

**CALIFORNIA DEPARTMENT OF FISH AND GAME**

**PENINSULAR BIGHORN SHEEP RECOVERY**

**2008 ANNUAL REPORT**

*A cooperative effort by the California Department of Fish and Game, U.S. Fish and Wildlife Service, and California Department of Parks and Recreation*



photo by Janene Colby

*This report presents information on the status, distribution, and management of peninsular bighorn sheep in eastern San Diego County and portions of Riverside and Imperial Counties, California, from January 1, 2008 through December 31, 2008.*

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## SUMMARY

This report highlights information collected by the California Department of Fish and Game (CDFG) over the reporting period, 1 January 2008 through 31 December 2008 relating to bighorn sheep (*Ovis canadensis*) in the Peninsular mountain ranges of southern California. The Peninsular bighorn sheep population contains nine designated recovery regions occupying portions of western Riverside and Imperial Counties and eastern San Diego County. CDFG conducted monitoring activities in seven of nine recovery regions located east of Highway 74: Central Santa Rosa Mountain (CSRM), Southern Santa Rosa Mountain (SSRM), Coyote Canyon (CoC), North San Ysidro Mountain (NSYM), South San Ysidro Mountain (SSYM), Vallecito Mountain (VM), and Carrizo Canyon (CC). CDFG jointly monitored CSRM with the Bighorn Institute (BI), while the Northern Santa Rosa Mountain (NSRM) and San Jacinto Mountain (SJM) recovery regions located west of Highway 74 were monitored solely by BI.

CDFG conducted ground monitoring of radio-collared sheep in the SSRM, CoC, NSYM, and SSYM recovery regions at least three days per week. Ground monitoring of collared sheep in the CSRM, VC, and CC recovery regions occurred as opportunity allowed. Ground monitoring efforts were focused on: 1) detection of mortality signals from collared sheep; 2) recording locations of collared sheep moving between recovery regions; and 3) observation of lambs associated with collared ewes to determine survival. Aerial telemetry monitoring was conducted from a Cessna 185 fixed-winged aircraft for all recovery regions two to three times per month. Aerial flights were used to monitor collared sheep for mortality and track movement.

During November 2008, CDFG in conjunction with BI, United States Fish and Wildlife Service (USFWS) and California Department of Parks and Recreation (CDPR) conducted two separate aerial population surveys. Survey results indicated that bighorn sheep in the peninsular ranges continued to increase in distribution and number. As of 31 December 2008, an estimated 773 adult bighorn sheep occupied the seven recovery regions located east of Highway 74 and the range-wide population is estimated at 876. The number of radio-collared sheep occurring east of Highway 74 at the beginning of 2008 was 90 (12M/78F) and as of 31 December 2008 the number of collared sheep was 75 (7M/68F).

The CDFG, in cooperation with BI and USFWS carried out the capture and radio-collar replacement of one adult male bighorn in the SJM recovery region on June 6, 2008.

## PERSONNEL

### **CDFG Resource Management and Air Services Divisions**

Oversight for recovery of peninsular bighorn sheep in 2008 was provided by Mr. Steve Torres, Senior Environmental Scientist with the Department's Resource Management and Policy Division. Statewide Bighorn Sheep Program management was carried out by the Resource Management and Policy Division's Dr. Ben Gonzales, Associate Wildlife Veterinarian. Dr. Gonzales also managed Bighorn Sheep Program funding and was the

statewide bighorn sheep veterinary coordinator. Mr. Tom Evans, Warden/Pilot for the Department's Air Services Division piloted all aerial telemetry flights.

### **CDFG South Coast Region, Wildlife Management Program**

Mr. Randy Botta, Associate Wildlife Biologist for the South Coast Region, provided oversight for field and aerial monitoring, assisted with aerial monitoring flights and mortality investigations, and supervised one field position working east of Highway 74. Mr. Botta also served as lead for capture and population survey plan development and field operations for the entire Peninsular Ranges. Field telemetry monitoring and mortality investigation and reporting were carried out by Ms. Janene Colby, Scientific Aid with the South Coast Region. Ms. Colby also provided assistance during capture and population survey efforts for the entire Peninsular Ranges.

