FINAL REPORT

IDENTIFYING SNOWY PLOVER NEST PREDATORS

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ELISE ELLIOTT-SMITH, USGS Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331. email: eelliott-smith@usgs.gov Phone: (541)-758-7390 Fax: (541)758-8806.

SUSAN M. HAIG, USGS Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331.

INTRODUCTION

Decline of Snowy Plovers (*Charadrius alexandrinus*) on the west coast has been attributed to predation, in addition to habitat loss and human disturbance (Page et al. 1995). Listed as threatened under the U.S. Endangered Species Act, recovery depends on minimizing nest predation to boost reproductive success. Although low nest success is a major impediment to population growth, there is little unequivocal evidence identifying species that prey on plover eggs. Single acts of predation are infrequent and quick, making them difficult to document. Monitors have relied on clues to help identify predators such as tracks or feathers left in the vicinity of depredated nests (Castelein et al. 2002). More often, there is no indication of which species is responsible for a predation event (Castelein et al. 2002, Lauten et al. 2003).

Leadbetter Point, WA, and Siltcoos, OR, are two Snowy Plover breeding sites in the Pacific Northwest with low nest success and overall reproductive success. Although 31 Snowy Plover nests were found on Leadbetter Point in 2002, only 2 hatched (Brennan 2002). Despite extremely poor nest success, surveyors have found few signs at failed nests indicating specific predator species. Leadbetter Point does not receive any predator management, although 2004 was the first year nests were exclosed with wire to deter predation. Corvids are thought to be a major nest predator at Siltcoos and exclosures have been used for many years to protect nests. Although many nests are exclosed, only about $^{1}/_{3}$ of nests hatch (average for 13 years) and the number of nesting attempts has declined over the past five years (Lauten et al. 2003).

Still photo and video cameras have been used at nests of many different bird species to help identify predators, understand predation patterns, and examine parent bird responses. Still motion/heat sensor cameras have been used on Snowy Plover nests in California and video cameras have been used at nests of a closely related species, the Piping Plover (*Charadrius* *melodus*). In an effort to identify species that prey on Snowy Plover nests on the Washington and Oregon coasts, we conducted a pilot study that investigated the use of cameras to document nest predators on Leadbetter Point and Siltcoos River estuary.

METHODS

The primary field site for this pilot study was Leadbetter Point, Willapa National Wildlife Refuge, WA. One digital motion/heat sensor camera was deployed at Snowy Plover nests on Leadbetter Point. A second digital camera was used at predator bait stations at Siltcoos, located at the mouth of the Siltcoos River in the Oregon Dunes National Recreation Area. Both cameras were high resolution color cameras that captured images during daylight hours.

We also tested a miniature black and white video camera with infrared illumination on a nest at Siltcoos. The primary purpose of videotaping nests was to evaluate their applicability to recreation studies. A secondary goal was to assess their usefulness in documenting predators and predation events for future studies.

Given the conservation status of Snowy Plovers, any disturbance to birds was considered and minimized during predator documentation activities. Cameras were setup as far as practical from nests. We tried to minimize time spent near the nest and kept total equipment setup time to less than 30 minutes for both photo and video monitoring. Checking still cameras was a very quick process that required less than five minutes at the nest. Video checks were slightly more involved, but did not require activities close to the nest.

Still Camera Use

Non-Typical's Cuddeback Digital Scouting Camera was used at Leadbetter Point, WA, and Siltcoos River estuary, OR. These cameras are capable of recording color images and short video clips during the daytime. We wanted to use an additional camera that had an infrared flash for taking nighttime photos (Highlander PhotoSpy), however, this camera was unavailable in the spring and summer of 2004. Since documenting nighttime predators is integral to our understanding of Snowy Plover nest predation, we acquired an infrared camera in the fall and will be testing it in 2005.

Although camera casings are "camouflage", they are about 7"x 9" including batteries and would have been visible if left exposed in beach habitat. Therefore, efforts were made to prevent theft or vandalism. We considered a variety of methods for concealing cameras including painting casing to resemble sand, hiding in hollowed out driftwood, concealing among debris, or partially burying in the sand. We decided to camouflage still cameras by painting them and applying glue and sand. Cameras were also partially buried in the sand amongst debris and were erected about 10 ft. from nests. False triggers by incubating plovers was a concern; previous research using 35mm cameras at Snowy Plover nests involved partially shielding the bottom half of sensor with a stiff piece of paper or cardboard. However, our initial sensor testing did not suggest false triggers would be common and camera memory cards were capable of storing many images. Therefore, we decided not to shield sensor and to use cameras on the highest sensitivity setting.

When possible, cameras were set up at the time a nest was discovered and were checked at least weekly. Cameras are small and light so we could carry them to the field in a backpack.

When a nest was discovered, we evaluated whether it was a good candidate for predator monitoring. Nests were considered ideal candidates when located in areas not readily visible to the public and with ample driftwood or debris nearby. We tried to document as many predation events as possible by setting up cameras at nests that would not be exclosed. After setting up cameras, they were checked during subsequent nest checks to ensure that there were not many false triggers and that there was space available on the memory card. If a camera had been checked at least once and appeared to be working properly, it was checked with binoculars from a distance on subsequent visits so as to minimize disturbance.

