Pronghorn Monitoring in the Pinedale Anticline Project Area

DRAFT 2016 Annual Report

Prepared for:

Pinedale Anticline Project Office (PAPO)

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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. Here, we report monitoring results for the winter of 2015-16, where estimates indicate an increase in pronghorn abundance of the PAPA since 2009-10.

Methods

We estimated pronghorn abundance in the pronghorn survey area which was representative of the PAPA (hereafter PAPA) in January and February 2016 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 abundance 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 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.

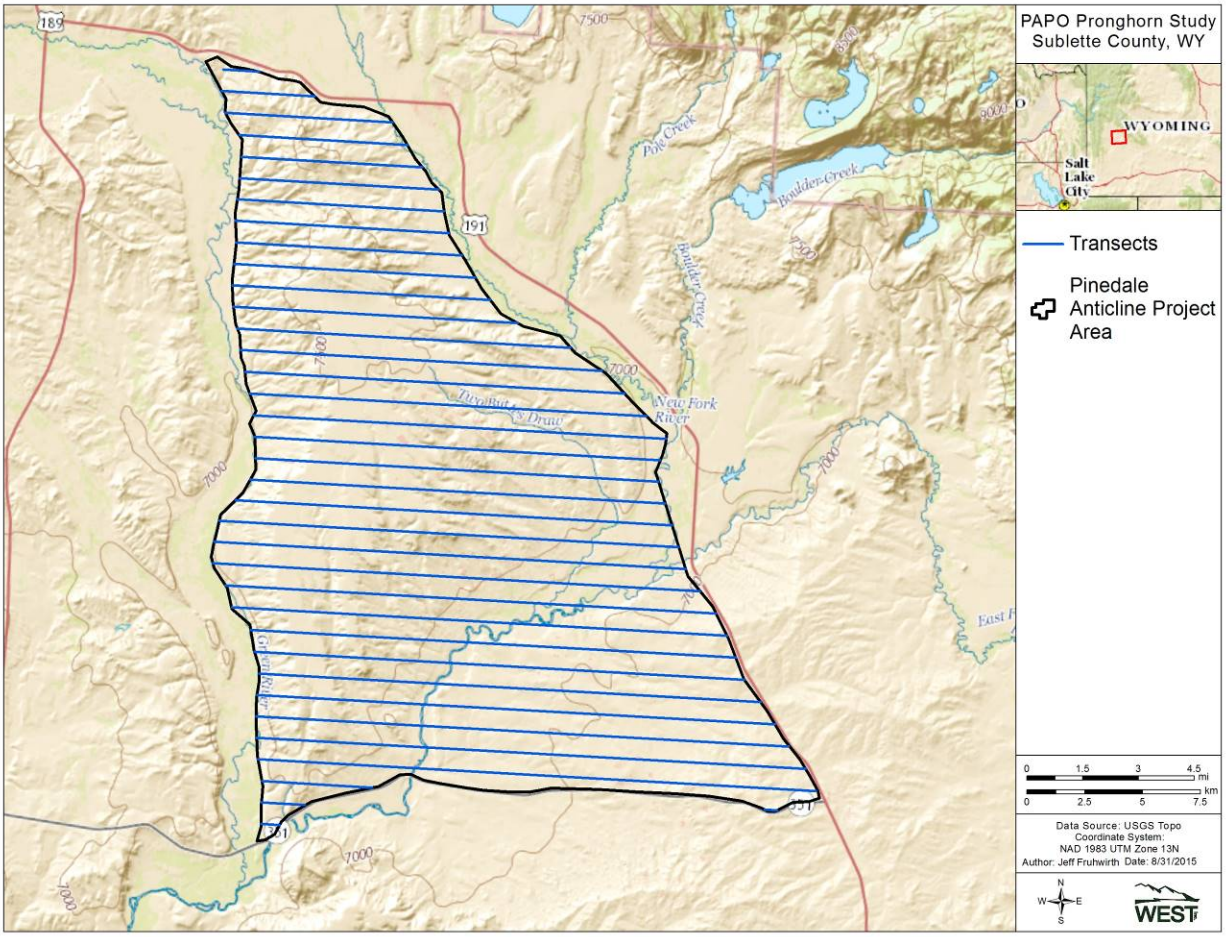

Figure 1. Survey transects over the Pinedale Anticline Project Area.

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.

