

2001 ANNUAL REPORT

**GAZOS CREEK MARBLED MURRELET
MONITORING PROGRAM**

Submitted to:

**APEX HOUSTON TRUSTEE COUNCIL
SACRAMENTO, CALIFORNIA**

**SEMPERVIRENS FUND
LOS ALTOS, CALIFORNIA**

Submitted by:

**STEVEN SINGER ENVIRONMENTAL &
ECOLOGICAL SERVICES
218 NEVADA STREET
SANTA CRUZ, CALIFORNIA
95060**

And

**HAMER ENVIRONMENTAL
19997 STATE ROUTE 9
MOUNT VERNON, WASHINGTON
98274**

JANUARY 2002

2001 ANNUAL REPORT
GAZOS CREEK MARBLED MURRELET MONITORING PROGRAM

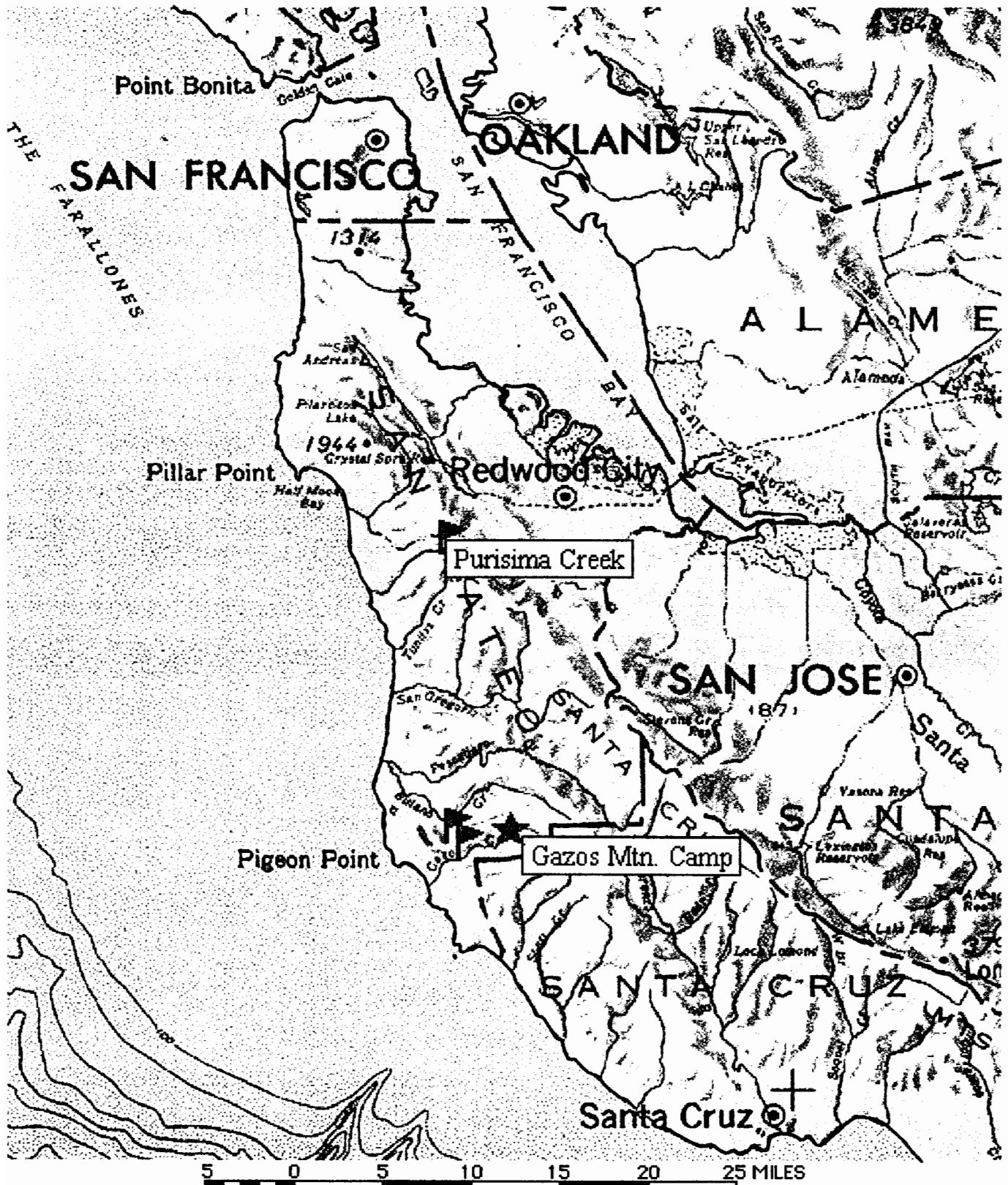
By
Steven W. Singer and Thomas E. Hamer

INTRODUCTION

In 1998 the Apex Houston Trustee Council contributed \$500,000 to the Sempervirens Fund for the purchase of murrelet breeding habitat in the Gazos Creek Watershed of the Santa Cruz Mountains. The Sempervirens Fund purchased the Gazos Mountain Camp property (see Figure 1 for location) that included 10 acres of old-growth forest and about 20 acres of second-growth forest containing residual old-growth trees for \$1.5 million (See Singer, 1998, for property description). In 2000, the Sempervirens Fund sold the property to the California State Parks Department as an addition to Butano State Park. Subsequently the State Parks Department leased the property to the Pescadero Conservation Associates.

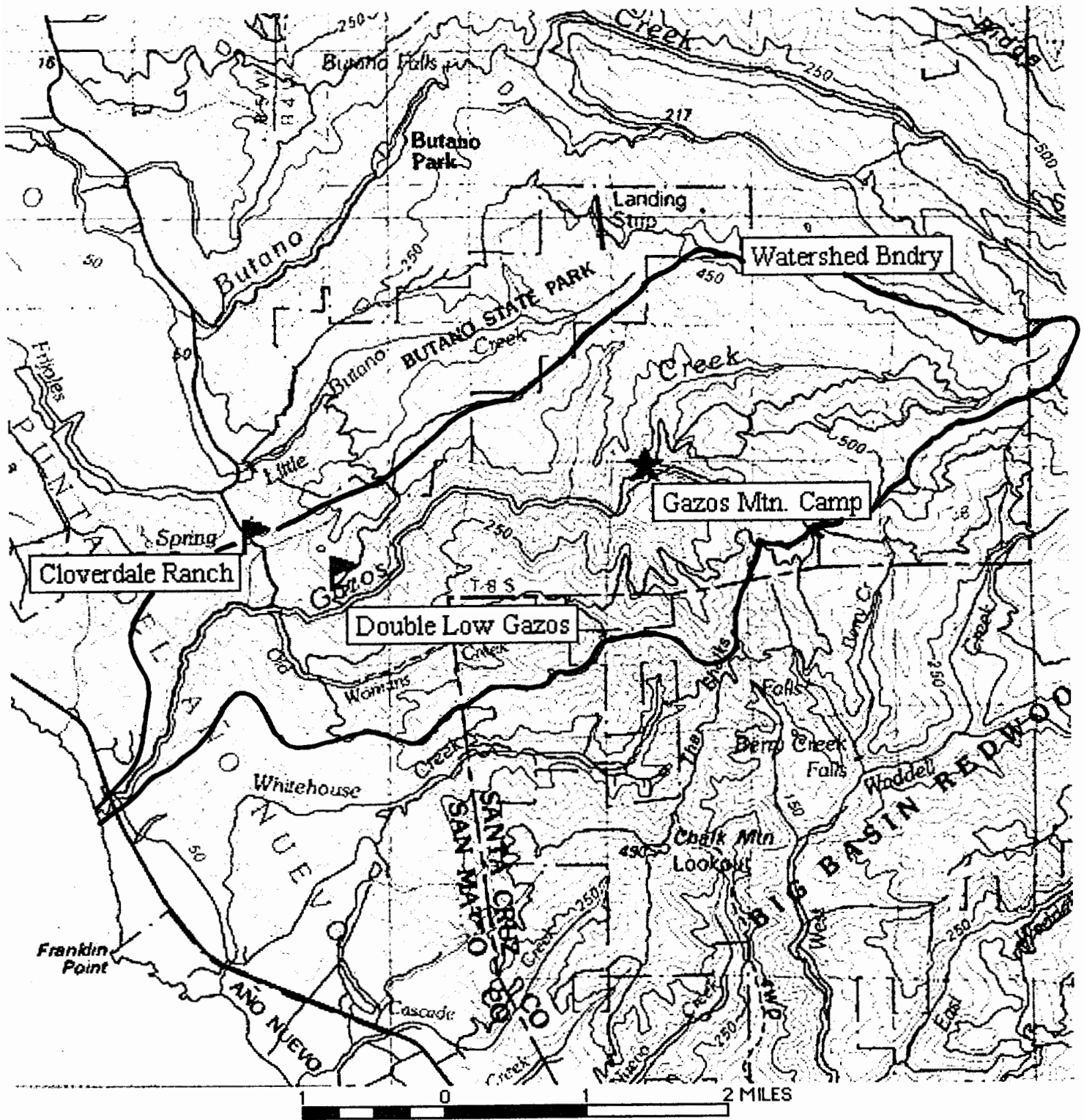
