Pronghorn Monitoring in the Pinedale Anticline Project Area: 2012 Annual Report

Prepared for:

Pinedale Anticline Project Office (PAPO)
P.O. Box 768, Pinedale, WY 82941

Prepared by:

Ryan M. Nielson and Hall Sawyer

Western EcoSystems Technology, Inc.
200 South 2nd St., Suite B, Laramie, WY 82070

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WEST Inc.
Environmental & Statistical Consultants

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SUGGESTED CITATION

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SECTION I: Wildlife monitoring and mitigation matrix

OVERVIEW

As part of the record of decision for gas development in the Pinedale Anticline Project Area (PAPA), the Bureau of Land Management (BLM) developed a Wildlife Monitoring and Mitigation Matrix (WMMM) that provides direction for development-phase wildlife monitoring (BLM 2008). For pronghorn (*Antilocapra americana*), the WMMM was intended to identify monitoring parameters that allow changes in pronghorn abundance to be quantitatively assessed. The WMMM specifies that mitigation measures will be triggered if a 15% decline in pronghorn abundance in the PAPA is detected in any year, or a cumulative change over all years beginning in the winter of 2009-10, relative to changes in the larger Sublette herd unit reference area. This threshold was not exceeded in the 2011-12 winter. Here, we report monitoring results for the winter of 2011-12.

METHODS

Abundance

We estimated pronghorn abundance in the PAPA in January, February, and March 2012 using aerial line transect surveys. The goal of each survey was to obtain a complete count of the number of pronghorn occupying each study area. Conducting multiple surveys allowed us to assess the variability in occupancy over time and estimate the average number of pronghorn occupying the study area during the winter period.

Line transects were spaced approximately ½-mile apart and were flown in an east-west orientation (Fig. 1) using fixed-wing aircraft flying at 300–400 feet above ground level (AGL) to minimize animal disturbance. Locations of all detected pronghorn groups were recorded using a Global Positioning System (GPS), and group sizes were visually counted. Groups with >50 animals were recorded with a hand-held video recorder (Sony HD Handycam HDR-CX100), so that group size could be determined by image analysis.

Figure 1. Survey transects over the Pinedale Anticline Project Area.

Video images were analyzed in the office by two independent observers. When a video clip could be reduced to one still image containing an entire pronghorn group, the two observers reviewed the image independently, and then collectively, until consensus was reached on the total group size (Fig. 2). When a video clip could not be reduced to a single image containing the entire group, we used the average of the two counts from independent observers viewing the same video clip as the estimated group size. The sum totals of observed group sizes were considered estimates of the total number of pronghorn occupying the PAPA during each survey.

Figure 2. Example of a pronghorn group count (*n* = 165) based on a video clip from an aerial survey.

We calculated 90% confidence intervals (CIs) for each abundance estimate using a bootstrap procedure (Manly 2006) that involved randomly selecting one of the two observer counts for non-consensus counts and adding those to the sum of group sizes from the consensus counts. This process accounted for the variation between observers in counting large groups. A total of 200 bootstrap samples were used to calculate 90% CIs based on the central 90% of the bootstrap distribution (i.e., "Percentile Method") for each estimate.

Pronghorn abundance varied substantially during the 2009-10, 2010-11, and 2011-12 winters, so we calculated an average abundance for each winter. Ninety-percent CIs were calculated by randomly sampling, with replacement, 2 survey days (for 2009-10 monitoring period; Nielson and Sawyer 2011) or 3 survey days (for 2010-11 and 2011-12 monitoring periods) from each winter, using the bootstrap procedure described above, and then averaging the new total counts. In addition, we calculated the percent change in abundance from the 2009-10 winter to the 2011-12 winter.

As requested by PAPO, we compared abundance estimates for the PAPA with those estimated by the Wyoming Game and Fish Department (WGFD) for the entire Sublette herd unit reference area. We note that using the herd unit as a reference area is of limited value because the reference area should not contain the PAPA, as the treatment will affect what is observed in the reference. Thus, the comparison does not allow potential treatment effects (e.g., gas

development) to be discerned from the reference area. Additionally, the WGFD herd unit estimates were based on POPII models that estimate population size from doe to fawn ratios, hunter success, winter severity, and adult survival. The WGFD herd estimates were not based on actual counts and do not have any measure of precision.