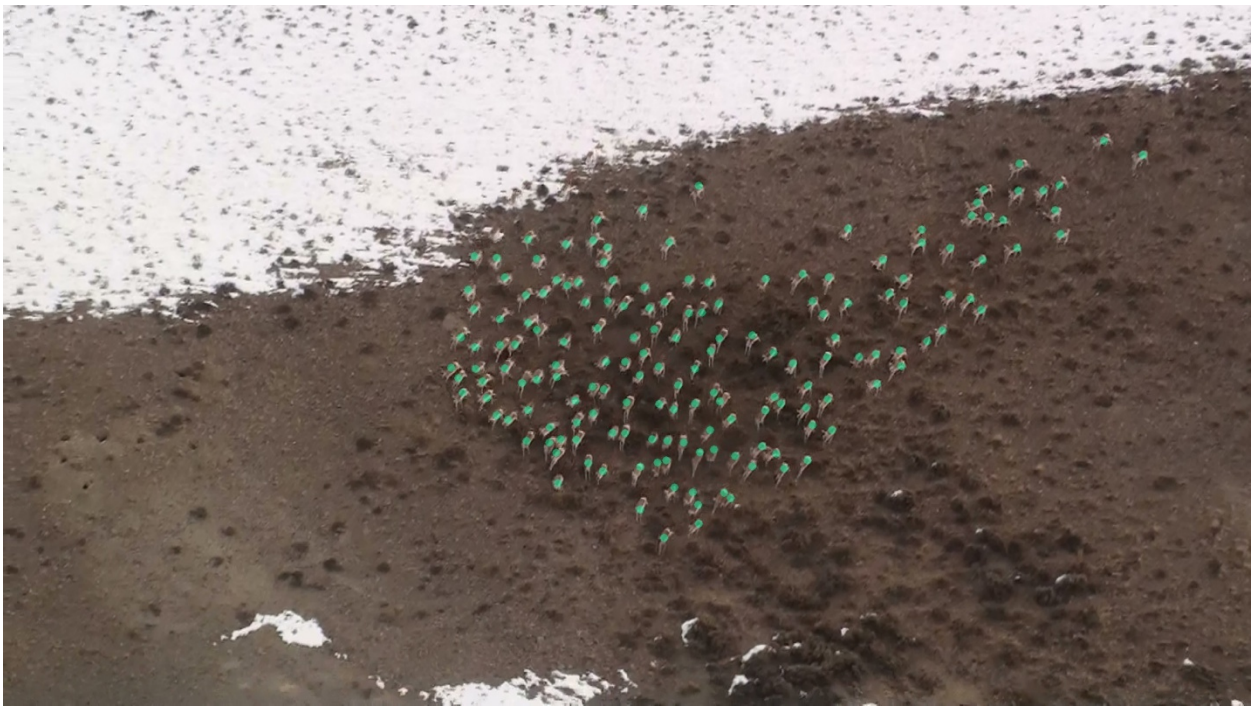

Figure 2. Example of a pronghorn group count (*n* = 165) based on a video clip from an aerial survey.

We calculated 90% confidence intervals (CIs) for each occupancy 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, 2011-12, 2012-13, 2013-14, 2014-15, and 2015-16 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 and 2015-16 monitoring period; Nielson and Sawyer 2011) or 3 survey days (for 2010-11 through 2014-15 monitoring periods; Nielson and Sawyer 2012, Nielson et al. 2013a, Nielson et al. 2014) 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 2015-16 winter.

Results

Pronghorn occupancy in the PAPA was variable across the 2 monthly surveys. We counted 4,138 pronghorn in 33 groups on January 23, and 5,858 pronghorn in 76 groups on February 24 (Table 1, Fig. 3). Based on these 2 surveys, the estimated average number of pronghorn occupying the PAPA during 2015-16 winter was 4,998 (90% CI: 4,079 – 5,872), compared to 1,533 (90% CI: 772 – 2,305) in the 2009-10 winter. This represents a 2.8-fold increase in

average abundance on the PAPA from 2009-10 to 2015-16 winters (90% CI: 1.15 to 6.5-fold increase; Fig. 4).

WGFD provides population estimates for the Sublette herd unit. These estimates are provided for a time period that includes June 1 through May 31, thus comparisons from the abundance surveys to the WDFD surveys are delayed a year. For example, an abundance survey that was conducted during the 2015-16 winter is compared to the 2016 WGFD population estimates reported in the 2016 Job Completion Report. The 2016 WGFD population estimates will be available May 2017. WGFD population estimates for the entire Sublette herd unit reference area were 59,000 in 2009-10 and 32,000 in 2015, representing a 46% decline (Table 2). Comparisons to the 2015-16 winter will not be available until May 2017.

Table 1. Abundance estimates for the Pinedale Anticline Project 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 (indicated by 90% CI = 'NA').

Area	Month	Winter 2009-10		Winter 2010-11		Winter 2011-12		Winter 2012-13		Winter 2013-14		Winter 2014-15		Winter 2015-16	
		Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI
PAPA	Jan	775	782 767	1,420	1,425 1,415	2,200	NA NA	1,492	1,505 1,480	2,022	2,179 1,852	3,657	3,823 3,496	4,138	4,207 4,059
	Feb	2,290	2,323 2,256	505	NA NA	1,126	1,142 1,109	605	610 600	2,975	3,056 2,884	5,160	5,358 4,949	5,858	5,880 5,835
	Mar	NA	NA NA	1,184	NA NA	2,258	2,263 2,253	2,604	2,609 2,599	2,232	2,261 2,201	7,224	7,280 7,163	NA	NA NA
	Avg.	***1,533***	***2,305 772***	***1,036***	***1,344 731***	***1,861***	***2,242 1,473***	***1,567***	***2,239 895***	***2,409***	***2,774 2,050***	***5,347***	***6,561 4,096***	***4,998***	***5,872 4,079***

Table 2. Wyoming Game and Fish Department pronghorn population estimates for the entire Sublette herd unit. Population estimates for the 2015-16 winter are not available until May 2017.