The cameras were equipped with detailed user manuals but brief operating descriptions and settings follow:

Non-typical Cuddeback Scouting Camera- Both cameras require four D batteries. One camera stores images on Smartmedia cards and the other camera uses Compact Flash cards (we used 168 mb). There is no on/off switch, so the camera turns on when batteries are inserted. Since camera settings need to be changed every time batteries are changed, and battery life is relatively long (about 30 days), batteries can be left in the camera for short periods when it is not in use. Although there is no way to turn off the camera, it may be disabled so no photos are taken.

There are five control buttons for operating the camera, all of which are inside the casing above the batteries. The “M” and “S” buttons are both menu buttons; the “S” button allows you to scroll through the camera settings and the “M” button allows access to information on photos taken and operating modes. The “↑” and “↓” buttons allow you to change camera settings and set the date and time. The “C” button is the equivalent to “enter” or “select” (although it is not always necessary to press “C” after changing a setting using the arrow buttons); it also provides access to sub-menus.

To set up camera for first time use, camera should display “ADV mode change?” when batteries are first inserted. If this is not displayed, press “C” button once. Then press “S” to change and/or check settings. After pressing “S” the default camera delay of one minute is displayed; you do not want to change this setting, nor do you want to change default settings for “Event Delay” or “Camera Window” which are displayed after pressing “S” a second and third time. After depressing “S” for the fourth time, “Set Date” appears; change the month with the down arrow and the day with the up arrow then press “S” again and “Set Year” displays. If necessary change the year using arrows then press “S” again and set the time using the down arrow to change the hour (and am/pm) and the up arrow to change minutes.

After pressing “S” again, press “C” to access the “Camera Setup” sub-menu. The camera display should read “Camera Mode - Motion”; “Motion” is the default setting and should not be changed. Continue to press “S” leaving the default settings of “Flash - Off” and “View Quality -Standard”. When “Video Mode -Off” displays, press the up arrow once to change the setting to “Video Mode -On”, then press “S” and “Video Time - 10 secs” should display. Since we did not experience many false triggers, it would be possible to set camera to take longer video clips (by changing video time with the up arrow); however, if camera often triggers accidentally, memory cards will fill quickly and only still photos should be saved (switch to “Video Mode - Off”).

Pressing “S” again will bring up the “Theftstop Setup?” sub-menu, that can be accessed by pressing “C”. The name (USFWS) and phone number (Newport, OR office) will already be programed into the camera and the codes will be “123". Therefore, you should not need to access this sub-menu. Press “S” and “C” again to access the “Camera Utilities” sub-menu. Press “S”one time and “Sense Level - High” should display; if it is not set to “High” use either arrow button to increase the sensitivity. Decrease the “Sense Level” to “Standard” if the camera takes too many photos of movement occurring at a great distance from the nest.

Set the operating mode using the “M” button in order to check the number of photos taken. Press “M” once and the number of photos appears; press “M” again and the total number of movement “events” appears. “Standby” should appear the third time “M” is pressed. Press the up or down arrows to change the operating mode. In “TestMode”, a red light will illuminate when the motion sensor is triggered, but no photo will be taken. Leave camera in “LiveMode Motion” when leaving camera in the field. When transporting camera to and from the beach or nest site select “Disarm?” by pressing “C”.

Check memory card space during subsequent visits to the nest site. “CardFull” will display if there is no more memory-- you may be able to read the display screen from a distance with your binoculars. Replace the card if it is full. If the card is not full, the camera must be approached to determine the number of pictures that have been taken. The “quick” method for checking photos taken is by covering the center hole of the camera with your finger until red light flashes. After the light goes off, immediately remove finger and the number of photos taken will display. Repeat the above steps if the first check is unsuccessful. After successfully checking photos, the camera will revert to back to “LiveMode Motion” in 10 minutes and you will need to be careful not to trigger the camera if you are still in the area. If the “quick check” method does not work, it may be necessary to open camera and use the “M” button to check for photos taken. The memory card should be able to store more than 40 video clips when the camera is operating in video mode and video time is set to 10 seconds. Do not change card unless there have been more than 20 false triggers (display will indicate 20 images saved). The memory card can store 400 images if the camera is functioning in normal snap-shot mode.

Video Camera Use

One nest at Siltcoos was monitored using video surveillance, with a infrared camera for day and night viewing. Monitoring involved use of the following equipment: IR "bullet"camera, a time lapse VCR, video tapes, connecting wires, 12 volt batteries, handheld monitor, and weatherproof storage box. The camera was very small (about 2"x3"), weatherproof, and was concealed with small pieces of driftwood and debris. Wires connecting cameras to the VCR unit were 100 ft long. We concealed wires by burying with sand after digging a 6-12" trough. The VCR and battery were protected in a weatherproof box partially buried and camouflaged with debris. The VCR was buried behind a large piece of driftwood, so that researcher activities at the VCR were not visible to nesting plovers.

