Summary report on pronghorn antelope road composition surveys in northeastern California, July 2023

Pronghorn buck near Smoke Creek, Lassen County. Photo by Alexa Murray.

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July 31, 2023

Introduction

The California Department of Fish and Wildlife (CDFW) is tasked with regularly collecting demographic and abundance information for monitoring California's pronghorn (*Antilocapra americana*) populations (Pyshora 1982, California Department of Fish and Game [CDFG] 2004). These data are a critical source of information to meet population objectives and guide sound harvest recommendations (O'Gara and Yoakum 2004). Regulated hunting has been an annual element of CDFW's pronghorn management program since 1964 (Pyshora 1982, Pyshora 1987, Sommer 2012). In 1982, seven Pronghorn Management Units (PMUs) were established, six of which also function as Hunt Zone (HZ) boundaries in northeastern California. Results from annual monitoring efforts form the basis from which tag allocation recommendations are derived (CDFG 2004).

Pronghorn monitoring in California has conventionally been divided into two annual periods to collect complementary information (Pyshora 1987, Yoakum et al. 2014). Composition surveys, in which sex and age class of observed groups is recorded, are typically conducted during the summer months prior to hunting seasons (Pojar 2004). Fawns are readily available for observation during this period, affording differentiation of a fawn: doe ratio and thus a metric of productivity (Salwasser 1980, O'Gara and Yoakum 2004, Yoakum et al. 2014). "Census" or abundance surveys, in which a comprehensive count is recorded, are typically conducted during the winter months after hunting seasons have ended (Pyshora 1982, Pyshora 1987, Sommer 2012). Pronghorn are concentrated on winter range during this period and results are used to describe a total minimum population size. Both data sources are important towards understanding population performance and guiding harvest recommendations (Pyshora 1982, Tsukamoto 1983, Pojar 2004).

From 1942–2020, CDFW staff annually conducted winter abundance surveys to generate minimum population counts for pronghorn in northeastern California (Sommer 2012, CDFW 2023). Between 1953–1998, CDFW staff also annually conducted summer composition surveys to complement the abundance surveys. In 1999, staffing and budgetary constraints resulted in the elimination of summer composition surveys and necessitated the modification of winter survey methods (Sommer 2012). Specifically, from 1999–2019 PMUs 1–3 and 4–5 were surveyed in alternating years.

While a robust mark-resight survey was successfully applied in 2020, a comprehensive survey of the northeastern California pronghorn population has not occurred since, due to the COVID-19 pandemic (Trausch et al. 2020, CDFW 2023). During the hiatus, CDFW staff drafted a long-term monitoring plan outlining application of more robust survey and monitoring methods over the next decade (CDFW 2023). However, the harsh environmental conditions and unknown mortality associated with the 2022–2023 winter expediated the need to gather up-to-date population information. We therefore elected to reinitiate a summer composition survey in July 2023.

Summer composition counts have traditionally been performed using fixed-wing aircraft (Pyshora 1982, Sommer 2012). Aerial services were not available at the time this effort was needed, however. Since pronghorn tend to occupy relatively flat, open habitat they are generally easier to observe and count from the ground compared to other large ungulates (O'Gara and Yoakum 2004, Yoakum et al. 2014). In fact, prior to the application of fixed-wing flights, wildlife managers successfully counted pronghorn by foot, horseback, and vehicle in this region (Dow 1939a, Dow 1939b, Stokes 1940). We thus chose to perform concentrated road-based ground counts to derive summer composition ratios prior to resuming winter abundance surveys in 2024.

Study Area

This survey took place across roughly six million acres of pronghorn range within PMUs 1–6, transcending portions of Siskiyou, Modoc, and Lassen counties in northeastern California (Fig. 1). Vegetation communities in this region represent a transition between Great Basin types to the east and montane types to the west (Pyshora 1982). The dominant vegetation includes sagebrush (*Artemisia* spp.), pine (*Pinus* spp.), fir (*Abies* spp.), juniper (*Juniperus* spp.), Sierran mixed conifer, annual/perennial grassland, and cropland (Sommer 2012). Evergreen forest covers much of the western extent of this area, as well as the Warner Mountains (the dividing line between PMUs 3 and 6, Fig. 1). A majority (~62%) of this region is composed of public land administered by federal government agencies including the United States Forest Service (USFS) and Bureau of Land Management (BLM), while the more productive lands are privately owned and utilized for raising livestock and cultivated crops.

