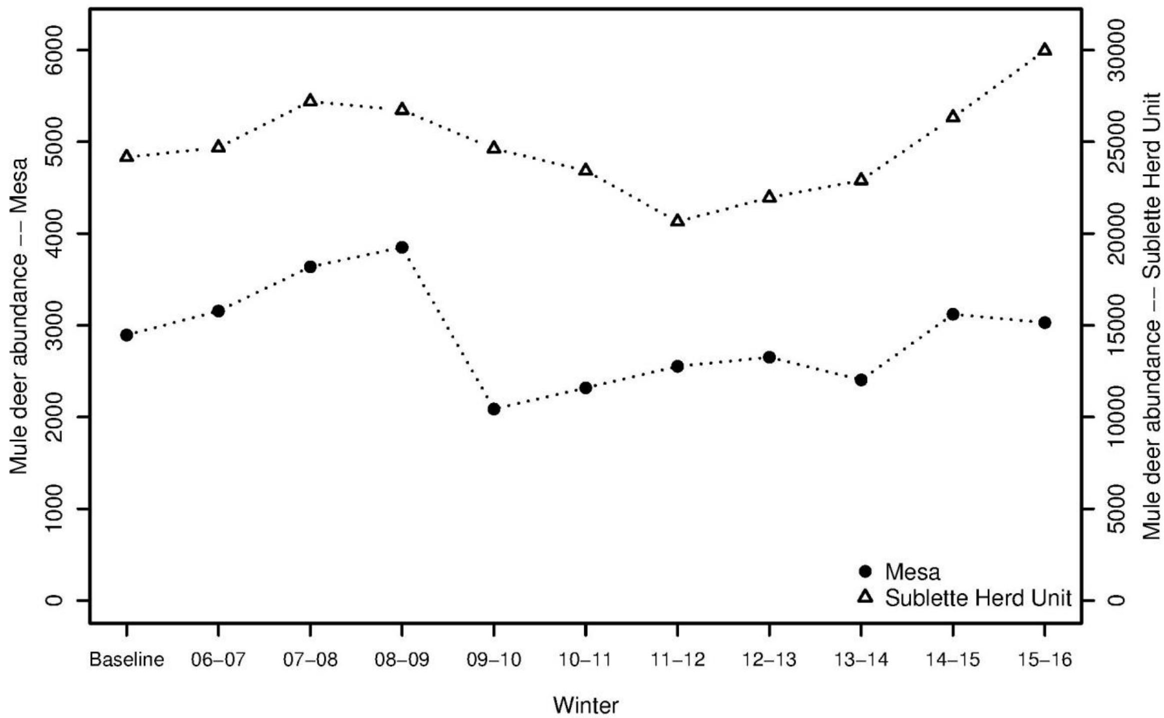
Mule Deer Monitoring in the Pinedale Anticline Project Area

2016 Annual Update



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NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

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SUGGESTED CITATION

Sawyer, H. and R. Nielson. 2016. Mule deer monitoring in the Pinedale Anticline Project Area: 2016 Annual Report Update. Western Ecosystems Technology, Inc., Laramie, WY.

SECTION I: Wildlife monitoring and mitigation matrix

OVERVIEW

As part of the Record of Decision for natural gas exploration and 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 mule deer, the WMMM was intended to identify monitoring parameters that allow changes in mule deer abundance to be quantitatively assessed. Monitoring was intended to be consistent with previous efforts that began in 2001 (Sawyer et al. 2009*a*), such that comparisons across years could be made. The WMMM specifies that mitigation measures will be triggered if a 15% decline in mule deer abundance is detected in any year relative to the Sublette herd unit, using the average of population estimates from winter's 2004-05 and 2005-06 as the baseline (BLM 2008). Here, we report monitoring results for the winter of 2015-16, where population estimates indicate that mule deer abundance has increased by 6% in the Mesa and 19% in Sublette herd since the baseline year.