## **RECOVERY PROGRAM OVERVIEW**

Activities conducted during 2008 were tied to recovery elements contained in Section 2 of the recovery plan for peninsular bighorn sheep. Section 2 of the recovery plan addresses the need to "Initiate or continue research programs necessary to monitor and guide recovery efforts". Activities conducted in 2008 are covered in sections II.D.2.1 (Monitor population status), II.D.2.1.2 (Monitor distribution), and II.D.2.1.4 (Monitor survivorship and cause-specific mortality) of the recovery plan.

### **Telemetry Monitoring**

As recommended in the recovery plan for peninsular bighorn sheep, CDFG maintains, to the extent possible, active VHF radio-collars on approximately 25-30% of all females in each recovery region. The number of new collars to be fitted in each recovery region to maintain this ratio of marked (radio-collared) females is based on aerial helicopter surveys conducted during the fall of even numbered years. Capture operations to fit needed collars on sheep are conducted during the fall of the proceeding survey year. At the beginning of the 2008 reporting period the seven recovery regions east of Highway 74 contained a total of 90 (12M/78F) active collars. The number of collars fitted to males and/or females and percentage of marked females in each recovery region were:

- CSRМ = 17 (4M/13F) : 40%
- SSRМ = 15 (1M/14F) : 22%
- CoC = 10 (2M/8F) : 38%
- NSYM = 13 (1M/12F) : 29%
- SSYM = 10 (2M/8F) : 45%
- VM = 13 (2M/11F) : 35%
- CC = 12 (0M/12F) : 13%

By the end of 2008 the seven recovery regions located east of Highway 74 contained a total of 75 (7M/68F) radio-collared adult sheep. Collars were lost through mortality in the CSRМ, SSRМ, CoC, NSYM, SSYM, VM, and CC recovery regions while collars

became non-functional in the CSRSM and VM recovery regions (see Survival and Lamb Mortality Monitoring). The number of collars in each recovery region and the number fitted to males and/or females and percentage of marked females in each recovery region at the end of 2008 were:

- CSRSM = 13 (2M/11F) : 28%
- SSRM = 13 (0M/13F) : 25%
- CoC = 8 (1M/7F) : 30%
- NSYM = 12 (1M/11F) : 24%
- SSYM = 8 (2M/6F) : 23%
- VM = 10 (1M/9F) : 21%
- CC = 11 (0M/11F) : 17%

Specific monitoring objectives for 2008 as described in the recovery plan for peninsular bighorn sheep were:

- (1) Monitor the status, dynamics, and trends of bighorn sheep.
- (2) Determine distribution and movement patterns of adult sheep. Identify whether or not there is significant movement of ewes within, and between recovery regions.
- (3) Monitor adult survivorship and cause-specific mortality. Continue to collect data in a manner that will allow comparison of survivorship and cause-specific mortality among recovery regions, years, and management strategies.
- (4) Identify and monitor disease, pathogens and vectors that may be limiting adult productivity and lamb survivorship.

### **Population Size and Estimation**

As of 31 December 2008, the seven recovery regions located east of Highway 74 contained an estimated 773 adult and yearling bighorn sheep. This represented 88% of all adult and yearling sheep in the peninsular ranges at that time. During November 2008 two separate aerial population surveys were conducted by CDFG in the peninsular ranges. A total of 449 adult sheep (157M/292F) and 84 lambs were observed east of Highway 74 (Table 1) and 43/84 (51%) of the radio-collared sheep present were observed. Population ratios for the seven recovery regions are provided in Table 2.

The first survey was conducted in the SSRM, CSRSM, NSRM, and SJM recovery regions during 4-7 November 2008 in cooperation with BI and USFWS. Within the Santa Rosa Mountains seven polygons were surveyed in 19 hours of flight time and 55 radio-collared sheep were distributed throughout the mountain range. A total of 183 adult sheep (66M/117F), 36 lambs, and 28/55 (51%) of the collared sheep present were observed. Individual mark-resight population estimates for adult and yearling sheep in the two recovery regions east of Highway 74 were: CSRSM = 122 and SSRM =155.