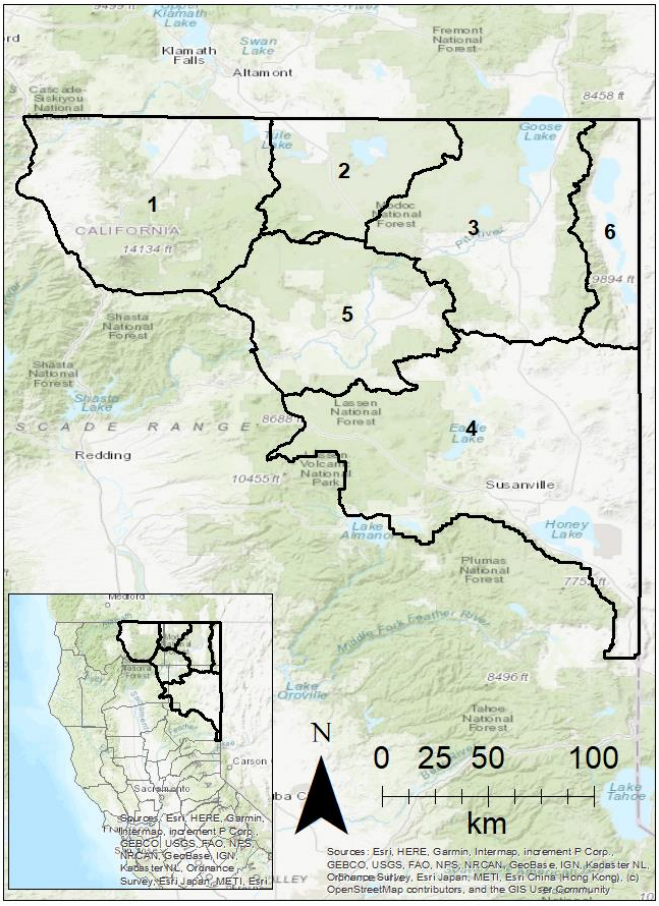

Figure 1. The Mount Dome (1), Clear Lake (2), Likely Tables (3), Lassen (4), Big Valley (5), and Surprise Valley (6) Pronghorn Management Units (PMUs) in northeastern California. These PMUs also serve as Hunt Zone (HZ) boundaries. The inset depicts the PMUs in relation to the balance of northern California counties.

Methods

From July 13–20, 2023, CDFW Wildlife Branch (WLB) and Region 1 (R1) staff completed road surveys for each PMU to gather herd composition data. Prior to surveys, R1 staff identified and digitized "primary" roads – roads known to be navigable by four-wheel

drive vehicles and likely to yield pronghorn observations – within each of the six PMUs. Spatial coverage by primary roads was maximized to the extent possible within each PMU. To satisfy the assumption of population closure, multiple survey teams sampled the same PMUs simultaneously. To avoid duplicative counts, survey teams were randomly assigned non-overlapping geographic areas associated with primary roads prior to surveying. The intent of mapping pre-determined primary roads was to serve as a flexible guide for survey teams to sample, but not to be limited to those roads exclusively. During surveys, teams traveled and surveyed any navigable roads in addition to the predetermined primary roads to search for pronghorn within their general geographic assignment.

We used the QuickCapture (ESRI Inc., Redlands, CA) mobile application for Apple iOS (v. 16.5.1, Apple, Inc., Cupertino, CA) to record the travel path and total kilometers sampled for each survey team. When a group of pronghorn were visually detected, surveyors safely pulled over and recorded the number of bucks, does, and fawns observed, with the assistance of optical equipment as necessary. If pronghorn were visually indistinct, the total number that were unidentifiable was recorded as "unknown." The QuickCapture application automatically recorded the latitude, longitude, date, and time associated with each observation collected when submitted by the user. The total group size was automatically summed for each observation within the application. All data were automatically uploaded to a central database once the device reconnected to a wireless network.

Results

From July 13–20, 2023, we surveyed a total of 2,954 km and detected a total of 542 pronghorn in 89 groups across all PMUs (Table 1, Fig. 2). Mean group size across all PMUs was 6.1 with group sizes ranging from 1–35. Of the total pronghorn observed, we classified 134 bucks, 321 does, and 78 fawns. There were 9 pronghorn classified as "unknown". Excluding the "unknown" pronghorn, the range-wide composition ratios were 42 bucks: 100 does: 24 fawns (Table 2). Bucks per 100 does ranged from 10–66 (Surprise Valley and Mount Dome, respectively), while fawns per 100 does ranged from 5–29 (Likely Tables and Clear Lake, respectively). Surveyed km per PMU ranged from 164 km in Mount Dome to 1,078 km in Lassen.