Abundance Survey Year	WGFD Job Completion Report	Estimate	% Change from 2009-10
2009-10	2010	59,000	--
2010-11	2011	37,800	-36
2011-12	2012	40,000	-32
2012-13	2013	34,000	-42
2013-14	2014	31,300	-47
2014-15	2015	32,000	-46
2015-16	2016	NA	NA

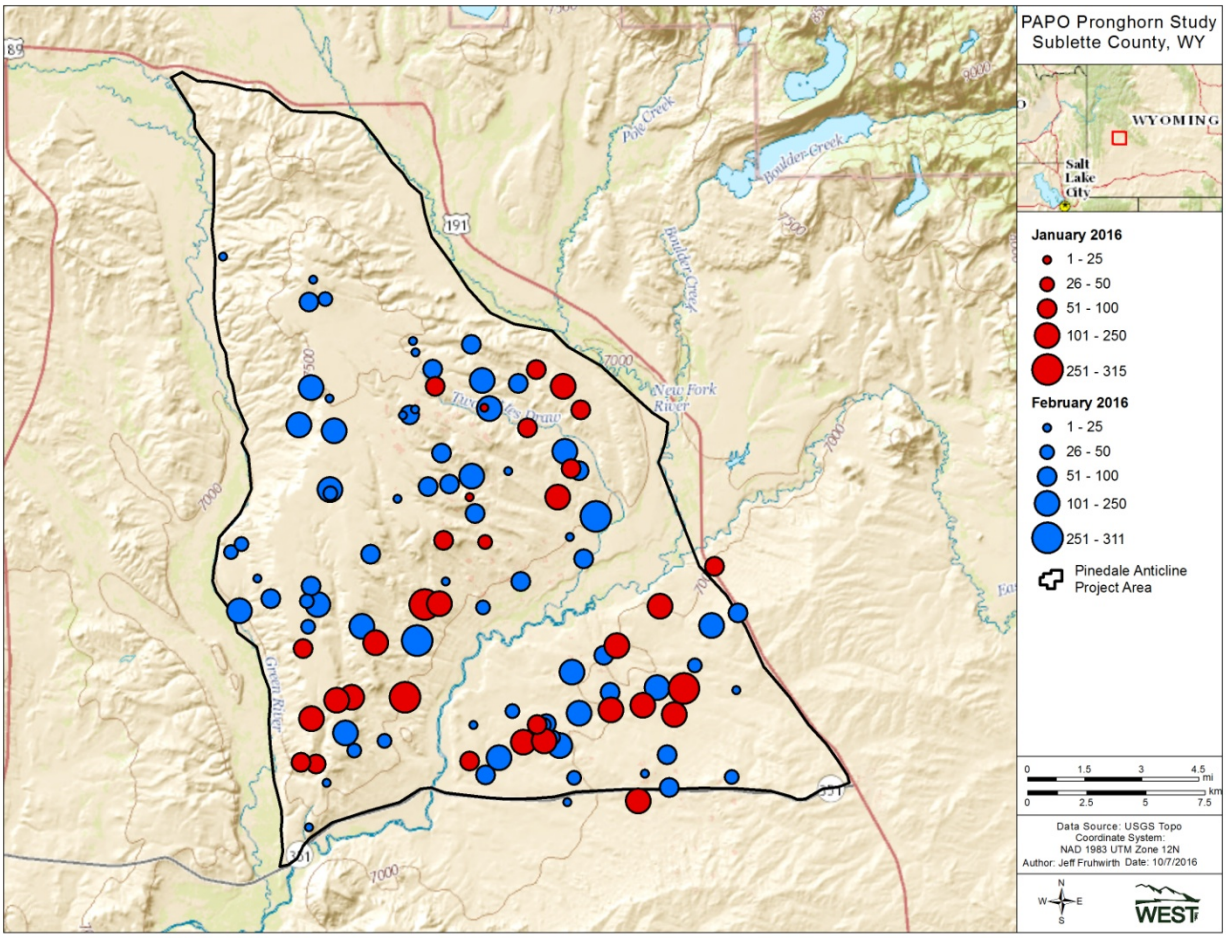

Figure 3. Location and relative size of pronghorn groups observed during aerial surveys over the Pinedale Anticline Study Area.

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 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.

However, we also recognize that marked animals are moving in and out of the study area within the winter period (see migration supplement). For example, during the winter (December 15 – March 15) of 2014-15, half of the marked pronghorn spent some time outside of the PAPA boundary. Importantly, our GPS data indicate that a substantial portion of animals utilize areas outside the study area boundary during the winter months (Fig. 4). We averaged the average proportion of time spent within the PAPA for each individual. The proportion of time spent on the PAPA decreased over time but the proportion of pronghorn that left the PAPA during the winter increased overtime. Such movements make estimating abundance difficult and could explain much of the variation observed between surveys. In addition, the high pronghorn estimates during the month of March are likely due to pronghorn from the south migrating through the PAPA.