RESULTS

Trends of Abundance: PAPA compared to Sublette Herd Unit

Pronghorn abundance in the PAPA was highly variable (see Section III for Discussion). We counted 2,200 pronghorn in 19 groups on January 30th, 1,126 pronghorn in 7 groups on February 28th, and 2,258 pronghorn in 86 groups on March 21st (Table 1, Fig. 3). Based on these 3 surveys, the estimated average number of pronghorn occupying the PAPA during 2011-12 winter was 1,861 (90% CI: 1,473 – 2,242), compared to 1,533 (90% CI: 772 – 2,305) in the 2009-10 winter. This represents a 21% increase in average abundance on the PAPA from 2009-10 to 2011-12 winters. However, this increase was not statistically significant at an alpha level of $\alpha = 0.10$ (90% CI: 68% decline to 186% increase).

In contrast, WGFD population estimates for the entire Sublette herd unit reference area were 59,000 in 2010 and 40,800 in August of 2011, representing a 31% decline. We note that the WGFD estimates were modeled from POPII software and have no confidence intervals associated with them. For future herd unit estimates, WGFD models will use a more statistically rigorous approach based on AICc (corrected Akaike Information Criterion) values (Burnham and Anderson 2002). Past herd unit estimates (i.e., 2009-10 to 2011-12) will be adjusted to reflect new modeling projections.

Table 1. Abundance estimates from winter aerial surveys over the Pinedale Anticline Project Area. Ninety percent confidence intervals are to the right of each total count, unless a consensus was reached on all group sizes (indicated by 90% CI = 'NA').

	Winter					
	2009-10		2010-11		2011-12	
Month	Estimate	90% CI	Estimate	90% CI	Estimate	90% CI
January	775	782 767	1,420	1,425 1,415	2,200	NA NA
February	2,290	2,323 2,256	505	NA NA	1,126	1,142 1,109
March	NA	NA NA	1,184	NA NA	2,258	2,263 2,253
Average	1,533	2,305 772	1,036	1,344 731	1,861	2,242 1,473