A condition of the Council's grant was that there be an on-going monitoring program of murrelet use at the Gazos Mountain Camp and surrounding watershed (see Figure 2). A monitoring program that utilized ground protocol surveys at Gazos Mountain Camp and radar surveys in the lower canyon was developed in 1998 and fully implemented in 1999. Ground observer surveys were used to determine general murrelet detection levels and types of murrelet activities near the old-growth stand, while ornithological radar was used to develop a watershed-specific index of murrelet abundance that could be used to determine changes in murrelet use and total numbers over time (for example, see Cooper et al. 1999a, b, Singer and Hamer 1999). Unlike the Pacific Seabird Group protocol surveys that use ground observers, radar surveys actually sample bird numbers (not artifacts of the birds like calls or short flight segments), and can provide an index of the population size that can be monitored from year to year to detect changes in bird abundance (Cooper et. al., 1999 a, b). We analyzed our initial data using the MONITOR (Gibbs, 1995) software program and initially designed a radar monitoring program to detect changes in murrelet use of the watershed that prescribed 7 surveys per year for 6 years. A review of the program parameters and radar results after the 2000 field season led to an extension of the number of survey years needed from 6 years to 8 years. A more rigorous power analysis of the radar data through 2001 is currently underway and results of that analysis will be reported elsewhere.