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. We estimated a significant 2.8-fold increase in abundance of the PAPA in 2015-16 compared to 2009-10.

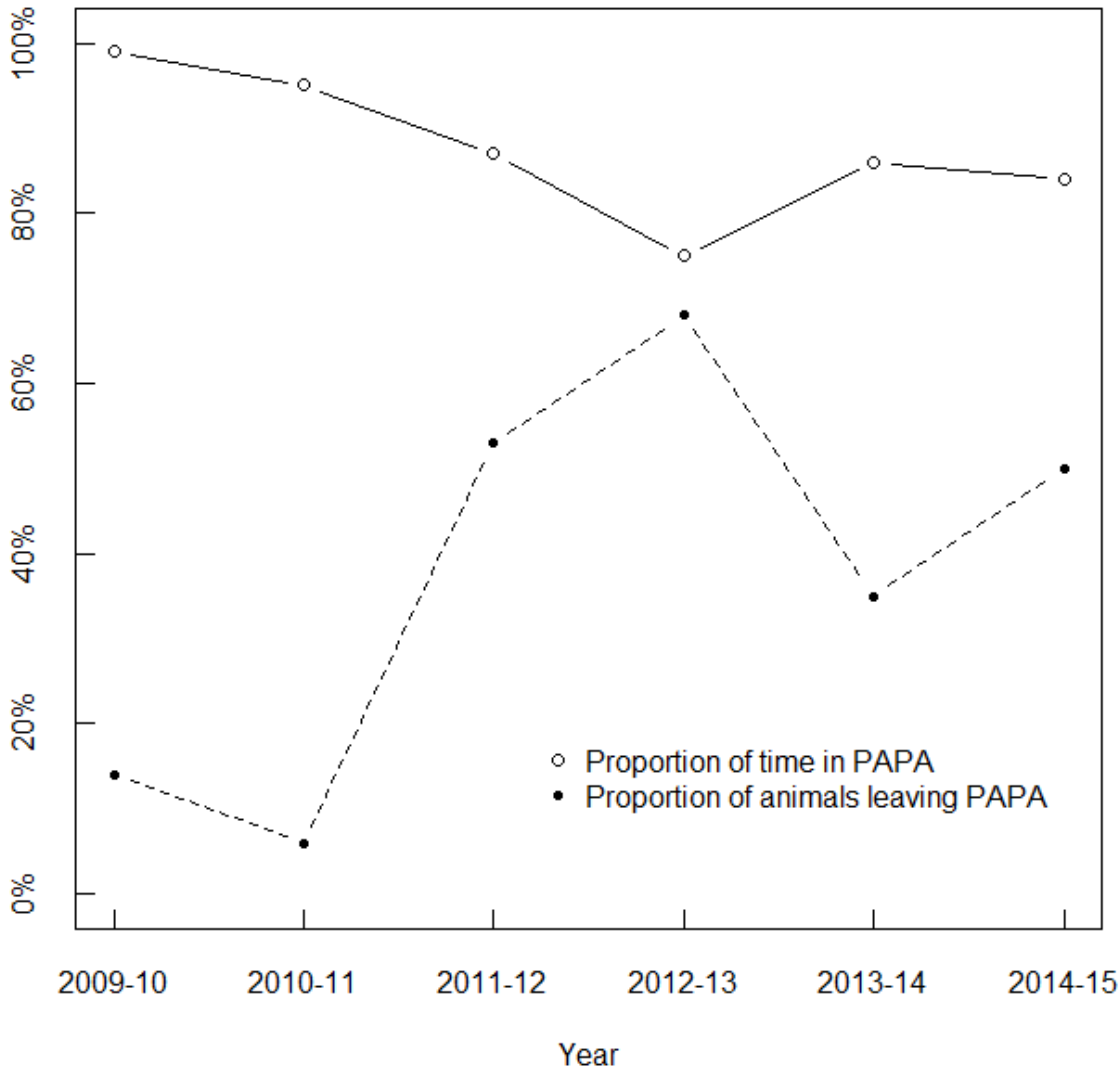

Figure 4. The proportion of total time pronghorn spent on the Pinedale Anticline Project Area and the proportion of pronghorn that left the Pinedale Anticline Project Area during the winter period.

SECTION II: Resource selection modeling

Overview

As part of the pronghorn monitoring effort we attempted 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 understand whether occupancy estimates were 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 document migration routes for the PAPA and Bench Corral (BC) Study Area sub-populations.

Methods

Capture and Collaring

We captured 30 adult female pronghorn on December 7, 2015 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, 2017. Capture efforts were split between the PAPA (*n*=18) and BC Study Area (*n*=12; Fig. 4). We attempted to sample pronghorn in proportion to their relative occupancy across both winter ranges (Fig. 4).