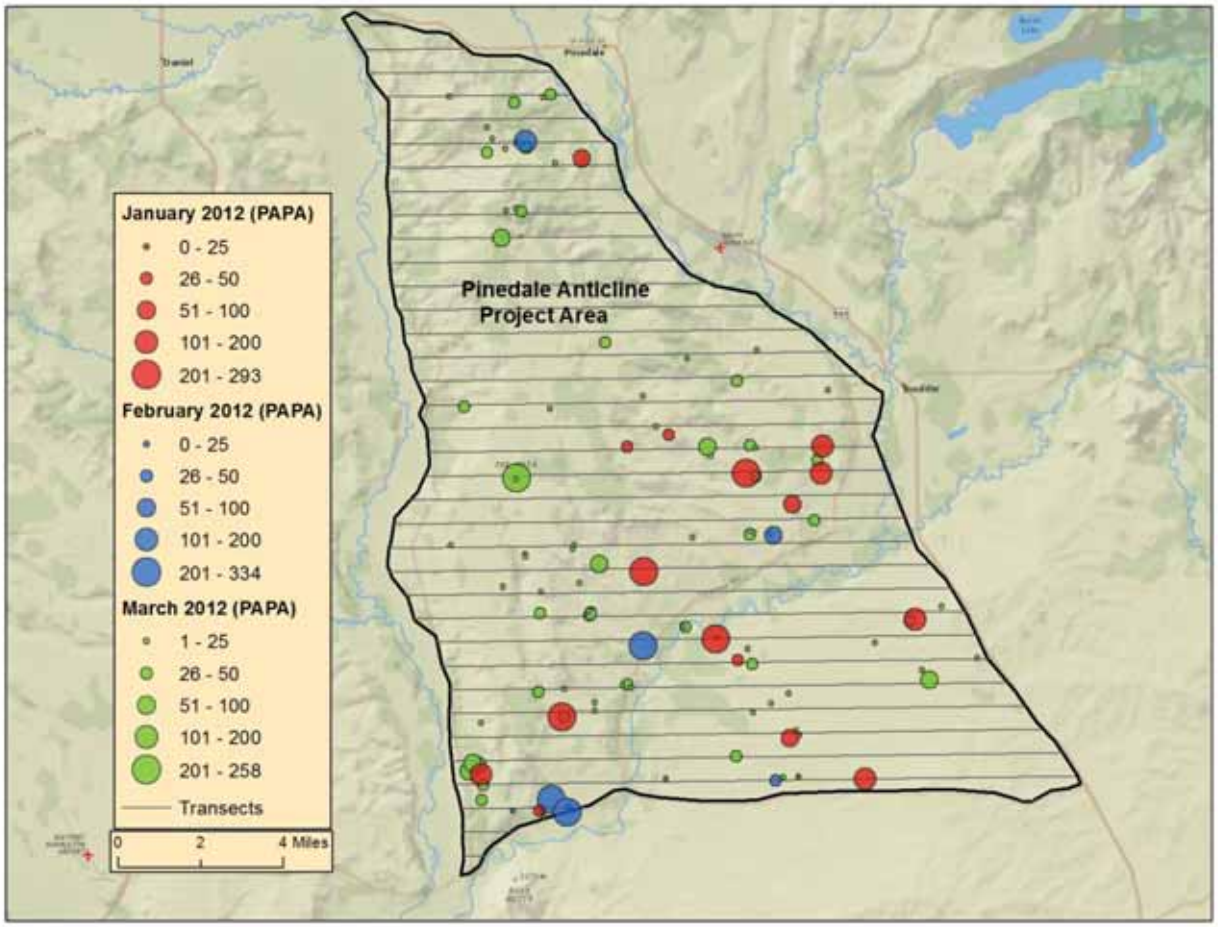

Figure 3. Location and relative size of pronghorn groups observed during aerial surveys over the Pinedale Anticline Project Area.

DISCUSSION

The current methodology for estimating pronghorn abundance does not adhere to common line transect distance methodology (Buckland et al. 2001), but instead is based on a 'complete count' technique (Seber 2002), that accounts for differences in observers viewing each video segment, and variability across surveys. Current application of the complete count technique involves flying a dense sample of line transects (spaced ½-mile apart), attempting to locate every group of pronghorn in the study area, and using high-definition video images to determine group size. A key assumption of this method is that few, if any pronghorn groups were missed or incorrectly counted.

The problem with application of traditional line transect distance methodology (Buckland et al. 2001) for pronghorn during the winter is the assumption that animals do not move in response to observers. Obviously, pronghorn are very mobile and react quickly to nearby aircraft, which would

likely violate this assumption and result in observers detecting groups after movement and further from the transect line.

At this time, we believe the 'complete count' approach is the preferred method and that surveying line transects ½-mile apart using HD video to determine group size is likely the most efficient and reliable method of estimating pronghorn abundance. However, it should be recognized that this technique can only produce an index, and not a complete count, unless we are confident that all pronghorn were detected and none were double-counted. Regardless of whether the estimate is considered a complete count or an index of abundance, this approach should provide a reliable means to monitor trends in pronghorn abundance through time. It is our opinion that the winter surveys provide accurate estimates of abundance when snow conditions are optimal – when pronghorn congregate in large groups and probability of detection is high.

The WMMM specifies that mitigation measures will be triggered if a 15% decline in pronghorn abundance in the PAPA is detected in any year compared to the first year of abundance monitoring (2009-10 winter), or a cumulative change over all years since the first year, relative to the larger Sublette herd unit reference area. Although we estimated a 21% increase in occupancy of the PAPA in 2011-12 compared to 2009-10, this increase was not statistically significant at an alpha level of $\alpha = 0.10$ based on CIs overlapping with 0.0.

SECTION II: RESOURCE SELECTION MODELING

OVERVIEW

As part of the pronghorn monitoring effort we attempt to maintain a sample (~30 animals) of GPS-collared pronghorn in both the Pinedale Anticline Project Area (PAPA) and Bench Corral Study Area to document movements and help ensure abundance estimates were not influenced by movements of animals between the two areas (i.e., marked animals occupy their respective winter ranges when we conduct counts). The GPS data provide additional opportunity to examine winter habitat use patterns and update migration routes for the PAPA and Bench Corral Study Area sub-populations.