Figure 1. Location of Gazos Mountain Camp and the 2001 radar survey stations in the Santa Cruz Mountains.



Printed from TOPO! ©1996 Wildflower Productions (www.topo.com)

Figure 2. Location of radar sites in or near Gazos Canyon and Gazos Mtn. Camp.



Printed from TOPO! ©1996 Wildflower Productions (www.topo.com)

METHODS

The methods used reflected the objectives of the monitoring program, which were to determine if murrelet use of the Gazos Mountain Camp property and the Gazos Creek Watershed changed over time. As in any monitoring program, we realized that it would take a period of years to determine if murrelet use had increased, decreased, or remained stable. Ornithological radar was selected as the best tool available to determine trends in the inland abundance of the birds. Radar has an advantage over other approaches (such as radio telemetry) because it does not stress or harm the birds.

Radar Surveys

Radar surveys were conducted using a Furuno model FCR-1141, 10-kW, X-band radar unit with a 2 meter long slotted wave guide array antenna that is sensitive enough to detect birds at a distance of up to 1.2 km. Pulse length could be set at 0.08, 0.6, or 1.0 μ sec, depending on range setting, which was either 0.5 or 0.75 nautical miles. The radar beam had a vertical span of 25 degrees and a horizontal beam width of 2 degrees. A biologist experienced in interpretation of radar echoes monitored the screen and recorded murrelet detections on a data sheet. The radar screen was recorded for the duration of each survey using a Sony 8mm video camera. These recordings were reviewed later to ensure that no murrelet detections were missed.

