

# **Report on spring aerial surveys of tule elk (*Cervus canadensis nannodes*) in the Mendocino Elk Management Unit**

Prepared by:

Angela Moran<sup>1</sup>, Ken Morefield<sup>2</sup>, and Kristin Denryter<sup>3</sup>

<sup>1</sup>California Department of Fish and Wildlife, Northern Region, Eureka, CA

<sup>2</sup>California Department of Fish and Wildlife, Northern Region, Redding, CA

<sup>3</sup>California Department of Fish and Wildlife, Wildlife Branch, West Sacramento, CA

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## **SUMMARY**

Routine population monitoring is essential to inform management, including regulated harvest, of big game species. In March 2020, staff from the California Department of Fish and Wildlife (CDFW) in the Northern Region, North Central Region, and Wildlife Branch conducted the first aerial surveys of tule elk in the Mendocino Elk Management Unit (EMU) since 2016. March 2020 surveys were the first in a proposed three-year series of surveys to establish baseline information on tule elk (*Cervus canadensis nannodes*) population numbers and distributions, which are anecdotally reported to be increasing. Staff spent two days conducting 13 h of aerial surveys from a Bell 407 helicopter to count elk in the Mendocino Elk Management Unit (EMU) in Mendocino County. A contract pilot flew the helicopter along transects spaced 800 m apart in the entirety of five polygons located in the vicinities of Potter Valley, Willits, Eden Valley, Laytonville/Sherwood Valley, and Covelo. The minimum count was 536 elk, of which 96 elk were positively identified as adult males, 4 were calves estimated to be <1-month old, and the remaining 436 included adult females and juveniles of both sexes that could not be distinguished definitively from adult females. Because of dense forest cover in some areas, we think our minimum count is conservative and lower than the true number of tule elk present in the Mendocino EMU. Thus, we recommend follow-up surveys from the ground during summer when elk are on pasture, if CDFW can collaborate with private landowners to survey elk on private lands. We recommend flying surveys between late August–January annually to acquire more accurate information on age and sex ratios of elk in the Mendocino EMU. Lastly, we also recommend following up aerial surveys of tule elk with ground surveys for Roosevelt elk along the heavily forested Mendocino coastline, where elk cannot be seen from a helicopter, to produce an EMU-wide estimate of elk abundance.

## Introduction

Populations of elk (*Cervus canadensis ssp.*) anecdotally are reported to be increasing in size and distribution throughout California. As elk populations increase, there is greater potential for human-elk conflicts. A primary goal (Goal 4) identified in the 2018 Elk Conservation and Management Plan by the California Department of Fish and Wildlife (CDFW) is to “alleviate human-elk conflicts and elk depredation complaints”. Objectives for alleviating conflict include to “reduce incidents of human-elk conflicts on private property by at least 25%” and “identify and map areas of high human-elk conflict; assess potential for alleviating damage by reducing localized elk populations through regulated hunting, where feasible.”

To more actively manage and respond to increased reports of conflict and to manage elk populations, consistent with goals in the 2018 Elk Conservation and Management Plan, CDFW initiated comprehensive monitoring of elk populations beginning in 2019. Population monitoring allows biologists to determine demographic rates (e.g., birth rates, death rates, recruitment, survival) of herds and herd size; track population trajectories; visualize habitat use and general health of animals; and identify areas of potential range expansions. Data collected during routine population monitoring is used to produce population estimates needed to evaluate potential effects of various harvest scenarios on populations.

In 2020, CDFW's Northern Region and Wildlife Branch collaboratively developed a plan for aerial surveys of tule elk (*C. c. nannodes*) in the Mendocino Elk Management Unit (EMU). Ground-based surveys of elk in the Mendocino EMU were not conducted regularly or systematically in the past and when they were conducted, they provided limited data, as many areas where tule elk occur in Mendocino are on private lands or are otherwise inaccessible from the ground. Hence, aerial surveys are a more appropriate and effective way to survey tule elk in the Mendocino EMU.

## SURVEY GOALS AND OBJECTIVES

Surveys in the Mendocino EMU in 2020 are part of a comprehensive, longer-term monitoring plan (currently being developed) to estimate EMU-wide abundances, demographic rates, habitat use, and movement patterns of elk. The overall goal of this survey was to collect baseline population information to better understand the status of tule elk in the Mendocino EMU. To that end, we aimed to accomplish the following objectives for tule elk in the Mendocino EMU:

1. Determine distributions of subherds throughout surveyed portions of the EMU.
2. Produce a minimum count.
3. Determine herd composition (age and sex ratios).