METHODS

Abundance

We estimated abundance in the Mesa portion of the PAPA using aerial counts similar to Freddy et al. (2004). The sampling frame was 68 mi^2 and reflected the relative size of the winter range (Fig. 1). We systematically sampled 46 1-mi^2 quadrat units and then surveyed those units by helicopter. In earlier years, 50% (*n*=34) of the quadrats were flown, but beginning in 2010, the number of sampled quadrats increased to 46 in an effort to increase precision of abundance estimates. The same 46 quadrats have been flown every winter since 2010. A real-time flight path was traced into the on-board global positioning system (GPS) and once the perimeter of the quadrat was established, all mule deer within the quadrat were counted. Although group size and vegetative cover may influence probability of detection (Samuel et al. 1987), we did not correct for potential visibility bias because the study area did not contain forest vegetation; rather it was characterized by homogenous sagebrush stands and snow cover. Further, when survey areas contain large numbers of animals that are widely distributed, recognition of individual groups may be nearly impossible, and thus attempting to determine visibility correction factors for groups is not feasible in these situations (Samuel et al. 1987). Regardless, consistency in surveying the same quadrats using the same methods and observer since 2001 strengthens our ability to detect trends in abundance. We used equations from Thompson et al. (1998) to calculate abundance and variance estimates.

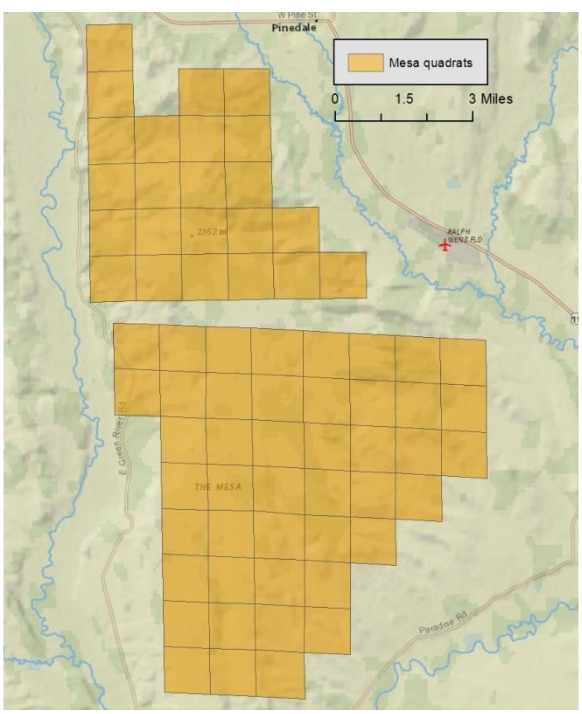

Figure 1. Location of 1-mi^2 quadrats in Mesa study area (*n*=68).

As requested by PAPO, we compared abundance estimates in the Mesa with those estimated by the Wyoming Game and Fish Department (WGFD) for the entire Sublette herd unit. We note that using the herd unit as a reference area may be of limited value because the reference area should not contain the treatment area (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 estimates were based on models and not actual counts.

RESULTS

Abundance

The WMMM considers changes in mule deer abundance on the Mesa using a baseline of 2,856, derived by averaging the winters of 2004-05 (2,818) and 2005-06 (2,894). The baseline for the reference area (Sublette herd unit) was identified as 27,254 in the WMMM (BLM 2008). However, the WGFD changed population models in 2013, which in turn changed the population estimates. Accordingly, the baseline estimate was updated to24,165 (i.e., the average of 2004-05 and 2005-06 winters) so that matrix comparisons would be consistent across years. To determine whether the mitigation threshold (15%) was exceeded, we calculated the observed population change in the Mesa from the baseline to present, and compared that to the population change observed in the reference area during the same time period. Between the baseline winter and 2015-16, mule deer abundance in the Mesa and Sublette herd unit increased by 6% and 24%, respectively (Table 1).

Table 1. Mule deer abundance estimates, standard errors (SE), and percent change for the Mesa and Sublette herd unit, baseline winter through 2015-16.