METHODS

Capture and Collaring

We captured 30 adult female pronghorn on January 12, 2012 and equipped them with store-on-board GPS collars (Generation 4; Telonics, Inc., Mesa, AZ) that were programmed to collect locations every 3 hours and drop off April 1, 2013. Capture efforts were split between the PAPA (n=13) and Bench Corral Study Area (n=17; Fig. 4). We attempted to sample pronghorn in proportion to their relative abundance across both winter ranges. On December 12, 2012 we captured 6 additional animals, including 4 in the PAPA and 2 in Bench Corral, to put out collars from animals that died during 2012. We attempted to sample pronghorn in proportion to their relative abundance across both winter ranges (Fig. 4).

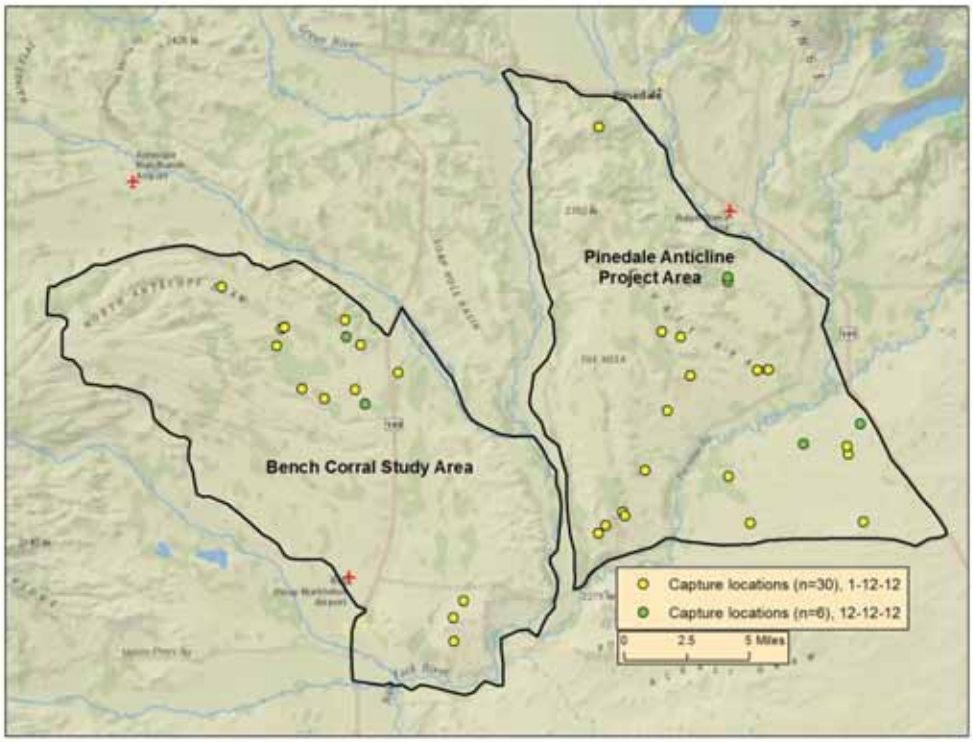

Figure 4. Capture locations of pronghorn in the Pinedale Anticline Project Area and Bench Corral Study Area on January 12 and December 12, 2012.

Habitat Use

Habitat use analysis will not be completed until the summer of 2013, after GPS collars are recovered from marked animals.

SECTION III: Sex and age classification surveys and trends in pronghorn abundance in the Pinedale Anticline Project Area (PAPA) and the Bench Corral Study Area.

OVERVIEW

As part of the pronghorn monitoring effort we conducted ground-based surveys to estimate the number of fawns and bucks per 100 does within the PAPA and Bench Corral Study Area during each winter. Age and sex ratios from the two study areas were compared to ratios developed by the WGFD for the entire Sublette herd unit reference area based on surveys conducted August 2011. In addition, we estimated pronghorn abundance in the Bench Corral Study Area in January, February, and March 2012 using aerial line transect surveys. The goal of each survey was to obtain a complete count of the number of pronghorn occupying the study area. Conducting multiple surveys allowed us to assess the variability in occupancy over time and estimate the average number of pronghorn occupying the area during the winter period.