A second survey was conducted in the CoC, NSYM, SSYM, VM, and CC recovery regions during 17-21 November 2008 in cooperation with the USFWS and CDPR. Bighorn habitat in 16 of 18 polygons was surveyed; two polygons were not surveyed due to time constraints and 54 radio-collared sheep were distributed throughout the recovery regions. A total of 307 adult bighorn (106M/201F), 54 lambs, and 26/54 (48%) of the collared sheep were observed. Individual mark-resight population estimates for adult and yearling bighorn sheep were: CoC = 52, NSYM = 82, SSYM = 53, VM = 215, and CC = 563. A secondary simultaneous double-count population estimate was also generated for the five recovery regions resulting in a population estimate (including lambs) of 535. For comparison, double-count estimates for adult and yearling sheep were generated for the VM and CC recovery regions due to the low number of collared sheep sighted and resulting large abundance estimates. Double-count estimates for adult and yearling sheep in the VM and CC recovery regions were 123 and 186.

**Table 1. Summary of bighorn sheep observed during 2008 aerial surveys**

Recovery Region	Lambs	Yrlg. Ewes	Adult Ewes	Cl. I (yrlg.) Rams	Cl. II Rams	Cl. III Rams	Cl. IV Rams	Total
CSRM	21	6	34	4	4	3	11	<b>88</b>
SSRM	9	5	46	5	9	6	9	<b>89</b>
CoC	13	1	26	1	3	5	4	<b>53</b>
NSYM	8	5	36	0	6	4	13	<b>72</b>
SSYM.	7	1	25	0	2	3	3	<b>41</b>
VM	8	9	33	1	6	13	14	<b>84</b>
CC	18	5	60	3	5	13	7	<b>111</b>
<b>Total</b>	<b>84</b>	<b>32</b>	<b>260</b>	<b>14</b>	<b>35</b>	<b>47</b>	<b>61</b>	<b>533</b>

**Table 2. Observed bighorn sheep ratios from 2008 aerial surveys**

Recovery Region	Lamb:Ewe <sup>a</sup>	Lamb: Ewe <sup>b</sup>	Yearling:Ewe <sup>c</sup>	Ram:Ewe <sup>d</sup>	Ram:Ewe <sup>e</sup>
CSRM	0.62	0.54	0.26	0.53	0.56
SSRM	0.20	0.18	0.22	0.52	0.57
CoC	0.50	0.48	0.08	0.46	0.48
NSYM	0.22	0.20	0.14	0.64	0.56
SSYM	0.28	0.27	0.04	0.32	0.31
VM	0.24	0.19	0.30	1.00	0.81
CC	0.30	0.28	0.13	0.42	0.43
<b>Overall</b>	<b>0.32</b>	<b>0.29</b>	<b>0.17</b>	<b>0.55</b>	<b>0.54</b>

<sup>a</sup> lambs per adult ewe.

<sup>b</sup> lambs per ewe (yearling and adult females combined)

<sup>c</sup> yearlings per adult ewe (male and female yearlings combined).

<sup>d</sup> adult ram per adult ewe (excludes yearling females and yearling males).

<sup>e</sup> includes yearling ewes and yearling rams

## **Distribution and Movement**

During 2008, CDFG monitored 90 adult radio-collared bighorn sheep in seven recovery regions located east of Highway 74 to document habitat use, distribution, and movement. Field staff detected collared and un-collared bighorn sheep of various age classes and sex regularly moving between recovery regions and between different geographic areas in the same recovery region. Movement across natural landscapes and two lane highways were documented and collared sheep inhabited new areas anywhere from a few days to several months.

***Central Santa Rosa Mountains:*** CDFG monitored 17 adult radio-collared bighorn sheep (4M/13F) in this recovery region. Aerial monitoring of collared sheep was conducted two to three times per month. Throughout 2008, collared sheep were primarily documented inhabiting the La Quinta and Martinez Canyon areas of the CSRM. Collared sheep in the La Quinta area were regularly detected in Sheep, Coyote, Bear, Devil, and Guadalupe Canyons and occasionally detected in Deep Canyon and on Indio and Eisenhower Mountains. Further to the south, collared sheep were detected in Martinez, Toro, and Agua Alta Canyons.