Winter	Mesa			Sublette Herd Unit			Relative % Change	Threshold Exceeded?
	Estimate	SE	% Change	Estimate	SE	% Change		
baseline[a]	2,856[a]	n/a	baseline*	24,165	n/a	baseline	n/a	baseline
2006-07	3,156	470	10%	24,699	n/a	2%	8%	NO
2007-08	3,638	424	27%	27,200	n/a	13%	14%	NO
2008-09	3,850	322	35%	26,732	n/a	11%	24%	NO
2009-10	2,088	325	-27%	24,630	n/a	2%	-25%	YES
2010-11	2,318	212	-19%	23,426	n/a	-3%	-16%	YES
2011-12	2,553	210	-11%	20,652	n/a	-15%	4%	NO
2012-13	2,652	220	-7%	21,969[b]	n/a	-9%	2%	NO
2013-14	2,405	243	-16%	22,900	n/a	-5%	-11%	NO
2014-15	3,121	325	9%	26,337[c]	n/a	9%	0%	NO
2015-16	3,030	266	6%	29,976	n/a	24%	-18%	

[a] Note: the Record of Decision (ROD; BLM 2008) uses 2,856 as the baseline and was derived from the average of 2004-05 and 2005-06 estimates.
[b] WGFD switched from POP2 model to spreadsheet model
[c] WGFD expanded Sublette herd unit to include hunt area 131, which supports approximately 4,000 animals

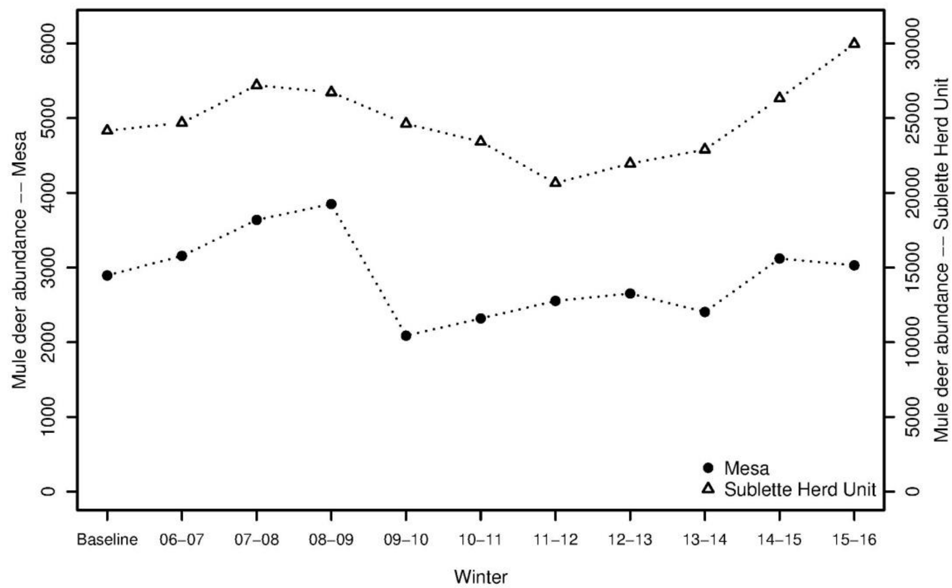

Figure 2. Mule deer abundance estimates for the Mesa and Sublette herd unit, baseline winter through 2015-16.

SECTION II: Habitat use

OVERVIEW

While not part of the WMMM, but in support of the mule deer monitoring effort, we attempt to maintain a sample (~30 animals) of GPS-collared deer across the Mesa and Ryegrass-Soapholes areas to document movements and help ensure abundance estimates are 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 Mesa and Ryegrass-Soapholes sub-populations, which have been reported annually since the WMMM was implemented. To reduce costs and take advantage of improved GPS technology, we began following the same animals through time in 2012. Those animals will carry collars through April 2018, at which time a variety of movement and habitat-use data will be available.

SECTION III: Long-term mule deer trends in Pinedale Anticline and Ryegrass-Soapholes

OVERVIEW

As part of the Record of Decision for natural gas exploration and 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 mule deer, the WMMM was intended to identify monitoring parameters that allow changes in mule deer abundance since 2006 to be quantitatively assessed. However, mule deer monitoring began in 2001 (Sawyer et al. 2009), following the original Record of Decision (BLM 2000). While not a component of the WMMM, here we report the long-term trends in mule deer abundance in the PAPA, as they are important for understanding the population dynamics of the Sublette deer herd in relation to gas development. Long-term trends indicate that mule deer have declined at higher rates in the Mesa portion of the PAPA compared to the larger Sublette herd unit and nearby Ryegrass-Soapholes area.