Murrelet detections on the radar screen were distinguished from detections made by other bird species on the basis of echo size, flight speed, and flight behavior. Radar surveys started 75 minutes before sunrise and ended 75 minutes after sunrise, and followed recommended procedures for conducting radar surveys in the appendix to the Pacific Seabird Group's "Methods for Surveying Marbled Murrelets in Forests" (Cooper and Hamer 2000).

Radar surveys were conducted in July. Eight surveys were conducted at the Double Low Gazos radar survey site (see Figure 2), but one was incomplete and not added to the database. Three radar surveys were conducted in other watersheds (see Figures 1 and 2) to provide comparative data.

Ground Observer Protocol Surveys

Ground observer protocol surveys were conducted in the ball field area of Gazos Mountain Camp in May, June, and July. All ground observer surveys were conducted according to the Pacific Seabird Group protocol (PSG Marbled Murrelet Technical Committee, 1994).

RESULTS AND DISCUSSION

Ground Observer Protocol Surveys

A total of 12 ground observer surveys were conducted at Gazos Mountain Camp – 3 in May, 3 in June, and 6 in July. Results are presented in Tables 1, 2, and 3.

Table 1. Results of May 2001 ground observer surveys – Gazos Mtn. Camp. Values for the mean, standard deviation (s.d.) and coefficient of variation (C.V.) are given at the bottom of each column where appropriate.

Date	% Overcast	Number of Detections (# visuals)	Number of Occupied Behaviors	Number of Single Silent Birds Below Canopy	Number of Silent Pairs Below Canopy
5/5/01	33	6 (0)	0	0	0
5/19/01	33	6 (0)	0	0	0
5/26/01	33 - 66	12 (1)	1	0	0
Mean		x = 8.00	x = 0.33		
s.d.		s.d. = 3.464			
C.V.		C.V. = 0.433			

Table 2. Results of June 2001 ground observer surveys – Gazos Mtn. Camp. Values for the mean, standard deviation (s.d.), and coefficient of variation (C.V.) are given at the bottom of each column.

Date	% Overcast	Number of Detections (# visuals)	Number of Occupied Behaviors	Number of Single Silent Birds Below Canopy	Number of Silent Pairs Below Canopy
6/9/01	66 – 0	12 (0)	0	0	0
6/16/01	0	4 (0)	0	0	0
6/23/01	100	11 (1)	1	0	0
Mean		x = 9.0	x = 0.33		
s.d.		s.d. = 4.359			
C.V.		C.V. = 0.484			

Table 3. Results of July 2001 ground observer surveys – Gazos Mtn. Camp. Values for the mean, standard deviation (s.d.), and coefficient of variation (C.V.) are given at the bottom of each column.

Date	% Overcast	Number of Detections (# visuals)	Number of Occupied Behaviors	Number of Single Silent Birds Below Canopy	Number of Silent Pairs Below Canopy
7/7/01	66 – 33	26 (3)	3	0	0
7/9/01	100	34 (16)	7	2	1
7/14/01	100	85 (60)	6	2	4
7/18/01	100	85 (43)	29	3	3
7/26/01	100	105 (79)	43	2	1
7/30/01	100	53 (25)	19	1	4
Mean		x = 64.66	x = 17.83	x = 1.666	x = 2.166
s.d.		s.d. = 31.703	s.d. = 15.728	s.d. = 0.715	s.d. = 1.722
C.V.		C.V. = 0.490	C.V. = 0.882	C.V. = 0.429	C.V. = 0.795

Results from 2001 are comparable with results from 1998 and 2000, but are not directly comparable to results from 1999 because surveying was conducted in different months and marbled murrelet detection levels typically show high seasonal variation (PSG Marbled Murrelet Tech. Comm. 1994). Tables 4 and 5 provide 1998, 2000, and 2001 data from the same month for comparative purposes.

Table 4. Comparison of the total detections and visual detections of Marbled Murrelets by ground observers – July 1998, July 2000, and July 2001 at Gazos Mountain Camp. Results were ranked from high to low by number of total detections.

