

SUMMARY OF FINDINGS

USE OF RADAR TO MONITOR MARBLED MURRELETS IN GAZOS CREEK AND ADJOINING WATERSHEDS IN THE SANTA CRUZ MOUNTAINS

by

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Background

In 1998, the Apex Houston Trustee's Council contributed \$500,000 to the Sempervirens Fund toward the purchase price of the Gazos Mountain Camp property. The property contains murrelet breeding habitat and is an occupied murrelet site. The purpose of the acquisition is to protect the old-growth murrelet habitat by including it in Butano State Park. The Council entered into an agreement with the Sempervirens Fund that called for, among other things, the instigation of a murrelet monitoring program. This report summarizes the findings of a 1998 radar pilot study that was first product of that monitoring program.

The 1998 radar pilot study commenced on July 13, 1998 and ended on July 24, 1998. It consisted of 12 dawn radar surveys, 1 dusk radar survey, 6 companion ground observer surveys, 6 ground observer surveys in the Gazos Camp meadow/ballfield area, and 2 ground observer surveys in other areas. Human error or weather conditions caused the loss of data from 2 radar surveys and 1 ground observer survey.

Objectives and Findings

Objective # 1 - Determine if the terrain and vegetation cover in the Gazos Creek Watershed and surrounding areas provide suitable locations for radar surveying of Marbled Murrelets.

Finding # 1 - Suitable locations for radar surveying do exist in the Gazos Creek Watershed even though radar does not perform well within heavily forested areas that are screened by tall trees and where there are few openings. Fortunately, forest cover in the Santa Cruz Mountains is not uniform and we were able to find suitable

radar survey sites in every watershed we investigated in the Santa Cruz Mountains. These watersheds included Gazos Creek, Waddell Creek, Whitehouse Canyon, and Little Butano Creek. Most coastal watersheds from Santa Cruz to Half Moon Bay have similar topography and vegetation near their mouths and would be suitable for radar monitoring. These include such important murrelet use areas as Pescadero Creek, Cascade Creek, and Scott Creek. Several types of physiographic features were available to use in the region that made for successful and efficient radar monitoring sites. These features included:

- * roads located on hillsides with openings in forested valleys
- * ridgetops and hilltops in chaparral or grass
- * valley bottom lands with meadow or cropland
- * grassy coastal plains at the mouth of canyons

Open areas of grassland or coastal scrub vegetation provide excellent opportunities for monitoring the mouths of major watersheds for murrelet movements due to the 360 degree scanning ability, the lack of blocking vegetation, and the way the steep-sided watersheds funneled birds as they headed inland. Relatively few detections were of birds passing over ridges or hilltops.

Objective # 2 - Demonstrate the capability of radar surveys to measure the number of murrelets using watersheds or portions of watersheds, and compare the accuracy of radar surveys to protocol surveys by human observers.

Finding # 2 - Radar surveys proved capable of detecting murrelet movement up or down canyon flyways (Lower Gazos Creek and Lower Waddell Creek stations), movement of birds into or out of canyons from sites near the mouth (Whitehouse Canyon and Little Butano Canyon stations), and usage of sub-watershed areas (Bear Gulch and Olmo Fire Road stations).

Only two weather conditions can interfere with radar surveys: (1) heavy rain during the survey period, and (2) dense fog during the site alignment and calibration period, although fog is not a problem during the actual survey period. We demonstrated that radar has the capability to detect birds in any lighting condition, in complete darkness, through the densest fog, and during periods of light mist or rain. Birds were commonly detected by radar out to a radius of 400 meters with the farthest birds detected at 950 meters. Therefore, radar was able to detect murrelets within an area that is 10 times larger than a ground observer could detect.

In five instances where the radar unit was paired with a ground observer, the ground observer always detected less than 50% of the murrelets detected by radar. In two cases the ground observers had zero detections when radar recorded 8 and 9 detections, respectively. Since radar identification of murrelets is associated with an extremely low identification error rate (Hamer, Cooper, and Ralph 1995), radar is much more accurate than protocol surveys for determining murrelet usage of an area. Radar allows quantification of murrelet numbers and the opportunity to analyze population trends over time. It always provides additional information that is only occasionally available to ground observers such as bird flight direction (inbound to nesting habitat or outbound), flight path, flight behavior, identified flight corridors, and documented daily activity patterns. Birds are less likely to be double-counted by radar than by a ground observer, since radar can distinguish whether a bird is flying to or from its nesting area and radar does not depend on the birds to call to detect them.