Movement of radio-collared sheep from the CSRM to either the NSRM or SSRM recovery regions was not detected. However, ground monitoring by BI detected movement of un-collared sheep from the CSRM to the NSRM. Additionally, an adult ewe and ram were struck and killed by vehicles on separate occasions while crossing Highway 74 to the NSRM.

***Southern Santa Rosa Mountains:*** CDFG monitored 15 adult radio-collared bighorn sheep (1M/14F) in this recovery region. Monitoring was conducted by air two to three times per month with ground monitoring occurring as opportunity allowed. Collared sheep in the SSRM were regularly documented between Sheep and Barton Canyons as well as the upper and mid-elevations of Palm, Big, Travertine, and Wonderstone Washes. Due to the presence of year round water in Rattlesnake Canyon, collared sheep were consistently detected in this canyon, as well as Coachwhip, Smoke Tree, and Palo Verde Canyons.

Movement of SSRM radio-collared sheep to other recovery regions or notable movement within the recovery region was not documented in 2008.

***Coyote Canyon:*** CDFG monitored 10 adult radio-collared sheep (2M/8F) in this recovery region. Aerial monitoring was conducted three to four times per month with ground monitoring occurring at least once per week. Collared sheep in CoC were regularly documented during winter (November through April) on Coyote Peak and during summer (May through October) in or adjacent to Box Canyon. During summer, collared sheep obtained water from Coyote Creek between Lower and Middle Willows.

Movement of three radio-collared females and one male to the NSYM recovery region were documented during 2008. As in 2007, these females occupied Coyote Peak during

winter and the northern end of the NSYM during summer. Between May and June the collared females along with their lambs moved to Box Canyon where they then crossed CoC at Lower Willows to the NSYM. In June, one of the collared females was detected on mortality in Lower Willows. Movement of the collared male between CoC and NSYM was recorded on several occasions during the six months the ram was collared. CDFG detected the ram on mortality in upper Borrego Palm Canyon (NSYM) in April 2008 and one of the collared females in Lower Willows during June 2008.

***Northern San Ysidro Mountains:*** CDFG monitored 13 adult radio-collared bighorn sheep (1M/12F) in this recovery region. Monitoring was conducted by air two to three times per month with ground monitoring occurring at least three times per week. Of the collared sheep inhabiting the NSYM, three females and one male were regularly documented in Hellhole Canyon; five females were regularly documented in Borrego-Palm Canyon; and four females were regularly documented in Watertank Canyon. Collared females in Borrego-Palm Canyon occupied Indian Head Peak during lambing but moved out of the canyon in winter where they occupied nearby east facing slopes. Several collared sheep inhabiting Hellhole Canyon were documented in lower Borrego-Palm Canyon during summer due to presence of available water. Collared sheep inhabiting Watertank Canyon were not documented south of Henderson Canyon during 2008 and obtained water from Coyote Creek at or below Lower Willows.

Movement of one collared female and one male to the SSYM recovery region was documented during 2008. Both collared sheep crossed Highway S-22 (Montezuma Grade) below Dry Canyon to the SSYM. While in the SSYM the collared ewe briefly occupied lower Tubb Canyon while the collared ram moved across Tubb Canyon and occupied Pinyon Ridge.

***Southern San Ysidro Mountains:*** CDFG monitored 10 adult radio-collared bighorn sheep (2M/8F) in this recovery region. Monitoring was conducted by air two to three times per month with ground monitoring occurring at least three times per week. Collared sheep in the SSYM were documented on Pinyon Ridge and Tubb Canyon during summer and on Yaqui Ridge during winter.

Movement of two radio-collared females from Yaqui Ridge to the VM recovery region across Highway 78 between Quartz Vain Wash and Nude Wash was documented during 2008. In addition, these females were also documented moving between Pinyon Ridge and Yaqui Ridge across Highway S-3 at Yaqui Pass within the SSYM recovery region. In February 2008 one of these collared ewes was struck and killed by a vehicle while crossing Highway 78 between Quartz Vain Wash and Nude Wash.