1998 Detections		2000 Detections		2001 Detections	
Date	Total and (# of Visuals)	Date	Total and (# of visuals)	Date	Total and (# of Visuals)
7/20	49 (22)	7/16	100 (66)	7/26	105 (79)
7/16	42 (11)	7/15	67 (46)	7/14	85 (60)
7/14	41 (17)	7/1	59 (31)	7/18	85 (43)
7/22	38 (14)	7/11	57 (22)	7/30	53 (25)
7/18	28 (10)	7/10	36 (15)	7/9	34 (16)
7/17	18 (6)	7/22	25 (13)	7/7	26 (3)

Table 5. Comparison of the number of occupied behaviors and single silent birds below canopy (SSBBC) detected by ground observers - July 1998, July 2000, and July 2001 at Gazos Mountain Camp. Results were ranked from high to low by the number of occupied behaviors.

1998 Detections		2000 Detections		2001 Detections	
Date	Occupied Behaviors and (SSBBC)	Date	Occupied Behaviors and (SSBBC)	Date	Occupied Behaviors and (SSBBC)
7/14	16 (10)	7/16	31 (1)	7/26	43 (2)
7/20	13 (4)	7/15	21 (0)	7/18	29 (3)
7/22	13 (3)	7/1	15 (0)	7/30	19 (1)
7/16	10 (3)	7/10	10 (0)	7/9	7 (2)
7/18	7 (3)	7/11	7 (4)	7/14	6 (2)
7/17	5 (1)	7/22	6 (1)	7/7	3 (0)

Tables 4 and 5 show an increase in overall detections and occupied behaviors from 1998 to 2001. However, the data are not statistically significant. It is quite difficult to demonstrate that changes in ground survey detection numbers from year to year are meaningful. Jodice (1998) conducted ground surveys at 5 sites in the Oregon Coast Range **on a near-daily basis** throughout the season for three breeding seasons. He found there to be a high variation in daily activity levels and concluded that the power of ground surveys to detect annual declines in detections of 25 percent and 50 percent were only “very low” and “moderate”, respectively.

Radar Surveys

Eleven radar surveys were conducted during July of 2001, 8 of which were at the Double Low Gazos site downstream of Gazos Mountain Camp, included one incomplete survey due to operator error. Results of the 7 complete surveys are presented in Table 6. For a detection to be

labeled as either “in-bound” or “out-bound”, the bird’s flight path had to be within 45 degrees of a line running along the long axis of the canyon. Detections labeled as “other” were of murrelets flying in other directions.

Table 6. Year 2001 results of radar surveys for murrelets at Double Low Gazos. Values for the mean (x), standard deviation (s.d.), and coefficient of variation (C.V.) are given at the bottom.

Date	% Overcast	Number of Detections	In-bound Detections & (% of Total)	Out-bound Detections & (% of Total)	Other Detections & (% of Total)
7/10/01	100	30	9 (30%)	18 (60%)	3 (10%)
7/12/01	100	30	6 (20%)	12 (40%)	12 (40%)
7/14/01	100	35	10 (29%)	8 (23%)	17 (49%)
7/15/01	100	29	11 (38%)	12 (41%)	6 (21%)
7/17/01	100	27	4 (15%)	11 (41%)	12 (44%)
7/18/01	100	36	5 (14%)	2 (6%)	29 (81%)
7/21/01	100	30	7 (23%)	5 (17%)	18 (60%)
Totals		217	52 (24%)	68 (31%)	97 (45%)
Mean		x = 31.00	x = 7.42	x = 9.71	x = 13.86
s.d.		s.d. = 3.26	s.d. = 2.63	s.d. = 5.25	s.d. = 8.59
C.V.		C.V. = 0.105	C.V. = 0.354	C.V. = 0.540	C.V. = 0.619

The 2001 radar total detection values ranged from 27 to 36, with a mean of 31.00. These numbers compare with the 2000 values of 30 to 68 and 46.14, respectively. Table 7 shows a comparison of the totals, means, and variation between radar surveys in 2000 and 2001 at Double Low Gazos.