RESULTS AND EVALUATION OF METHODS

Still Cameras

One camera was used at three nests on Leadbetter Point, WA. The first nest was depredated and photos revealed a corvid in the vicinity of the nest (less than 3 m from the nest bowl; Figure 1). Unfortunately it was not possible to determine whether the bird in the photo was a Crow or a Raven, and there was no direct evidence (bird at nest or egg in beak) that the bird photographed was responsible for the predation event. The corvid was not visible during the 10 second video clip that followed the still photo. During camera testing (prior to deploying at a nest) we sometimes observed a slight delay between a trigger event and the photo. Therefore it is possible that the corvid depredated the nest and a photo was taken as the bird was leaving the nest bowl.

Unfortunately we do not have any photos from the other two nests. The second nest was depredated and the camera was moved to a third nest immediately, without replacing the memory card. Although the third nest was successful, the camera was stolen at the nest along with potential photos of a predator at the second nest.

We were also unable to document predators at bait stations. Cameras were not used at bait stations until very late in the season after many predators had already been removed. However, there was some evidence that the bait station had been approached and the camera failed to document it. After about a week or two of use at bait stations, the camera stopped working completely. Despite being "waterproof", we had a lot of problems with sand penetrating the casings and it is likely that camera malfunction was due to sand. We will use a different camera (Highlander PhotoSpy) with infrared nighttime capability to document predators at bait stations during spring 2005.

Video Cameras

One nest on south Siltcoos was monitored for three 24 hr periods during the second week of July. Since the primary purpose of video monitoring was documentation of recreation disturbance, we had intended to record a nest over the fourth of July weekend when coastal recreation activity is high; however, we were delayed due to a blown fuse. During three days of video monitoring we did not detect any predators or recreation disturbance at the nest or in the immediate vicinity of the nest. Although we did not record predators, if there had been an incident at the nest, picture quality was sufficient for identification predator species, at least during daylight hours (and possibly at night).

This method is very appealing in that it has potential to provide complete and continuous information on predator activity near the nest throughout the day and night. Unlike still cameras, video monitoring is unlikely to "miss" a predator in the area since there are no problems with false triggers or failure to trigger the camera and there is no delay before image is captured. Additionally, continuous recording would make it possible to actually view the predation event instead of just producing an image of a predator near the nest.

However, one drawback in using this method is that high energy requirements require frequent site visits. To record a nest continuously, batteries and video tapes needed to be changed every day. Personnel were not available to change batteries daily so we were unable to continuously record nests from initiation to fail date or hatch day. Field personnel generally visit sites once or twice a week. Daily visits would require substantially greater effort, and this level of effort is often unfeasible.

Since batteries and video tapes need to be changed daily, this method can also be quite invasive. Battery changes are relatively quick and do not take place directly at the nest, but involve activity at about 100 m from the nest. The nest we recorded was close to a foredune and large drift wood, so we were able to approach the equipment surreptitiously to change the battery. However, this would not be possible at many nests and changing the battery daily would result in a major disturbance to incubating plovers. Therefore, although this method may have the greatest potential for revealing information about predation, nests must be chosen carefully to minimize researcher disturbance.

CONCLUSIONS

Although we monitored four nests, we were unable to successfully and unequivocally identify any nest predators. Further testing should be conducted to determine the usefulness of still cameras since we were only able to obtain photos from one failed nest. However, our research suggest some problems with still cameras. Since we did not actually capture a predator at the nest in the failed nest photos, the camera either failed to trigger, or there was a delay before trigger, or possibly a combination of failure and delays. Sand penetrating camera casings was an additional problem that may cause camera malfunction.

If field personnel are available for daily battery and cassette changes, video monitoring is likely the best method for documenting nest predators. Its strengths are both diurnal and nocturnal continuous recording capabilities which could provide absolute evidence of a predation event (not just a predator in the area) and would likely allow for predator identification to species. Drawbacks of this method are that it requires a great deal of effort, is at least somewhat invasive, and would not be appropriate for nests located far from foredunes and cover.

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Figure 1. Corvid captured by Non-Typical Cuddeback camera near depredated nest at Leadbetter Point, WA. (19 May 2004**).**

LITERATURE CITED

Castelein, K. A., D. J. Lauten, S. R. Pixley, L. N. Renan, M. A. Stern, and C. Grinnel. 2002. The distribution and reproductive success of the western snowy plover along the Oregon coast - 2002. The Oregon Natural Heritage Information Center, Oregon State University, Portland, OR.

Lauten, D. J., K. A. Castelein, B. V. Smithers, K. C. Jander, E. Elliott-Smith, and E.P. Gaines. 2003. The distribution and reproductive success of the western Snowy Plover along the Oregon coast - 2003. The Oregon Natural Heritage Information Center, Oregon State University, Portland, OR.

Page, G. W., J. S. Warriner, J. C. Warriner & P. W. C. Paton. 1995. Snowy Plover (*Charadrius alexandrinus*). In *The Birds Of North America, No. 154*. A. Pool and F. Gill, eds. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C., USA