METHODS

Sex and age classification surveys

Ground surveys were conducted within 24 hours of each aerial survey. The PAPA and Bench Corral Study Area were surveyed on consecutive days. We attempted to classify a minimum of 400 animals in each area during each survey. Ninety-percent CIs were calculated for each estimate using a bootstrap procedure (Manly 2007). The bootstrap process involved taking 200 simple random samples with replacement of individual groups observed during the ground surveys, and re-calculating the age/sex ratios to produce 200 new estimates. The 5 and 95% percentiles of the bootstrap distribution were used as lower and upper 90% confidence limits, respectively.

Abundance

Pronghorn abundance in the PAPA and Bench Corral Study Area was estimated for each winter, beginning in 2009-10, using the same methods described in Section I. Again, line transects were spaced approximately ½-mile apart and were flown in an east-west orientation (Fig. 5) using fixed-wing aircraft flying at 300–400 feet above ground level (AGL) to minimize animal disturbance. Locations of all detected pronghorn groups were recorded using a GPS, and group sizes were visually counted. Groups with >50 animals were recorded with a hand-held video recorder (Sony HD Handycam HDR-CX100), so that group size could be determined by image analysis.

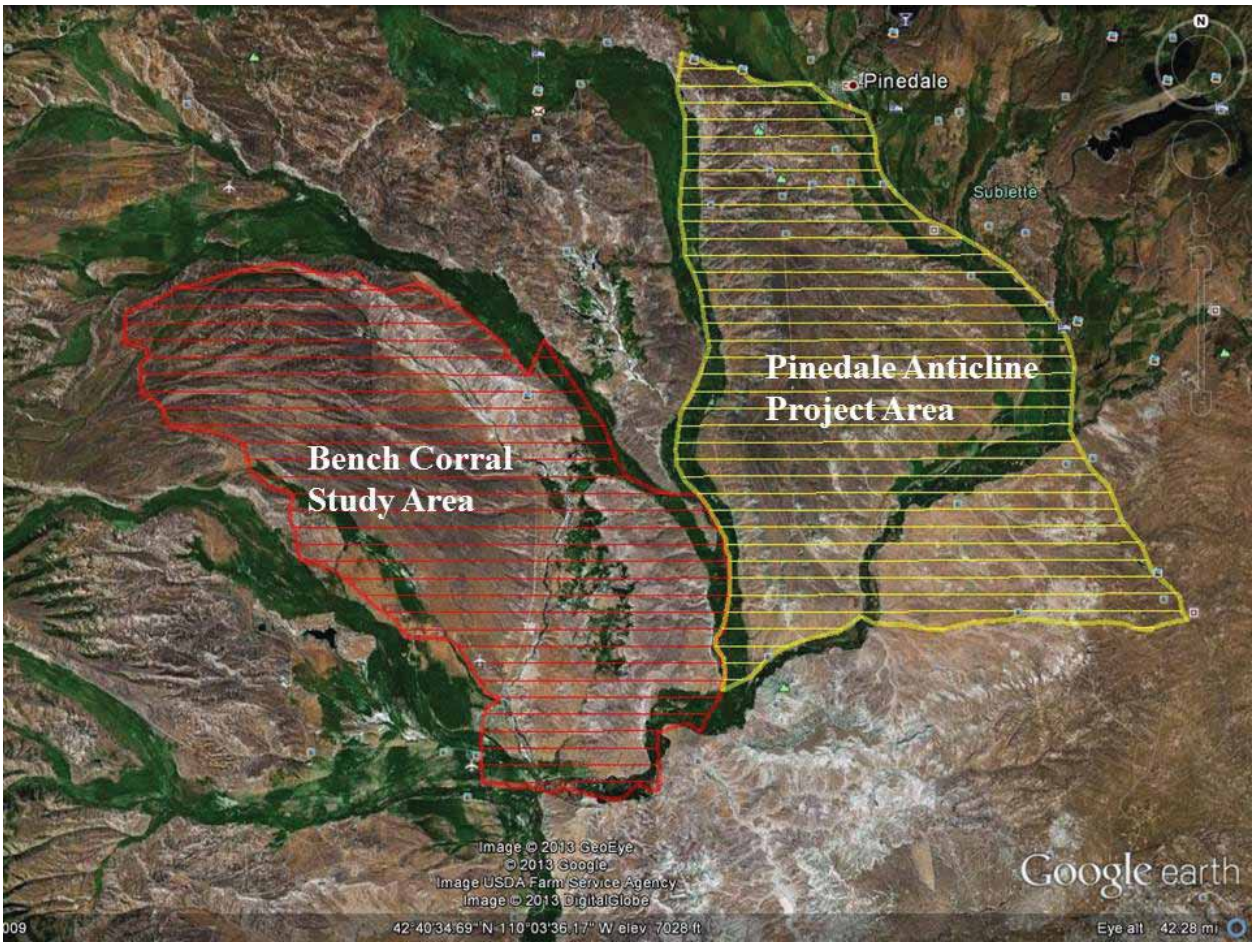

Figure 5. Survey transects in the Pinedale Anticline Project Area and the Bench Corral Study Area.

RESULTS

Sex and age classification surveys

The average number of fawns per 100 does was 28.2 (90% CI: 23.9 to 33.7) in the PAPA and 21.4 (90% CI: 16.9 to 25.5) in the Bench Corral Study Area (Table 2). The WGFD estimate for the entire Sublette herd unit reference area based on surveys conducted August 2011 was 63 fawns per 100 does.