Table 1. *The number of pronghorn antelope groups, total pronghorn observed, associated classifications, and the total kilometers surveyed by vehicle (km) within each Pronghorn Management Unit (PMU)and range wide, collected July 13–20, 2023 in northeastern California.*

PMU	No. groups	Total	Bucks	Does	Fawns	Unk.	km
1 - Mount Dome	14	80	27	41	12	0	163.74
2 - Clear Lake	3	25	6	15	4	0	339.78
3 - Likely Tables	7	35	12	22	1	0	741.22
4 - Lassen	48	278	75	152	43	8	1,077.83
5 - Big Valley	10	46	8	32	6	0	302.76
6 - Surprise Valley	7	78	6	59	12	1	328.60
Total 1–6	89	542	134	321	78	9	2,953.92

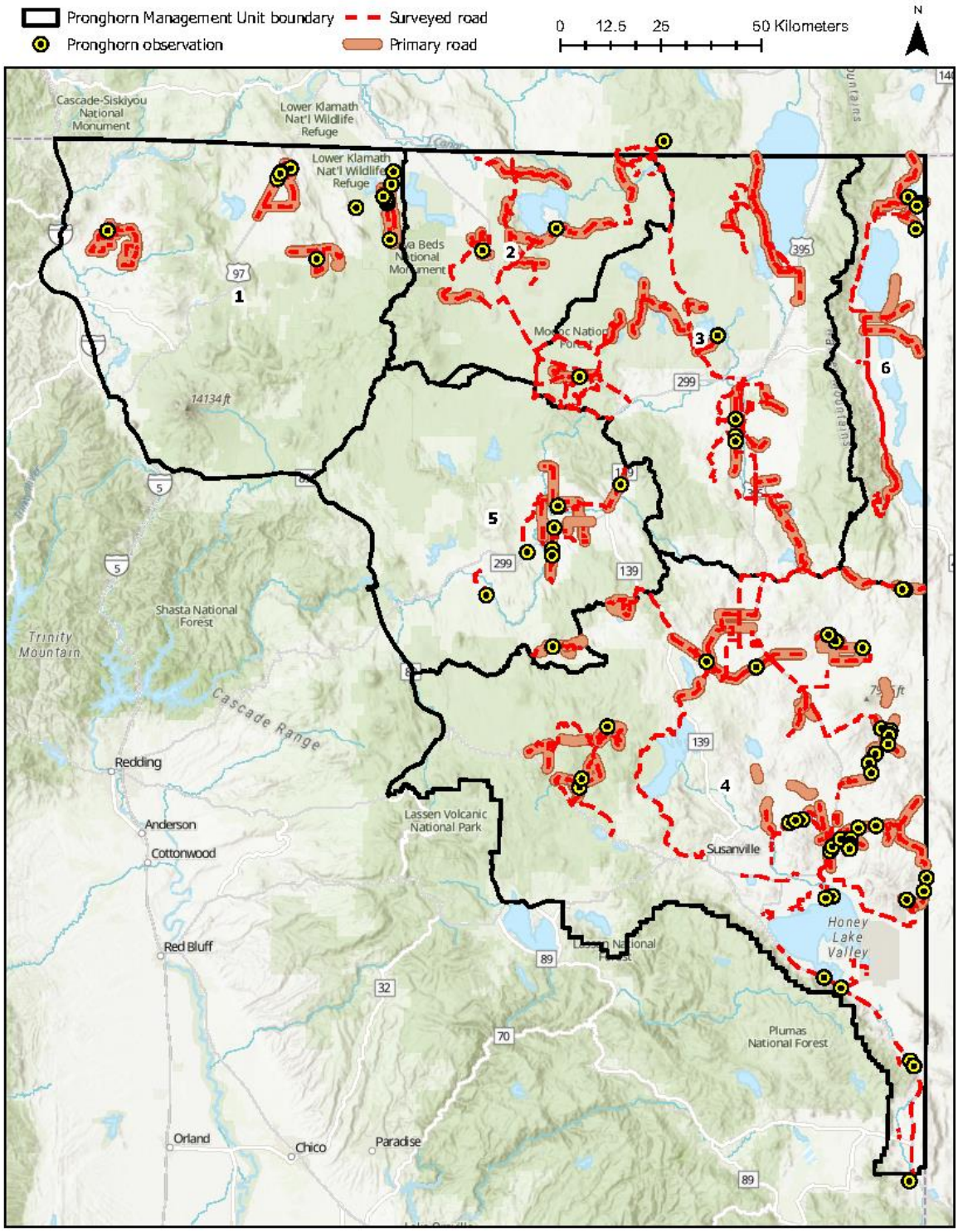

Figure 2. *Primary roads (orange lines), surveyed roads (dashed red lines), and pronghorn antelope observations (yellow circles) recorded during road surveys performed between July 13–20, 2023 in northeastern California. Pronghorn Management Unit (PMU) boundaries are displayed in black, including the Mount Dome (1), Clear Lake (2), Likely Tables (3), Lassen (4), Big Valley (5), and Surprise Valley (6) PMUs. Map produced by K. Morefield, CDFW Region 1.*

