned, and wind) can be difficult and may require additional information.**

Trampled
Eggs found destroyed (not depredated) and tracks of a larger species directly through nest location.

Destroyed – Human

- Human footprints directly next to or on the nest location and:
  - one or more eggs missing from the clutch, or
  - evidence that eggs were destroyed including shell fragments or contents.
- Human footprints near nest with evidence that was something was dragged over, dropped or placed on nest.

Failed Unknown
Eggs missing well before estimated hatch date, but absence of clear evidence of depredation, wind loss, tide, or trampling.

Unknown
Eggs missing close to estimated hatch date but evidence of hatch would have been obscured by weather conditions or other factors.