The average number of bucks per 100 does was 49.7 (90% CI: 46.4 to 53.3) in the PAPA and 39.1 (90% CI: 31.0 to 46.3) in the Bench Corral Study Area (Table 3). The WGFD estimate for the entire Sublette herd unit reference area based on surveys during the summer of 2011 was 59 bucks per 100 does.

Table 2. The number of fawns observed per 100 does, along with 90% confidence intervals, based on ground surveys in January, February and March of 2012, for the Pinedale Anticline Project Area (PAPA) and the Bench Corral (BC) Study Area.

Area (Survey)	# Groups	Fawns per 100 Does	90% Confidence Interval Lower Limit	90% Confidence Interval Upper Limit
PAPA (Jan)	4	33.5	25.92	39.9
PAPA (Feb)	5	22.6	18.5	34.2
PAPA (Mar)	16	29.5	22.1	40.5
PAPA (Jan, Feb & Mar)	25	28.2	23.9	33.7
BC (Jan)	5	30.3	21.4	34.0
BC (Feb)	4	17.1	11.8	25.6
BC (Mar)	13	21.0	17.1	23.5
BC (Jan, Feb, & Mar)	22	21.4	16.9	25.5
PAPA and BC (Jan)	9	32.3	28.6	37.1
PAPA and BC (Feb)	9	19.8	16.2	25.4
PAPA and BC (Mar)	29	24.8	21.1	30.1
PAPA and BC (Jan, Feb & Mar)	47	24.8	21.5	28.0

Table 3. The number of bucks observed per 100 does, along with 90% confidence intervals, based on ground surveys in January, February and March of 2012, for the Pinedale Anticline Project Area (PAPA) and the Bench Corral (BC) Study Area.

Area (Survey)	# Groups	Bucks per 100 Does	90% Confidence Interval Lower Limit	90% Confidence Interval Upper Limit
PAPA (Jan)	4	43.2	40.6	46.0
PAPA (Feb)	5	52.2	52.1	52.3
PAPA (Mar)	16	53.2	45.2	63.6
PAPA (Jan, Feb & Mar)	25	49.7	46.4	53.3
BC (Jan)	5	48.3	26.3	55.3
BC (Feb)	4	44.7	35.0	64.3
BC (Mar)	13	28.6	21.7	37.0
BC (Jan, Feb, & Mar)	22	39.1	31.0	46.3
PAPA and BC (Jan)	9	45.2	38.3	49.5
PAPA and BC (Feb)	9	48.4	42.5	55.4
PAPA and BC (Mar)	29	39.5	32.9	47.7
PAPA and BC (Jan, Feb & Mar)	47	44.4	40.2	49.1