Table 2. *Composition ratios for pronghorn antelope, expressed as bucks: 100 does: fawns for each Pronghorn Management Unit (PMU) and the range-wide total collected July 13–20, 2023 in northeastern California. Ratios were derived from classification data presented in Table 1.*

PMU	Bucks	Does	Fawns
1 - Mount Dome	66	100	29
2 - Clear Lake	40	100	27
3 - Likely Tables	55	100	5
4 - Lassen	49	100	28
5 - Big Valley	25	100	19
6 - Surprise Valley	10	100	20
Total 1–6	42	100	24

Discussion

The ground-based surveys we applied allowed for classification of pronghorn group composition in northeastern California and produced demographic ratios useful to assist wildlife managers in making management decisions. The goal of CDFW's pronghorn program is to maintain viable, healthy pronghorn populations, provide a variety of recreational activities, including regulated harvest opportunity, and to minimize conflicts with humans (Pyshora 1982, CDFG 2004). When reviewing and recommending adjustments to harvest strategies, CDFW considers the observed ratios in tandem with measured population abundance, population trend, hunter harvest success, and age-at-harvest data (CDFG 2004, CDFW 2023). It is therefore necessary to routinely gather composition data to determine if pronghorn managers are achieving population objectives.

Because pronghorn are more dispersed and in relatively smaller groups during the mid-to-late summer, the period in which we surveyed is conventionally considered the best time to complete composition counts (Bear 1969, Pyshora 1977, Pojar 2004). However, results from this ground-based effort should be interpreted with some caution, and only as one piece of an evidence-based approach. The relatively low minimum counts we recorded within each zone compared to previous aerial surveys (see: Trausch et al. 2020 and Hudgens and Lovio 2023) demonstrates that this effort yielded an incomplete count, despite the expectation that pronghorn would be more visible in open habitat.

Sampling from the ground was negatively affected primarily by inaccessible roads which presumably limited access to additional pronghorn groups. For example, in areas with greater traffic volume, pronghorn may tend to avoid roads, especially doe-fawn groups as they practice greater risk avoidance (Gavin and Komers 2006, Robb et al. 2022). Although traffic volume is not necessarily "high" in the areas we surveyed, pronghorn here may nevertheless be more negatively influenced by roads than we anticipated. With access curtailed in some areas, some portion of the pronghorn population was unreachable and thus spatially unavailable for observation. Similarly, advanced successional habitat, particularly areas of elevated juniper encroachment, may have also reduced the number of pronghorn available for detection. Where survey teams could safely navigate (and assuming pronghorn were present), terrain

and vegetation obstruction limited our ability to detect pronghorn. In a few cases, pronghorn groups were detected but surveyors were unable to classify them because they were too distant from the observer, even with the added benefit of binoculars and spotting scopes.

Despite these constraints, the range-wide composition ratios reported for California pronghorn herein – 42 bucks:100 does: 24 fawns – are similar to those recently reported for Oregon and Nevada pronghorn populations. The latest report from the Oregon Department of Fish and Wildlife (ODFW) indicated a statewide composition ratio of 28 bucks:100 does: 31 fawns in 2021 (ODFW 2021) while the Nevada Department of Wildlife (NDOW) reported a statewide composition of 37 bucks:100 does: 35 fawns (NDOW 2023). Including the associated 95% CIs, our resultant ratios of 42 (95% CI = 32–52) bucks and 24 (15–33) fawns overlaps both point estimate ratios generated for neighboring populations. Because California pronghorn are known to annually migrate in to and out of both Oregon and Nevada, relating results across jurisdictions is useful for both validating and providing context to our observations (Springer 1950, Pyshora 1982, Hudgens et al. 2016).