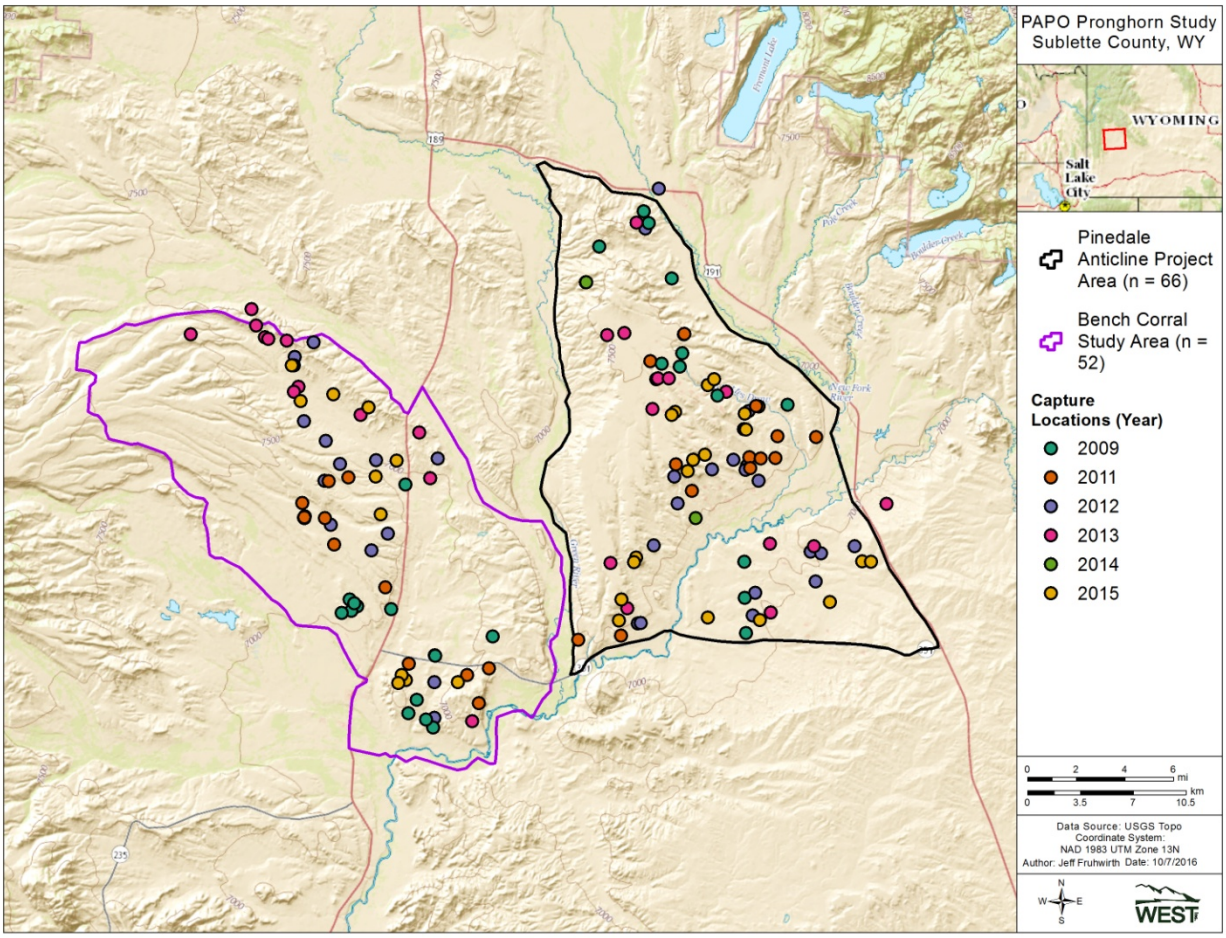

Figure 5. Capture locations of pronghorn in the Pinedale Anticline Project Area and Bench Corral Study Area in January and December, 2009-2014.

Habitat Use Modeling

Habitat use analysis will not be completed until the summer of 2017, after GPS collars are recovered from marked animals.

SECTION III: Trends in Pronghorn Occupancy in the Pinedale Anticline Project Area and the Bench Corral Study Area

Overview

As part of the pronghorn monitoring effort we estimated pronghorn occupancy in the Bench Corral (BC) Study Area in January and February 2016 in addition to the Pinedale Anticline Project Area (PAPA) 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

Pronghorn occupancy in the PAPA and BC was estimated for each winter, beginning in 2009-10, using the same methods described in Section I. 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 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.