Table 7. Comparison of the totals, means, standard deviations, and coefficients of variation between 2000 and 2001 radar surveys at Double Low Gazos.

Detection Type	Parameter	2000	2001
All Detections	Total	323	217
	Mean	46.142	31.000
	Standard Deviation	13.801	3.265
	Coefficient of Variation	0.299	0.105
In-bound Detections	Total (and % of All)	85 (26%)	52 (24%)
	Mean	12.142	7.428
	Standard Deviation	4.298	2.636
	Coefficient of Variation	0.353	0.354
Out-bound Detections	Total (and % of All)	144 (45%)	68 (31%)
	Mean	20.571	9.714
	Standard Deviation	10.244	5.250
	Coefficient of Variation	0.498	0.540
Other Detections	Total (and % of All)	94 (29%)	97 (45%)
	Mean	13.428	13.857
	Standard Deviation	7.322	8.591
	Coefficient of Variation	0.545	0.619

Radar surveys were undertaken at two other locations in 2001 – Cloverdale Ranch (Goat Ranch Road) (see Figures 1 and 2) and Purisima Creek (see Figure 1). Cloverdale Ranch is along an apparent flight corridor to Little Butano Canyon from the ocean or lower Gazos Creek. Purisima Creek is the northernmost documented of occurrence of murrelets in the Santa Cruz Mountains. The most recent surveys for murrelets in Purisima were several ground observer surveys conducted in 1996. Those and detections done in previous years had low values (typically 0 – 3 detections except for cases where a birds or birds were sighted repeatedly) and suggested that only a small number of birds were using Purisima Canyon for breeding (Singer, unpublished data). Consequently it was decided to conduct a radar survey here to determine if this “subpopulation” was still present. A radar survey would provide more thorough census than a ground observer survey. Results of this survey and the Cloverdale Ranch surveys are given in Table 8 below.

Table 8. Results of radar surveys for marbled murrelets at other locations in the Santa Cruz Mountains in 2001.

Station	Location	2001 Total Detections and (Date)
Goat Ranch Road	Cloverdale Ranch	13 (7/16/01)
Goat Ranch Road	Cloverdale Ranch	21 (7/22/01)
Purisima Creek	Purisima Creek Open Space Preserve	8 (7/20/01)

The Cloverdale Ranch station is located in Cloverdale Valley not far from Gazos Creek Canyon. The majority of detections here were of birds flying from west to east or vice-versa; and from southwest to northeast, or vice-versa. These are routes that connect Little Butano Canyon to the ocean. The Purisima Creek station was located in Purisima Creek Open Space Preserve about 5 miles upstream from the ocean. The Preserve contains a low density of scattered residual old-growth trees (some containing suitable nest platforms) and two very small stands of old-growth forest (Singer and Bulger 2000). The survey station was in the main canyon downstream of the old-growth stands, but not far from forest with residual old-growth trees. The detection of murrelets on 7/20/01 confirms that murrelets are still using this canyon. However, since 1996, the lower canyon has been occupied by a large roost of common ravens, which forage throughout the preserve and through which murrelets need to fly each day. Because ravens are a known predator of murrelets, the future viability of this subpopulation remains very uncertain. We believe that as other canyons with murrelet breeding populations become more densely populated with murrelet predators (such as the common raven and the peregrine falcon), the remaining canyons with a low density of these predators, such as Gazos Creek Canyon, will become more valuable as breeding habitat. Monitoring the population trend in Gazos Creek Canyon, as we are attempting to do, will help to document if this is the case.

CONCLUSION AND RECOMMENDATIONS

Both radar and ground observer surveys are useful tools in monitoring murrelet use of Gazos Mountain Camp and the Gazos Creek Watershed. The ground observer surveys are providing evidence of nesting at the Gazos Mountain Camp through the detection of occupied behaviors and the detection of single silent murrelets flying below the canopy. Radar surveys are providing us information on the numbers of murrelets using the watershed, how those numbers compare to other areas, and will, if the monitoring program is extended, tell us if the Gazos Creek population is increasing, decreasing, or stable over time. We have hired a statistician to help us to decide how to best use the funds that are available and to compare the MONITOR population modeling software with other software that is available.