METHODS

Abundance

We estimated abundance in the Mesa portion of the PAPA using aerial counts similar to Freddy et al. (2004). The sampling frame was 68 mi^2 and reflected the relative size of the winter range (Fig. 3). We systematically sampled 46 1-mi^2 quadrat units and then surveyed those units by helicopter. In past years, 50% (*n*=34) of the quadrats were flown, however beginning in 2010, the number of sampled quadrats increased to 46 in an effort to increase precision of abundance estimates. The same 46 quadrats have been flown every winter since 2010. A real-time flight path was traced into the on-board global positioning system (GPS) and once the perimeter of the quadrat was established, all mule deer within the quadrat were counted. Although group size and vegetative cover may influence probability of detection (Samuel et al. 1987), we did not correct for potential visibility bias because the study area did not contain forest vegetation; rather it was characterized by homogenous sagebrush stands and snow cover. Further, when survey areas contain large numbers of animals that are widely distributed, recognition of individual groups may be nearly impossible, and thus attempting to determine visibility correction factors for groups is not feasible in these situations (Samuel et al. 1987). Regardless, consistency in surveying the same quadrats using the same methods and observer since 2001 strengthens our ability to detect trends in abundance. We used equations from Thompson et al. (1998) to calculate abundance and variance estimates.

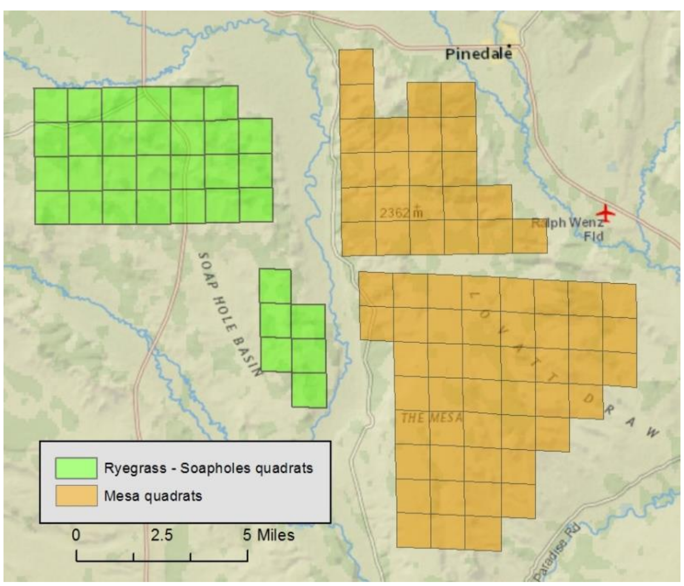

Figure 3. Location of 1-mi^2 quadrats in Mesa (*n*=68) and Ryegrass-Soapholes (*n*=33).

In contrast to the WMMM in Section I, where population estimates from one year were compared to another year, here we used regression analysis to examine population trends through time. This type of analysis is more likely to reflect changes in population because it is less sensitive to year-to-year variation in abundance. We used a weighted linear regression to account for differences in annual variation in the estimates of abundance.

RESULTS

Abundance

Mesa: We conducted aerial surveys in the Mesa during the winters of 2001-02 through 2015-16 (Table 2). A weighted regression analysis revealed a negative trend over the 15-year period (*Abundance in the Mesa* = 3834 – 95[*year*], *P* = 0.034) with an average decline of 95 deer per year (Fig. 5). Based on the 15-year weighted regression trend, deer abundance declined 36% from 2001 to 2016.

Sublette Herd Unit: During the same time period, WGFD population estimates for the larger Sublette herd unit suggest deer numbers declined less than those observed in the Mesa (Table 2 and Fig. 6). Regression analysis indicated a negative trend over the 15-year period (*Abundance in Sublette herd unit* = 28334 - 313[*year*], *P* = 0.005), with an average decrease of 313 deer per year. The 15-year regression trend indicates deer abundance declined by 16% (Fig. 6).

Ryegrass-Soapholes: As another comparison, we conducted aerial surveys west of the Mesa in the Ryegrass-Soapholes area, beginning in 2006 (Table 2). To date, GPS data indicate that Ryegrass-Soapholes mule deer rarely intermix with Mesa deer during survey periods. The weighted regression analysis revealed no statistically significant trend across the 10-year period (*Abundance in Ryegrass-Soapholes* = 1280 + 46[*year*], *P* = 0.416; Fig. 7).