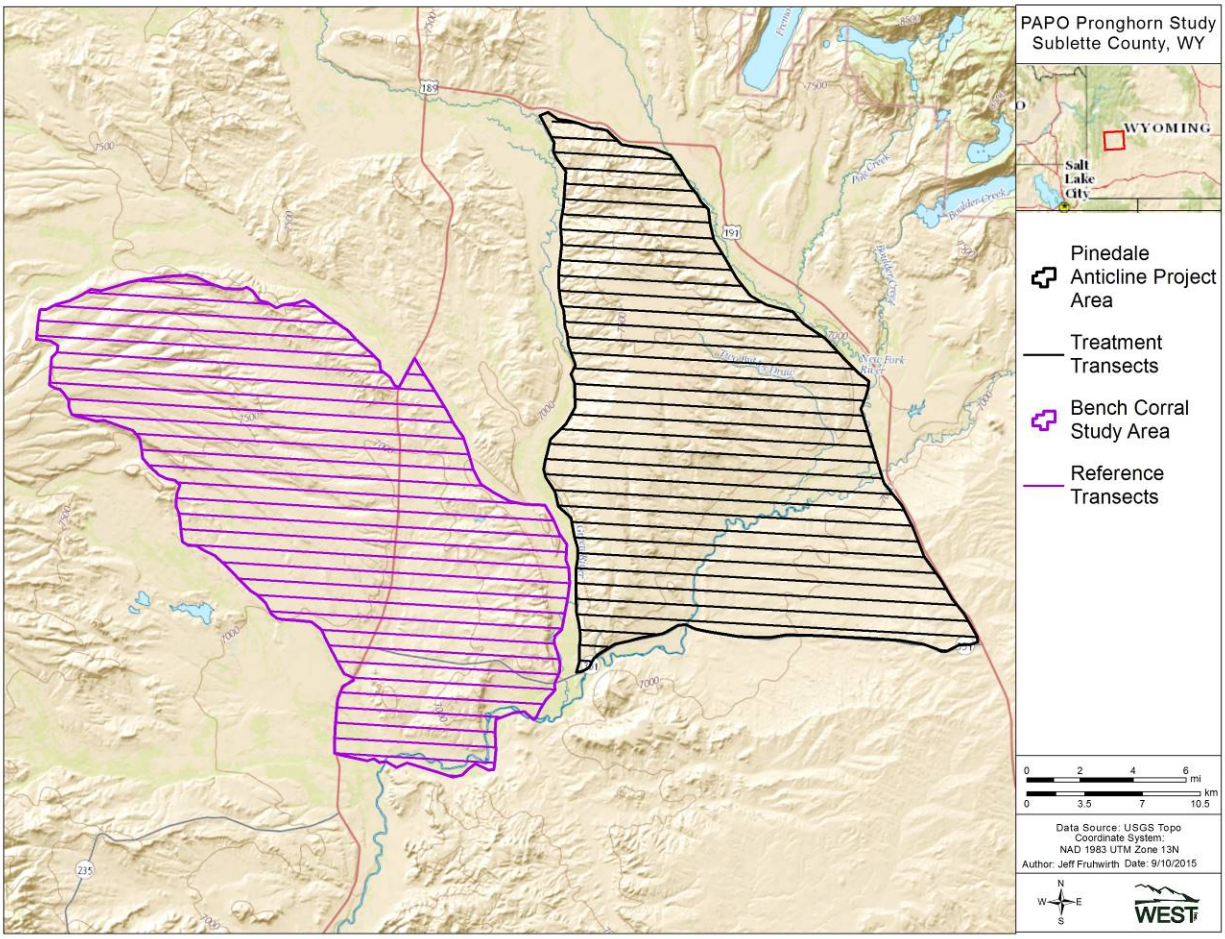

Figure 5. Survey transects used to estimate pronghorn occupancy within the Pinedale Anticline Project Area and the Bench Corral Study Area.

Results

Pronghorn abundance in the PAPA was highly variable. We counted 4,138 pronghorn in 33 groups on January 23, and 5,858 pronghorn in 76 groups on February 24 (Table 8). Based on these 2 surveys, the estimated average number of pronghorn occupying the PAPA during 2015-16 winter was 4,998 (90% CI: 4,079 – 5,872), compared to 1,533 (90% CI: 772 – 2,305) in the 2009-10 winter (Fig. 6). This represents a 2.8-fold increase in average abundance on the PAPA from 2009-10 to 2015-16 winters (90% CI: 1.15 to 6.5-fold increase; Fig. 7).

Pronghorn abundance was less variable in the BC across the two surveys during the winter of 2015-16. We counted 2,488 pronghorn in 26 groups on January 22 and 3,000 pronghorn in 37 groups on February 23 (Table 8, Fig. 6, Fig. 7). The average number of pronghorn occupying in the BC during the three surveys was 2,744 (90% CI: 2,473 – 2,028), compared to 2,742 (90% CI: 2,808 – 2,670) in the 2009-10 winter. There was no significant difference in the average abundance (-0.83%) in the BC from 2009-10 to 2015-16 winters (90% CI: -10.0 decrease to 12% increase).

Table 8. Abundance estimates for the Pinedale Anticline Project Area and Bench Corral 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.