The most commonly prescribed buck ratio goal among wildlife management agencies is 20 bucks: 100 does in the presence of regulated harvest (Salwasser 1980, Tsukamoto 1983, CDFG 2004). This is considered a biologically safe objective because enough bucks remain post-hunt to meet complete breeding requirements (Salwasser 1980, O'Gara and Yoakum 2004, Yoakum et al. 2014). CDFW considers a desirable buck ratio to be 24 bucks: 100 does, as this objective retains additional bucks for breeding, improves hunting and viewing opportunities, and ensures that age structure diversity is maintained (Pyshora 1982, Amacher 1995, CDFG 2004). Our results here indicate each PMU exceeded the buck: doe objective except for Surprise Valley. Surprise Valley has been described as an "erratic" interstate population, meaning pronghorn, let alone bucks, are not always present or available for detection, so this result is not unexpected (Pyshora 1977, Pyshora 1982, Pyshora 1987). This population segment interacts with pronghorn occupying Game Management Unit (GMU) 011, where NDOW reported a ratio of 24 bucks: 100 does in 2022 (NDOW 2023).

A fawn ratio between 30–50 fawns: 100 does is typical for populations occupying the intermountain west and can be even lower in the arid southwest (Yoakum et al. 2014). As a metric of productivity and recruitment, an increase or decrease related to this predefined threshold can prompt management action. For example, the Arizona Game and Fish Department (AZGFD) recommends consideration of a reduction in harvest when the fawn ratios decline below 30 fawns: 100 does (Yoakum et al. 2014, AZGFD 2022). Our results suggest the productivity and recruitment may be depressed in this region, consistent with a slight abundance decline that has been previously described for California's northeastern pronghorn population (Hudgens et a. 2016).

Factors known to negatively affect pronghorn in the Great Basin ecosystem include juniper encroachment, altered fire regimes, intensive grazing, feral horse competition, heightened predation, establishment of invasive species, and severe winters, among others (O'Gara and Yoakum 2004, Yoakum et al. 2014, Zeller et al. 2021, NDOW 2023). Depressed reproduction is known to occur the year following severe winter conditions

(Yoakum et al. 2014), and this region experienced the deepest snowpack on record during the 2022–2023 winter (Hudgens and Lovio 2023). Whether our observed fawn ratios represent a decline in the fawn crop or a continued trend relative to previous years is difficult to determine without recent composition ratios to compare to. While the winter conditions preceding our efforts may have impacted 2023 natality, no single factor can fully explain the depressed productivity and gradual abundance decline that has been observed in this population to date (Garcelon and Hudgens 2020). Continued inventory, monitoring, and research are needed to determine the effects each of these factors may have on population productivity more fully.

Management Implications

Routine inventory and monitoring is required to provide wildlife managers with the necessary information to make science-based decisions. We recommend a return to annual summer composition surveys to complement winter abundance surveys. Future summer composition surveys should be performed using fixed-wing aircraft to gather data more efficiently and to avoid the pitfalls related to ground-based searches. Such methods will allow CDFW staff to survey a greater total area and avoid the limitations associated with impassable roads, obstructive terrain/vegetation, and ambiguity by distance. Should aerial services remain unavailable during future summer periods, we recommend including additional all-terrain vehicle (ATV) or utility task vehicle (UTV) survey teams to navigate roads heretofore inaccessible by conventional 4WD vehicles, with the aim to increase spatial coverage, accommodate for pronghorn road-avoidance behavior, and increase pronghorn detections.

Although the buck ratios we report support the notion that the bucks-only harvest regime employed by CDFW is likely not impacting the population (Hudgens et al. 2016), consideration of a reduced harvest recommendation is warranted when combined with the observed fawn ratios (Yoakum et al. 2014, AZGFD 2023). Close attention should be given to the Likely Tables PMU, which has experienced a continued population decline and where we observed the lowest fawn ratio out of each PMU (Hudgens et al. 2016, Trausch et al. 2020, Hudgens and Lovio 2023). It is noteworthy that this extended decline prompted a reduction in buck tags from 90 to 50 in the Likely Tables PMU as recently as 2021 (California Fish and Game Commission [CFGC] 2021). Final recommendations regarding potential harvest adjustments will be made after completing winter abundance surveys for all six PMUs. Recommendations will not only take into consideration demographic and abundance survey results, but also population trend, hunter harvest success, age-at-harvest data, and sociological factors (Pyshora 1982, CDFG 2004, CDFW 2023).

Acknowledgements

Thanks to K. Morefield for coordinating the QuickCapture and GIS components of this effort. Thanks to CDFW WLB staff J. Diamond, B. Furnas, B. Leo, A. Murray, J. Ponce, and C. Steinbeiser and CDFW R1 staff S. Anderson, A. Avrin, P. Divine, B. Ehler, C. Found-Jackson, R. Shinn, and B. Wong for their assistance in safely completing these surveys.

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Pronghorn does at CDFW's Ash Creek Wildlife Area, Lassen County. Photo by Jenny Diamond.