Table 2. Mule deer abundance estimates and standard errors (SE) for the Mesa, Sublette Herd Unit, and Ryegrass-Soapholes, winters 2001-02 through 2015-16.

Winter	Mesa		Sublette Herd Unit		Ryegrass - Soapholes	
	Estimate	SE	Estimate	SE	Estimate	SE
2001-02	5,228	820	32,011	n/a	--	--
2002-03	4,676	614	28,881	n/a	--	--
2003-04	3,564	395	29,670	n/a	--	--
2004-05	2,818	325	24,115	n/a	--	--
2005-06	2,894	311	24,215	n/a	--	--
2006-07	3,156	470	24,699	n/a	986	237
2007-08	3,638	424	27,200	n/a	1,106	260
2008-09	3,850	322	26,732	n/a	1,862	249
2009-10	2,088	325	24,630	n/a	2,223	201
2010-11	2,318	212	23,426	n/a	1,109	180
2011-12	2,553	210	20,652	n/a	1,727	165
2012-13	2,652	220	21,969	n/a	1,210	92
2013-14	2,405	243	22,900	n/a	1,547	138
2014-15	3,121	325	26,337[a]	n/a	2,606	339
2015-16	3,030	266	29,976	n/a	1,573	136

[a] WGFD expanded Sublette herd unit to include hunt area 131, which supports approximately 4,000 animals

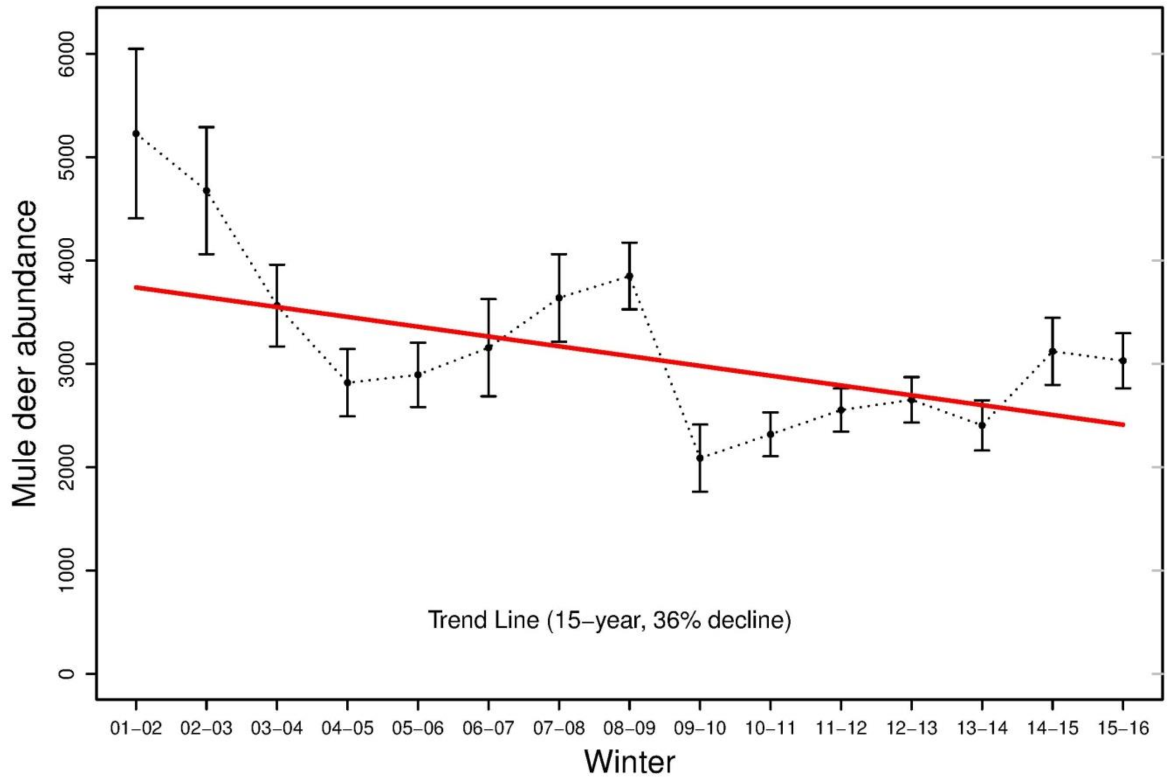

Figure 4. Mule deer abundance estimates (± SE) and 15-year negative trend (-36%) for the Mesa.