Area	Month	Winter 2009-10		Winter 2010-11		Winter 2011-12		Winter 2012-13		Winter 2013-14		Winter 2014-15		Winter 2015-16	
		Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI	Est.	90% CI
PAPA	Jan	775	782 767	1,420	1,425 1,415	2,200	NA NA	1,492	1,505 1,480	2,022	2,179 1,852	3,657	3,823 3,496	4,138	4,207 4,059
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	Avg.	***1,533***	***2,305 772***	***1,036***	***1,344 731***	***1,861***	***2,242 1,473***	***1,567***	***2,239 895***	***2,409***	***2,774 2,050***	***5,347***	***6,561 4,096***	***4,998***	***5,872 4,079***
BC	Jan	2,682	2,713 2,656	1,307	1,318 1,294	1,856	1,871 1,840	510	533 487	495	503 487	4,486	4,626 4,352	2,488	2,510 2,463
	Feb	2,802	2,817 2,785	2,088	2,094 2,082	1,528	1,561 1,494	231	NA NA	1,336	1,469 1,154	4,575	4,728 4,427	3,000	3,038 2,959
	Mar	NA	NA NA	1,524	NA NA	1,772	1,787 1,756	840	NA NA	2,536	2,606 2,466	3,998	4,046 3,958	NA	NA NA
	Avg.	***2,742***	***2,808 2,670***	***1,640***	***1,902 1,375***	***1,718***	***1,837 1,591***	***527***	***743 316***	***1,456***	***2,190 713***	***4,353***	***4,627 4,090***	***2,744***	***3,028 2,473***

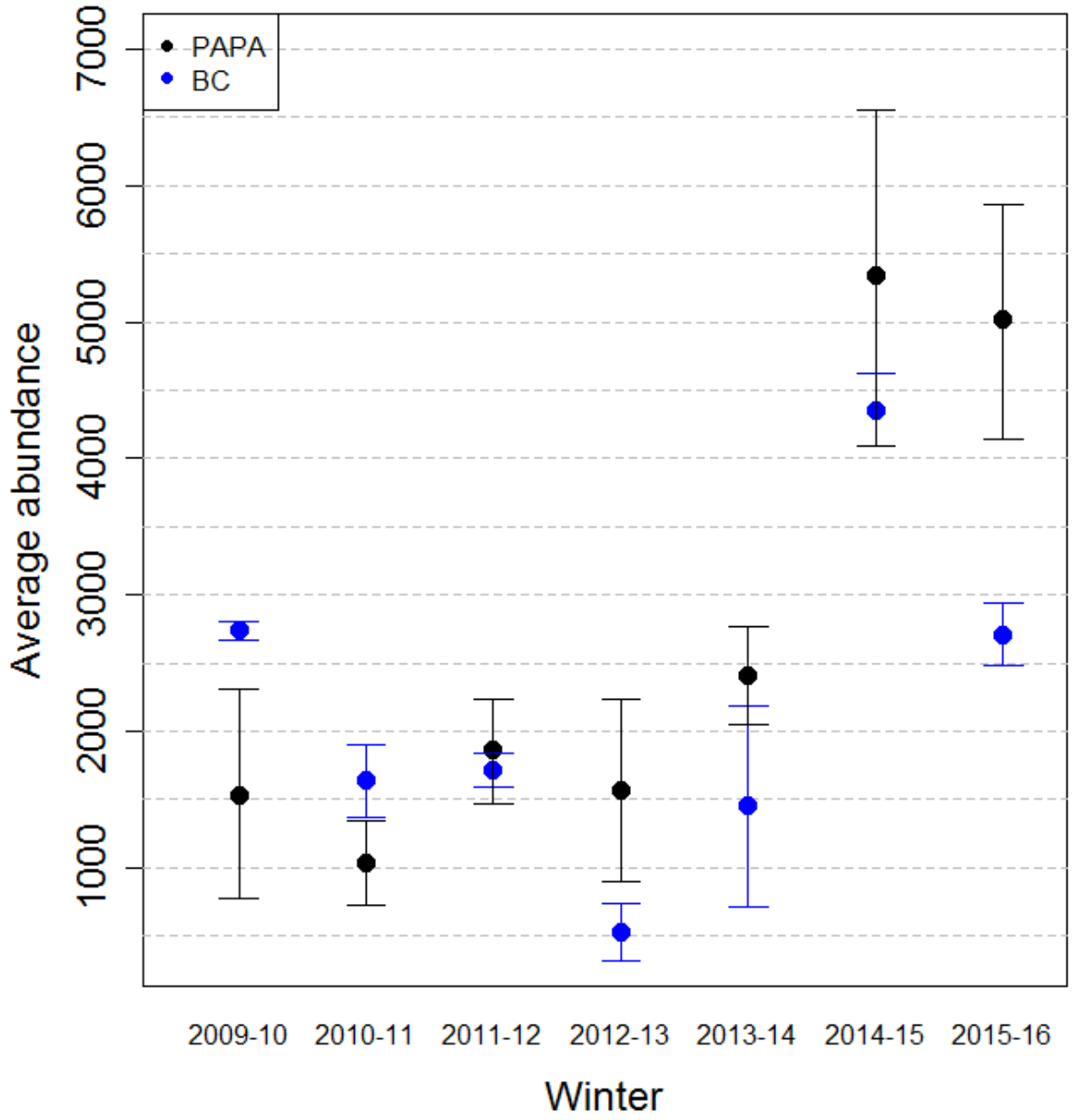

Figure 6. Average pronghorn abundance within the Pinedale Anticline Project Area and Bench Corral Study area during winter aerial surveys.