Abundance

Pronghorn abundance in the PAPA was highly variable. We counted 2,200 pronghorn in 19 groups on January 30th, 1,126 pronghorn in 7 groups on February 28th, and 2,258 pronghorn in 86 groups on March 21st (Table 1, Fig. 3). Based on these 3 surveys, the estimated average number of pronghorn occupying the PAPA during 2011-12 winter was 1,861 (90% CI: 1,473 – 2,242), compared to 1,533 (90% CI: 772 – 2,305) in the 2009-10 winter. This represents a 21% increase in average abundance on the PAPA from 2009-10 to 2011-12 winters. However, this increase was not statistically significant at an alpha level of $\alpha = 0.10$ (90% CI: 68% decline to 186% increase).

In contrast, pronghorn abundance was less variable in the Bench Corral Study Area across the three surveys during the winter of 2011-12. We counted 1,856 pronghorn in 21 groups on January 30th, 1,528 pronghorn in 12 groups on February 27th, and 1,772 pronghorn in 37 groups on March 20th (Table 4, Fig. 6). The average number of pronghorn occupying in the Bench Corral Study Area during the three surveys was 1,718 (90% CI: 1,591 – 1,837), compared to 2,742 (90% CI: 2,670 – 2,808) in the 2009-10 winter. This represents a statistically significant 37% decrease in the average abundance in the Bench Corrals Study Area from 2009-10 to 2011-12 winters (90% CI: 28% decline to 50% increase).

Table 4. Abundance estimates for the Pinedale Anticline Project Area (PAPA) and Bench Corral (BC) Study Area from winter aerial surveys. Ninety percent confidence intervals are to the right of each total count, unless a consensus was reached on all group sizes.

		Winter					
		2009-10		2010-11		2011-12	
	Month	Estimate	90% CI	Estimate	90% CI	Estimate	90% CI
PAPA	January	775	782 767	1,420	1,425 1,415	2,200	NA NA
	February	2,290	2,323 2,256	505	NA NA	1,126	1,142 1,109
	March	NA	NA NA	1,184	NA NA	2,258	2,263 2,253
	Average	1,533	2,305 772	1,036	1,344 731	1,861	2,242 1,473
Bench Corral	January	2,682	2,713 2,656	1,307	1,318 1,294	1,856	1,871 1,840
	February	2,802	2,817 2,785	2,088	2,094 2,082	1,528	1,561 1,494
	March	NA	NA NA	1,524	NA NA	1,772	1,787 1,756
	Average	2,742	2,808 2,670	1,640	1,902 1,375	1,718	1,837 1,591