***Vallecito Mountains:*** CDFG monitored 13 adult radio-collared bighorn sheep (2M/11F) in this recovery region. Monitoring was conducted by air two to three times per month with ground monitoring occurring two to three times per month. Collared sheep were documented throughout the recovery region from Split Mountain in the east to Plum Canyon in the west. From east to west sheep were documented in the following areas, Split Mountain, Alma Wash, Fish Creek Wash, Harper Canyon, Sunset Mountain, Whale

Peak (June Wash), Nolina Wash, Bighorn Canyon, Mine Wash, Stag Cove, Lizard Wash, and Plum Canyon. A majority of collared sheep occupied Split Mountain, Sunset Mountain, and Lizard Wash/Plum Canyon throughout the year while others moved seasonally between these “core” areas and other areas in the recovery region, including the Fish Creek Mountains. Several collared sheep were documented moving between the VC and SSYM.

Movement of three radio-collared females to the Fish Creek Mountains via Split Mountain was documented in 2008. Additionally, one collared female and one ram were documented moving between VM and SSYM. Both sheep crossed Highway 78 multiple times and at various places throughout the year. Crossing areas included points between Quartz Vain and Nude Wash, Stag Cove, (possibly crossed Highways S-3 and 78), and a point between Lizard Wash and Plum Canyon. In December 2008 the collared ram was detected on mortality in the SSYM just north of Tamarisk campground.

***Carrizo Canyon:*** CDFG monitored 12 adult radio-collared bighorn sheep (0M/12F) in this recovery region. Monitoring was conducted by air two to three times per month with ground monitoring occurring as opportunity allowed. All collared sheep were regularly documented during summer (May through October) in the lower portion of the canyon. Specific areas where collared sheep were detected included Sweeney Canyon to upper Carrizo Palm Canyon in the Jacumba Mountains and Indian Gorge in the Tierra Blanca Mountains. During winter (November through April) eleven of the twelve collared females were documented in the Coyote Mountains. The remaining collared ewe remained in the lower portion of CC.

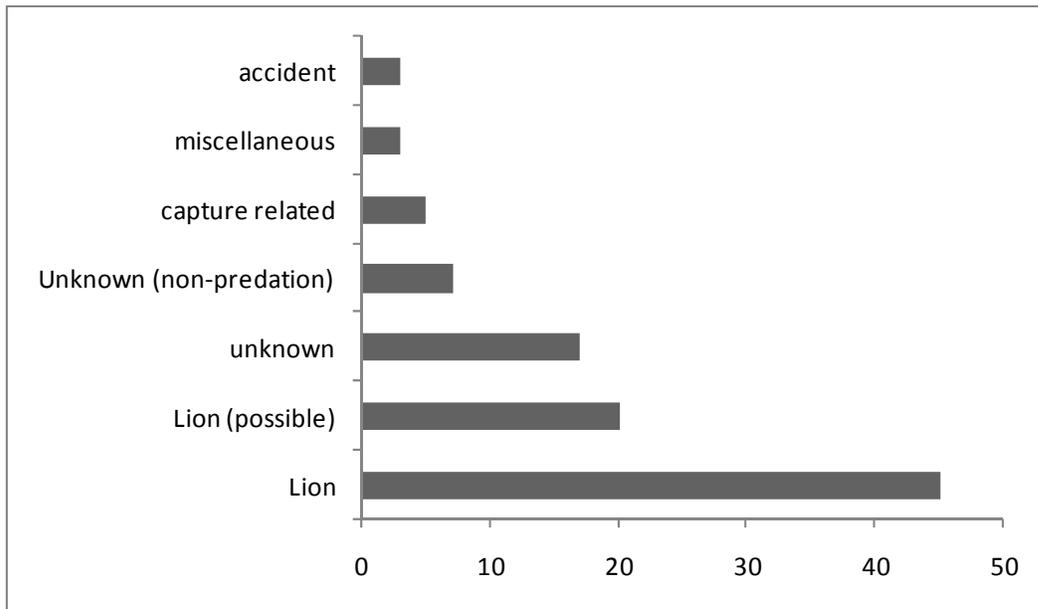
No movement of collared sheep to other recovery regions was documented during 2008. However, as noted above, all but one of the collared females moved to the Coyote Mountains during the winter. In 2008, as in past years, collared sheep moved to Sweeney Canyon from locations within CC in late October or early November and subsequently crossed Highway S-2 at Sweeney Pass into the Coyote Mountains. Collared sheep were regularly documented in or adjacent to Fossil Canyon, Painted Gorge, and Carrizo Mountain. By June, all collared sheep had moved from the Coyote Mountains to CC.