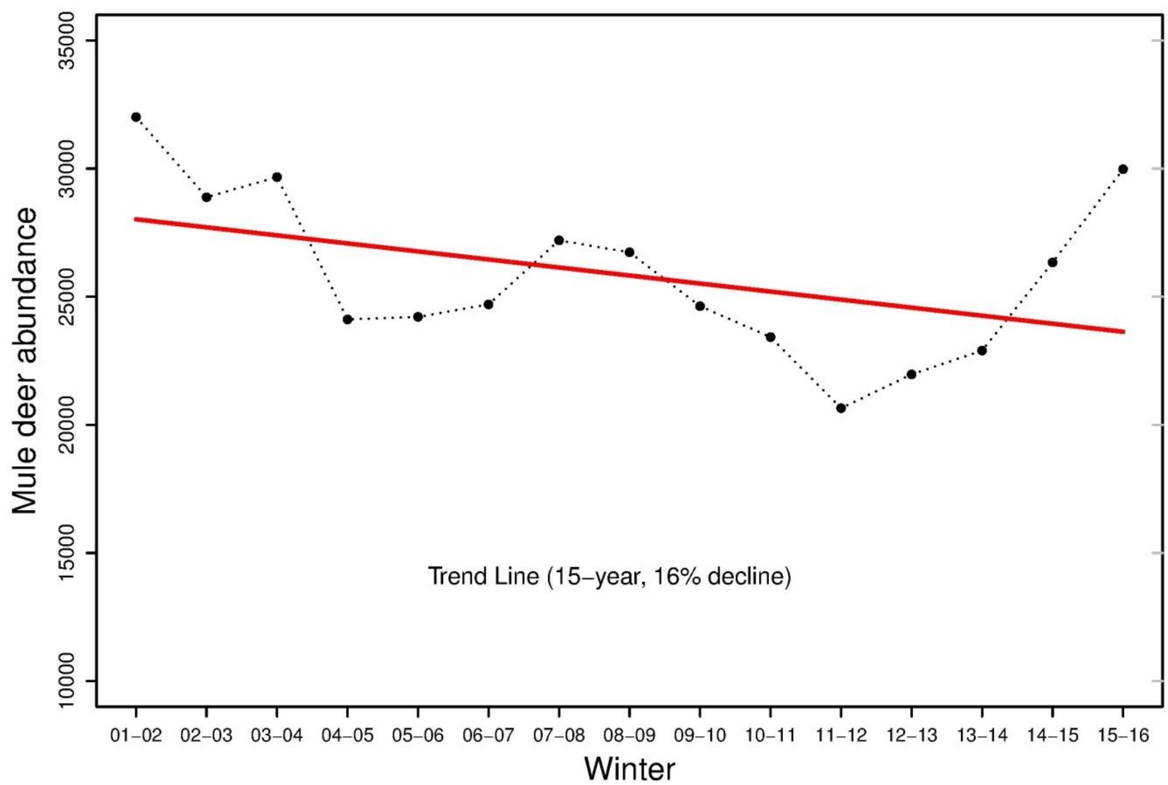

Figure 5. Mule deer abundance estimates and 15-year negative trend (-16%) for the Sublette herd unit.