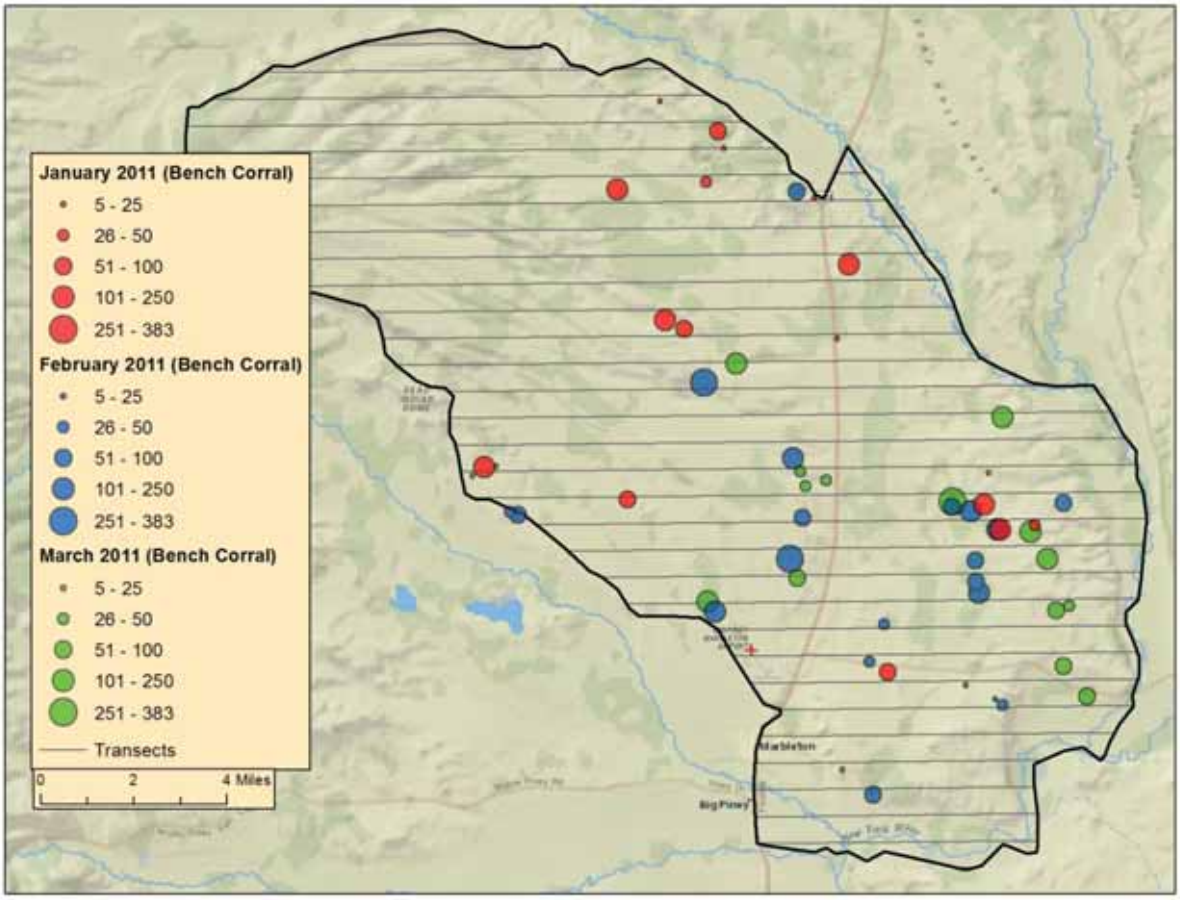

Figure 6. Location and relative size of pronghorn groups observed during aerial surveys over the Bench Corral Study Area

DISCUSSION

Although we estimated a 21% increase in occupancy of the PAPA in 2011-12 compared to 2009-10, this increase was not statistically significant at an alpha level of $\alpha = 0.10$ based on overlapping CIs. The high variability in the estimates of pronghorn abundance in the PAPA and Bench Corral could be the result of changing snow conditions and probability of detection. However, we believe a more likely explanation is movement of animals outside of the designated study areas. Specifically, the southern boundaries of both study areas appear to be fluid. Pronghorn in the Sand Draw or Duke's Triangle region of the PAPA often move south of highway 351 and occupy a range that extends 10-20 miles south of the study area. Pronghorn that winter east of HWY 189 in the Bench Corral area appear to move south beyond the Green River another 10-15 miles. For example, on our March telemetry flight, 10 marked animals were outside of the designated study areas, including 4 from Bench Corral and 6 from PAPA. The GPS collars that will be recovered this spring will contain 2 consecutive years of data and provide detailed information on how many, and how often, animals move outside of the designated study areas.

The winter of 2009-10 was the first attempt to estimate pronghorn abundance in the PAPA and Bench Corral Study Area. In 2009-10 we tested two different HD video cameras, and we did not conduct a March survey due to a lack of snow and early detected migration of pronghorn from the study areas. Thus, we recommend considering the winter of 2009-10 to be a 'pilot' year, and winter of 2010-11 as the baseline to which future abundance estimates will be compared to determine if the WMMM trigger has been met. If the 2010-11 winter is considered the baseline for calculating future changes in abundance, there was an estimated 80% increase in occupancy of the PAPA in 2011-12 (90% CI 12% increase to 206% increase).

It is not clear why the winter estimates of the numbers of fawns and bucks per 100 does in the PAPA and Bench Corral Study Area were so different from the WGFD estimates for the entire Sublette Herd Unit based on surveys conducted in August of 2011. However, differences in the timing of the surveys and the spatial extent covered during each survey may have produced estimates that are not directly comparable.

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