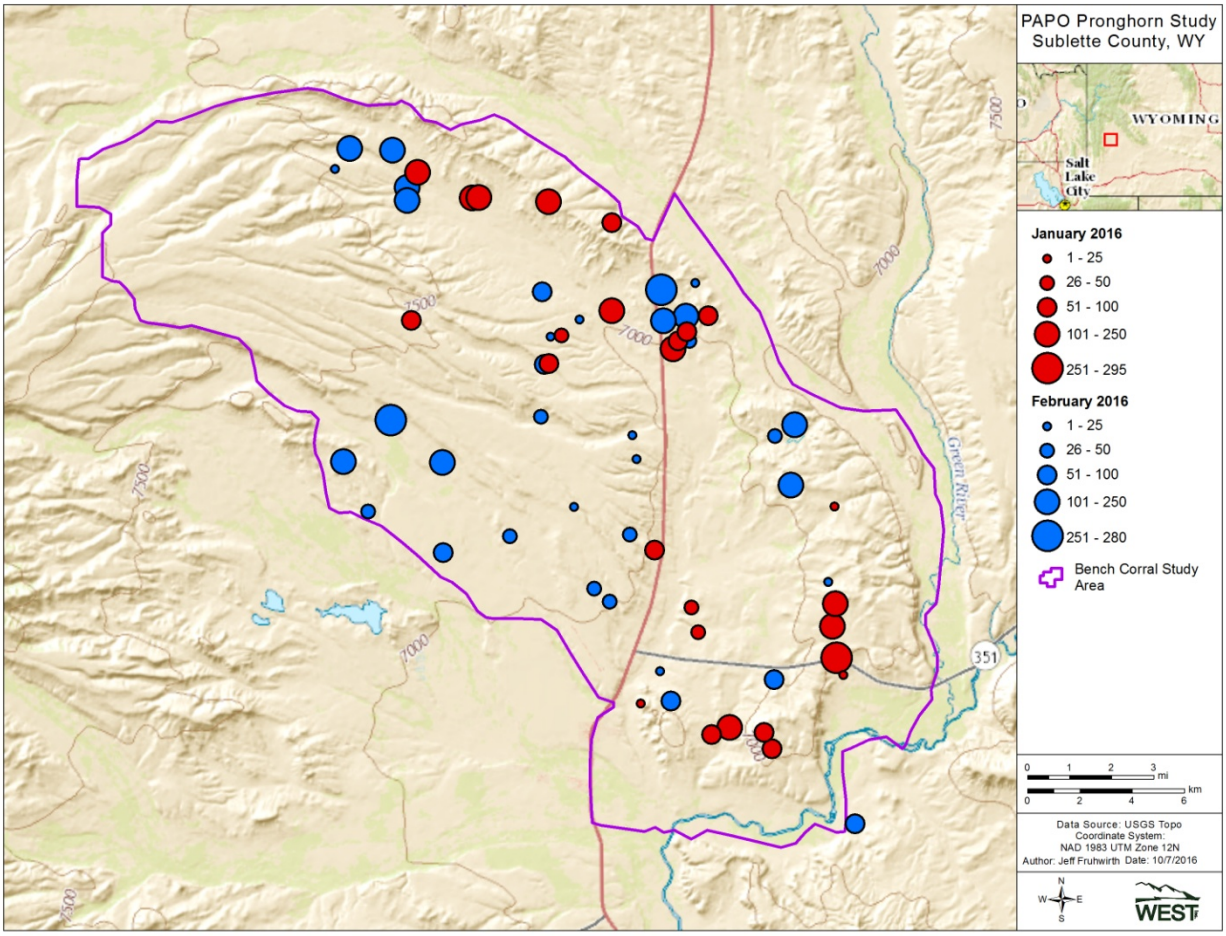

Figure 7. Location and relative size of pronghorn groups observed during aerial surveys over the Bench Corral Study Area.

Discussion

We estimated a 2.8-fold increase in abundance of the PAPA in 2015-16 compared to 2009-10. We did not detect a significant increase or decrease in the average abundance in the BC from 2009-10 to 2015-16. The high variability in the estimates of pronghorn abundance in the PAPA 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 (Nielson et al. 2013b). Pronghorn that winter east of HWY 189 in the BC area appear to move south beyond the Green River another 10-15 miles (Nielson et al. 2013b).

The winter of 2009-10 was the first attempt to estimate pronghorn abundance in the PAPA and BC. 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 4.1-fold increase in abundance of the PAPA in 2015-16 (90% CI; 2.26-fold increase to 6.24-fold increase). Change in abundance from 2010-11 to 2014-15 increased by 71% within the BC (90% CI; 37 to 109% increase).

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