To optimize our use of the remaining funds it is our tentative recommendation that only the core surveys of this project be undertaken in future years. These would be 6 ground surveys at Gazos Mountain Camp in July and 7 radar surveys at Double Low Gazos between July 10 and July 17.

LITERATURE CITED

Cooper, B.A. and T.E. Hamer. 2000. Use of Radar for Marbled Murrelet Surveys, in, Marbled Murrelet Technical Committee, ed., Methods for Surveying Marbled Murrelets in Forests: An Update to the Protocol for Land Management and Research. Pacific Seabird Group, Seattle, WA.

Cooper, B.A., M.G. Raphael, and D.M. Evans. 1999a. Radar Studies of Marbled Murrelets on the Olympic Peninsula, Washington, 1996 - 1998. Unpubl. report prepared for the USDA Forest Service, Olympia, WA., by A.B.R., Inc., Forest Grove, OR.

Cooper, B.A., C. Strong, and N. Bentivoglio. 1999b. Radar-based Monitoring of Marbled Murrelets in Oregon. Unpubl. report prepared for USFWS, Portland, OR., by A.B.R., Inc., Forest Grove, OR.

Gibbs, J.P. 1995. Monitor: Users Manual. Dept. of Biology, Yale University, New Haven, CT.

Jodice, P. G. R. 1998. Behavioral Ecology of Marbled Murrelets in Forest and Marine Ecosystems of Oregon. Ph.D. Dissertation, Dept. of Wildlife Science, Oregon State University, Corvallis, OR.

PSG Marbled Murrelet Technical Committee. 1994. Methods for Surveying for Marbled Murrelets in Forests: A Protocol for Land Management and Research. Unpubl. report for Pacific Seabird Group, Seattle, WA.

Singer, S.W. 1998. Murrelet Habitat Management Guidelines for the Gazos Mountain Camp Property. Report prepared for the Sempervirens Fund and the Apex Houston Trustee Council, by 'Steven Singer Environmental and Ecological Services', Santa Cruz, CA.

Singer, S.W. and J. Bulger. 2000. The Extent of Old-growth Forest in the Santa Cruz Mountains. Unpublished draft report prepared for the Big Creek Lumber Company by 'Steven Singer Environmental and Ecological Services', Santa Cruz, CA.

Singer, S.W. and T.E. Hamer. 1998. Summary of Findings – Use of Radar to Monitor Marbled Murrelets in Gazos Creek and Adjoining Watersheds in the Santa Cruz Mountains. Report prepared for Sempervirens Fund and the Apex Houston Trustee Council, by 'Steven Singer Environmental and Ecological Services', Santa Cruz, CA.

Singer, S.W. and T.E. Hamer. 1999. Gazos Creek Marbled Murrelet Monitoring Program – 1999 Annual Report. Report prepared for Sempervirens Fund and the Apex Houston Trustee Council, by 'Steven Singer Environmental and Ecological Services', Santa Cruz, CA.

Singer, S.W. and T.E. Hamer. 2001. Gazos Creek Marbled Murrelet Monitoring Program – 2000 Annual Report. Report prepared for Sempervirens Fund and the Apex Houston Trustee Council by 'Steven Singer Environmental and Ecological Services', Santa Cruz, CA.

ACKNOWLEDGEMENTS

We would like to thank the Apex Houston Trustee Council, the Oil Spill Prevention and Response Office of the California Department of Fish and Game, and the Sempervirens Fund for providing funding and support for this monitoring program. We are grateful for the cooperation provided to us by the California State Parks Department (especially the staff at Butano State Park), the Pescadero Conservation Alliance, the Peninsula Open Space Trust, the Midpeninsula Regional Open Space District, and Mr. Jim Rourke. Last, but not least, we wish to thank our hard-working, early-rising field crew of Melanie Spies, the radar technician/biologist who conducted the radar surveys; and Bryan Mori, the field biologist who did the ground protocol surveys.