Objective # 3 - Make a preliminary count of the number of birds entering or leaving the Gazos Creek Watershed and adjoining watersheds.

Finding # 3 - Two stations were utilized for radar surveys of murrelets flying in or out of the Gazos Creek Watershed. The first station, Hill #621, was located downstream of the junction of Cloverdale Valley with Gazos Creek, while the second station, Lower Gazos Road, was located about 0.5 km above the Cloverdale Valley junction. Two surveys at the first station revealed a large percentage of the Marbled Murrelet detections to be birds entering or leaving the Cloverdale Valley, an apparent flyway to Little Butano Canyon. Only from the second station were we able to detect Marbled Murrelets entering or leaving the forested part of the Gazos Creek Watershed. This station was on the flyway used by murrelets traveling to or from suitable breeding habitat in the upper watershed, including the Gazos Mountain Camp property.

Two radar surveys at Lower Gazos Road found 22 and 20 detections (combined inbound and outbound detections). If we assume that each bird detected had an active nest and the nest was in the incubation stage (an unlikely scenario on both counts), and that few birds flew through the Gazos into other watersheds (probably true), then the number of murrelets nesting in the Gazos Creek Watershed during the study period was 20 to 22 birds. This estimate is very preliminary since only two days were sampled and there is some day-to-day variability, but it does provide a high-end estimate. Total yearly nesting use of the Gazos Creek Watershed could

be higher since early nesters would have finished nesting prior to the initiation of our study. To accurately quantify murrelet use of the watershed, radar surveys should be conducted in both the early and late portions of the breeding season and more replicate surveys should be done during each survey period.

To put the detection numbers from Lower Gazos Road into perspective, radar surveys were also conducted at the mouths of adjoining watersheds, and at the Waddell Creek Watershed. The Waddell Creek Watershed contains Big Basin Redwoods State Park at its upper end which is known to support a large number of nesting murrelets. The following table compares the number of detections from different stations.

Murrelet Detections by Radar at Different Stations

Station	Number of Radar Surveys	Number of Detections per Survey	Comments
Lower Gazos Rd.	2	22, 20	Watershed includes Gazos Mountain Camp property.
Little Butano Ck.- A	1	8	Watershed is documented breeding area with lots of suitable nest trees
Little Butano Ck. - B	1	28	Watershed is documented breeding area with lots of suitable nest trees
Whitehouse Canyon	2	14, 7	Murrelet usage not known previously. Only small areas of remnant old-growth present.
Lower Waddell Creek	1	31	Well documented nesting area in upper watershed with a high level of murrelet activity.

Objective # 4 - Use protocol surveys by human observers to better characterize Marbled Murrelet activity at Gazos Mountain Camp (ie., the Villa Cathay property).

Finding # 4 - Six protocol surveys by a ground observer were conducted in the meadow/ballfield area of Gazos Mountain Camp during the two week pilot study period. The number of total detections varied from 18 to 49, with the larger numbers likely associated with birds detected more than once. The maximum number of murrelets seen at once during each day ranged from 3 to 4. The number of occupied behaviors seen each day ranged from 5 to 16, and there was at least one detection each day of a single silent murrelet flying below canopy. On one occasion a rare type of murrelet occupied behavior, a 'jet plane sound', was detected. Murrelets were frequently seen flying either into or out of the stand on the west side of the creek that contains many potentially suitable nest trees. These observations are highly indicative of nesting on the property - likely in the hillside stand of old-growth trees across the stream from the meadow.