### **Survival and Lamb Mortality Monitoring**

In 2008, CDFG detected and investigated 12 (4M/8F) adult radio-collared bighorn sheep mortalities east of Highway 74 (Table 3). Mortalities by recovery region were CSR = 3; SSR = 2; CoC = 2; NSYM = 1; SSYM = 2; VM = 1; and CC = 1. Causes of mortality and percentage of all mortalities were lion predation = 5 (42%); probable lion predation = 3 (25%); vehicle = 1 (8%); miscellaneous = 1 (8%); and unknown = 2 (17%). Causes and percentage of documented mortalities in 2008 were consistent with that documented since 1993 (Figure 1.)

**Table 3. Cause of death for collared sheep – January 1 to December 31, 2008**

Sheep ID	Location	Sex	Age (yrs.)	month	cause
163	SSYM	F	10	January	Lion
9130	SSRM	F	8	February	Lion
164	SSYM	F	9	February	Vehicle
211	NSYM	M	6	April	Lion
219	CoC	F	4	June	Unknown (non-predation)
157	CC	F	13	June	Lion (probable)
178	CoC	F	9	September	Lion (probable)
0930	SSRM	M	Adult	October	Lion (probable)
9080	CSRM	F	5	October	Lion
9090	CSRM	F	Adult	November	Unknown
0950	CSRM	M	Adult	November	Lion
171	VM	M	9	December	Chronic Tooth Infection



Percent by Cause (1993 – 2008)

Figure 1. Percent of sheep mortalities by cause 1993 to 2008.

Of the 12 mortalities involving radio-collared sheep documented in 2008, 7 (58%) occurred during winter and spring (November through May). This timing pattern was consistent with known sheep mortalities documented since 1993 (Figure 2). The number of collared sheep mortalities in 2008 was higher than that documented in 2007 and above the range of four to eight mortalities documented over the previous five years.