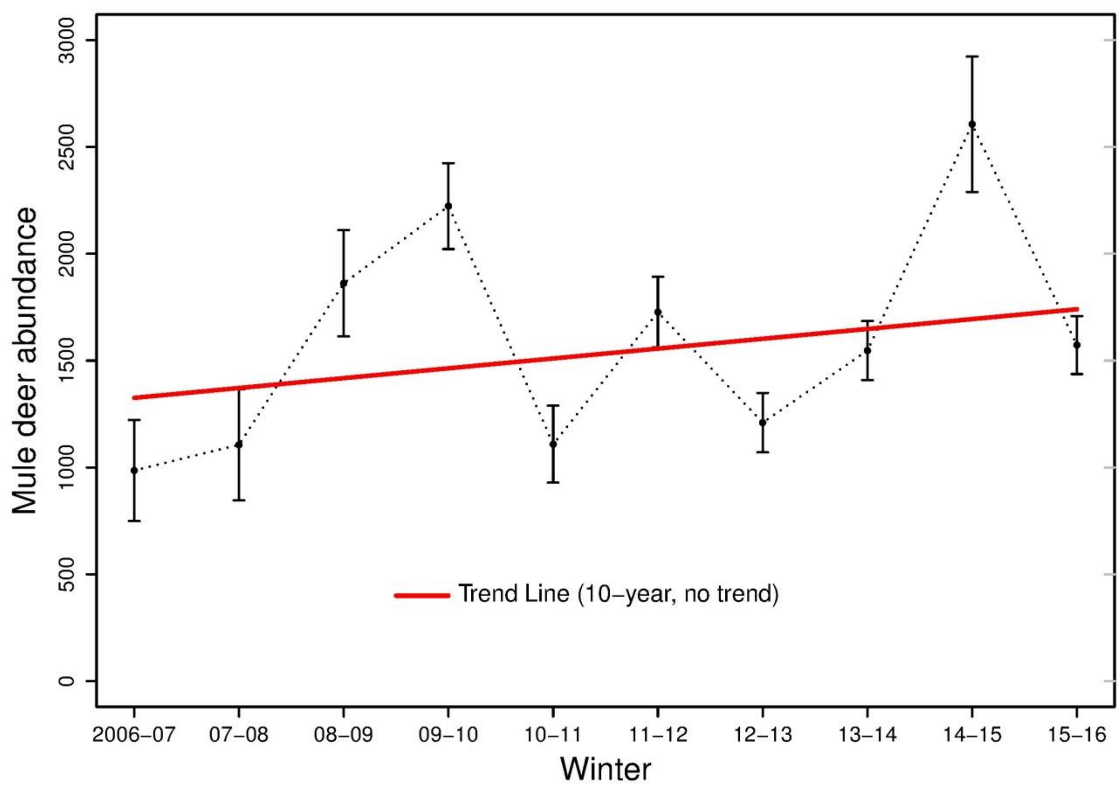

Figure 6. Mule deer abundance estimates (± SE) and 10-year trend line for the Ryegrass -Soapholes area. Although the trend line indicates a slight increase, the positive trend was not statistically significant.

DISCUSSION

Our task was to estimate mule deer abundance in the Mesa and compare population changes with those observed in the larger Sublette herd unit and an adjacent winter range with no gas development (i.e., Ryegrass-Soapholes area). Since large-scale gas development began (BLM 2000), the 15-year (2001-2015) trend in mule deer abundance on the Mesa shows an overall decline of 36%. This decline was concurrent with documented behavioral changes of mule deer avoiding well pads (Sawyer et al. 2006, 2009*a*, *b*). Of interest here is whether mule deer numbers declined at a similar rate in other portions of the Sublette herd unit. The PAPO requested that abundance in the Mesa be compared to population estimates modeled by the WGFD for the entire Sublette herd unit. The 15-year (2001-2014) trend in mule deer abundance for the entire herd unit indicated an overall decline of 16%. Because there was no variance estimate associated with the WGFD numbers, the precision of year to year variation in herd unit numbers is unknown. Nonetheless if we assume the herd estimates are reliable, then mule deer in the Mesa have declined at a higher rate compared to the larger herd unit. However, it is important to note that the Sublette herd unit contains the Mesa, so population trends in the Mesa can significantly influence those observed in the larger herd unit. Thus, comparing the Mesa with the larger Sublette herd does not allow potential treatment effects (e.g., gas development) to be discerned.

As an additional comparison, the Ryegrass-Soapholes area was identified as a potential study area in 2006 because GPS data suggests minimal deer movement between the two areas when winter surveys are conducted. Comparison with the Ryegrass-Soapholes is advantageous because the same abundance estimations methods (quadrat counts) are used there, and because of their close proximity, the two areas experience similar winter conditions. The 10-year population trend in the Ryegrass-Soapholes has been stable or slightly increasing, whereas the 15-year trend in the Mesa has declined. Using both the Sublette herd unit and Ryegrass-Soapholes as a comparison, there is no evidence that deer in the region have declined at rates observed in the Mesa.

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