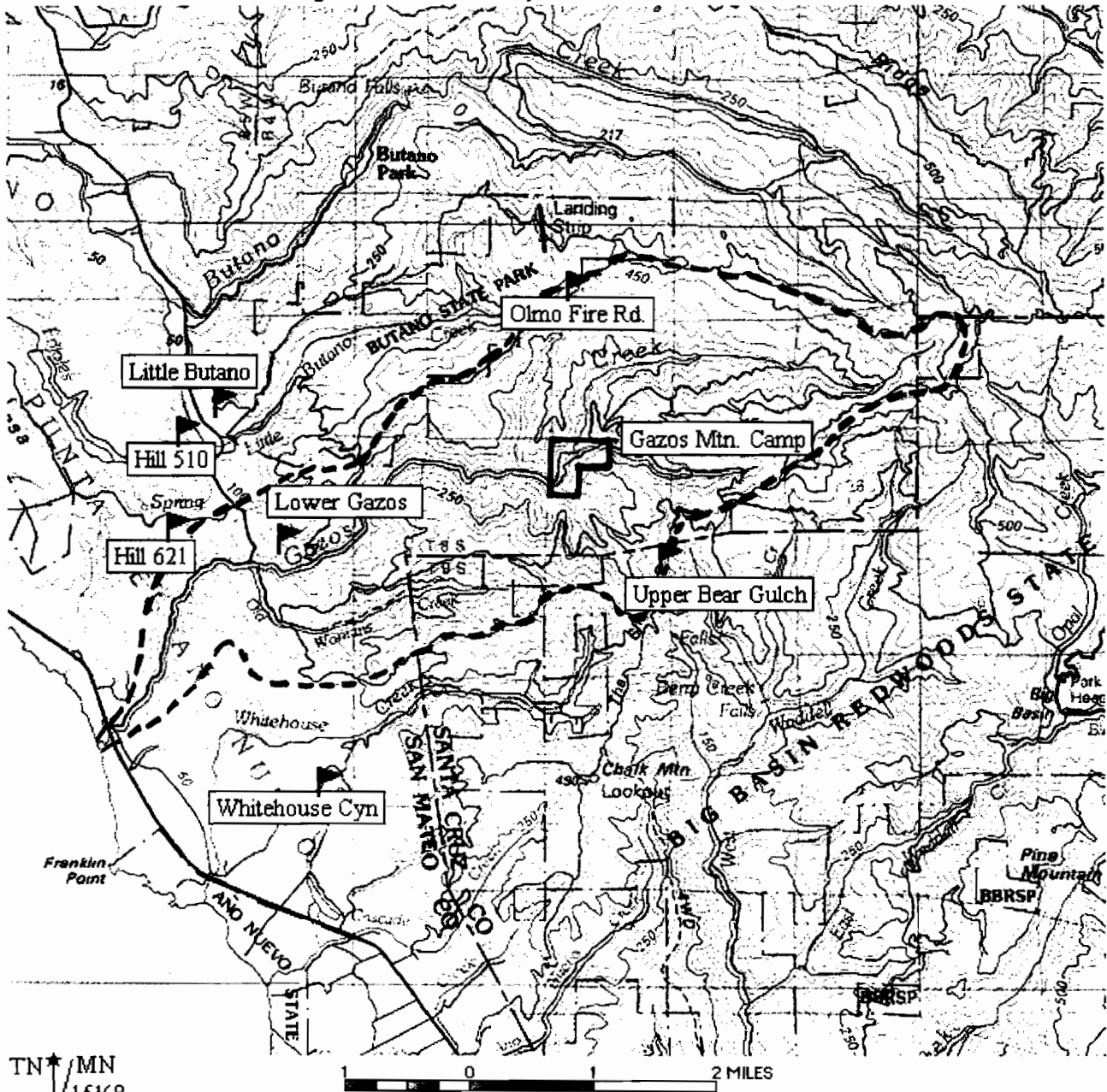
Concluding Remarks

Radar works well in the Santa Cruz Mountains and is the ideal tool for determining the number of murrelets using different watersheds and for detecting changes in the number of murrelets using a given watershed over time. Protocol ground surveys are useful for collecting some data from areas not suitable for radar use, and for determining murrelet behavior in or near potentially occupied stands. The best murrelet monitoring program for the Gazos Creek Watershed will be one that incorporates both radar surveys and protocol ground surveys, and utilizes the radar surveys to quantify yearly changes in murrelet use.

Literature Cited

Hamer, T.E., B.A. Cooper, and C.J. Ralph. 1995. Use of Radar to Study the Movement of Marbled Murrelets at Inland Sites. Northwestern Naturalist 76 (2): 73 -78.

Figure 1 - Radar Survey Stations near Gazos Creek



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KEY:

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