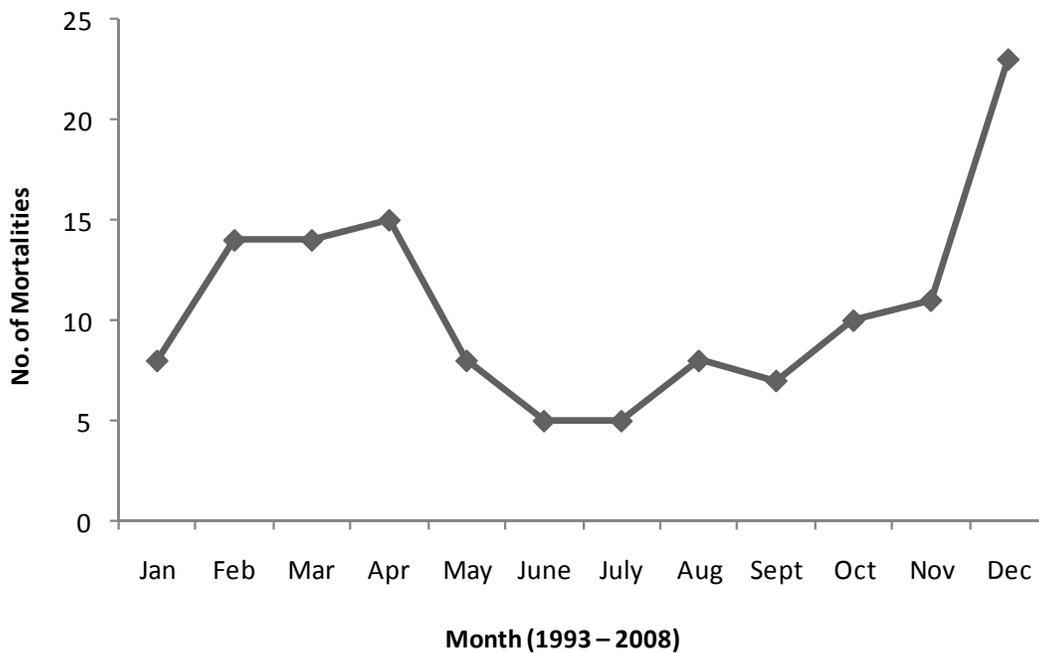


Figure 2. Number of sheep mortalities by month from 1993 through 2008

### ***Lamb Mortality Monitoring***

In 2007, CDFG documented several sick lambs and lamb deaths in Borrego-Palm Canyon located in the NSYM. Results from the 2007 Anza-Borrego Desert State Park (ABDSP) waterhole count held in July indicated a low lamb:adult female ratio (lambs per 100 females = 7%) in Borrego-Palm Canyon relative to other locations (12% for the SSYM, 26% for CoC, and 78% for Rattlesnake Springs in the SSRM). Numerous hikers had also reported finding sick or dead lambs in Borrego-Palm Canyon during the spring of 2007. As a result of anecdotal evidence of high lamb mortality, CDFG initiated a pilot study in 2008 in order to test the feasibility and logistics of monitoring the NSYM and SSYM. The main objective was to examine lamb survival to 3 and 6 months and examine the timing of parturition, lamb production, lamb:adult female ratios, and timing of sick lambs and lamb deaths.

CDFG monitored a total of 23 marked females in the NSYM ( $n = 13$ ) and SSYM ( $n = 10$ ) between January - May and August - September 2008. In the SSYM, there were 8 females with functional VHF radio-collars, 1 female with a non-functional collar, and 1 ear-tagged female. In the NSYM, there were 12 females with functional VHF radio-collars and 1 female with a non-functional collar. Data collected during monitoring were used to generate descriptive statistics for collared females and their lambs as well as non-

collared females and lambs concerning timing of parturition, lamb production, lamb survival to 3 months and 6 months, timing of sick lambs, and lamb deaths, lamb:ewe ratios (lambs per 100 females), female yearling:adult female ratios, young female:adult female ratios, and male:female ratios for both the NSYM and SSYM. Lamb production for radio-collared females was higher in the NSYM (92%) than the SSYM (78%); however, survival to 3 and 6 months was lower in the NSYM (75% and 21% respectively) than the SSYM (86% and 57% respectively).

A full report for the 2008 lamb mortality monitoring effort will be submitted to USFWS and CDPR upon completion anticipated by March 31, 2009.

## **Captures**

In cooperation with BI and USFWS, CDFG captured and re-collared an adult male bighorn on June 6, 2008 in the SJM. The sheep was captured in Hurricane Canyon using a net-gun fired from a helicopter and then flown to a base camp in Blaisdell Canyon for processing. During processing a non-functional Global Positioning System (GPS) radio-collar was replaced with a mortality-sensing VHF collar and the following samples and data were collected: blood, pharyngeal swab, nasal swab, feces, hair, parasites, and vital signs. The ram was released without incident and diagnostic disease testing results were normal.

## **2009 CDFG Proposed Activities**

In 2009, CDFG will continue on going monitoring efforts involving:

- (1) Monitoring the status, dynamics, and trends of bighorn sheep.
- (2) Determining the distribution and movement patterns of adult sheep and identifying whether or not there is significant movement of ewes within, and between recovery regions.
- (3) Monitoring adult survivorship and cause-specific mortality and data collection in a manner that will allow comparison of survivorship and cause-specific mortality among recovery regions, years, and management strategies.
- (4) Identifying and monitoring disease, pathogens and vectors that may be limiting adult productivity and lamb survivorship.
- (5) Conducting fall captures to fit new or replacement radio-collars on adult males and/or females throughout the peninsular ranges, including SJM, NSRM, SSRM, CoC, NSYM, SSYM, VM, and CC.