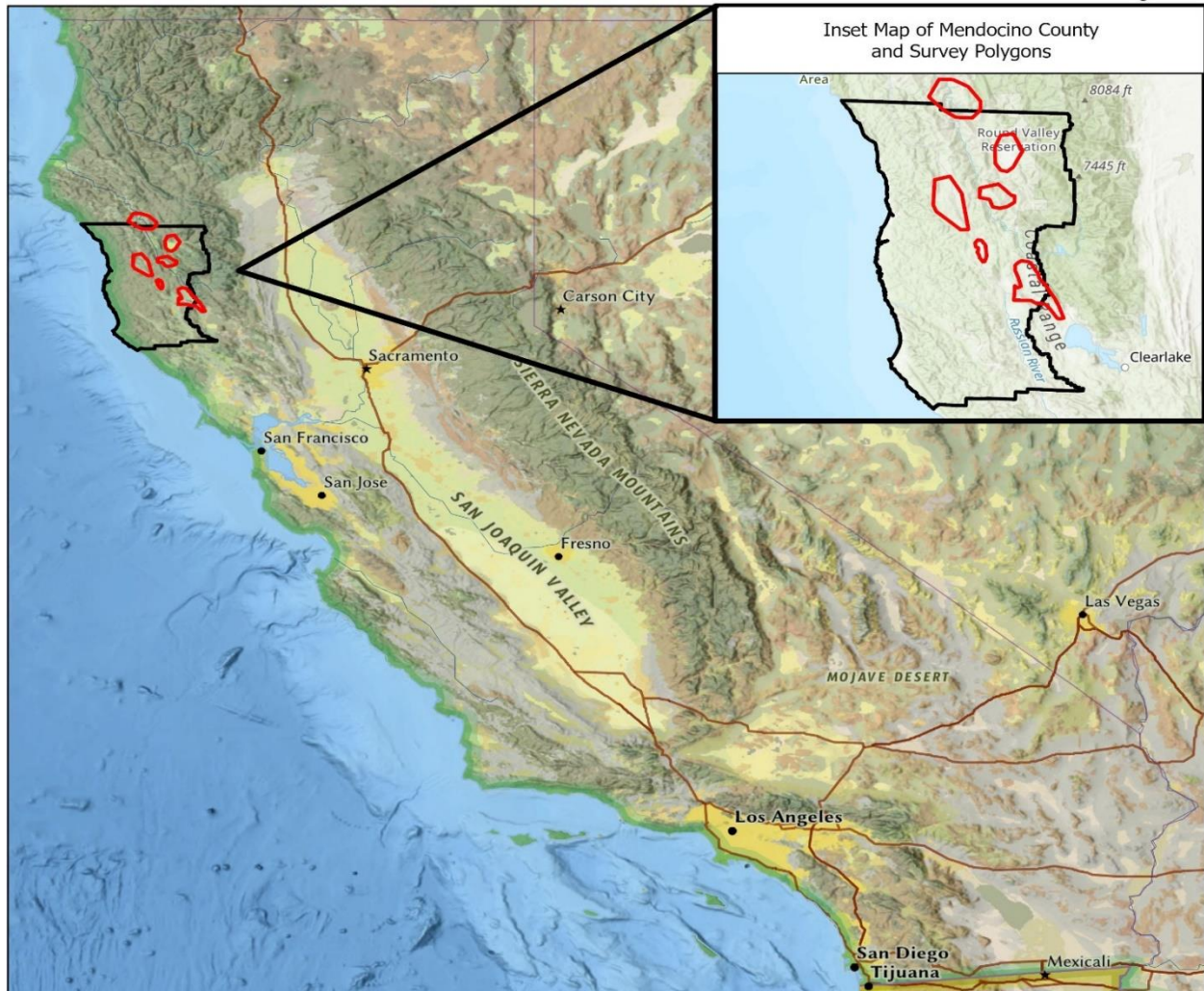
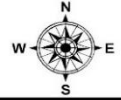
## STUDY AREA

The survey took place in the Mendocino EMU in Mendocino County, California (Figure 1). The 2018 Elk Conservation and Management Plan describes the Mendocino EMU as

## Mendocino County Elk Surveys

 Elk Survey Polygons  Mendocino County

0 50 100 200 Miles



**Figure 1: The Survey Polygons in the Mendocino EMU, Mendocino County, California.**

a system of north and northwest-trending mountains and valleys. Elevation extends from sea level to 6,954 ft above sea level at Anthony Peak. Summer temperatures can exceed 95 °F in interior Mendocino County and freezing temperatures occur in the winter in many areas. Annual precipitation ranges from 45–80 in throughout the EMU, falling mostly as rain. Mendocino County is 80% private land and the primary land uses are timber, livestock, and agriculture production. Elk presence on public land is limited. The county is divided into the following vegetation types:

- 50% redwood, Douglas-fir, and mixed-coniferous forests
- 15% woodlands and savannahs
- 10% chaparral
- 20% riparian and agriculture
- 5% other

Although both Roosevelt (*C. c. roosevelti*) and tule elk occur in Mendocino County, they occur in different habitat types and areas. Roosevelt elk live in coniferous forests along the coastline from the Humboldt-Mendocino county border south to Westport, and occasionally occur south and east of this area. Tule elk are most prevalent inland around Highway 101 and in the vicinities of Lake Mendocino, Potter Valley, Willits, Laytonville/Sherwood Valley, Eden Valley, and Covelo. There have been some reports of home range overlap in the two species, but this has not been well studied, and these surveys occurred in areas occupied almost exclusively by tule elk.

## **METHODS**

Prior to survey flights, we mapped flight transects spaced 800 m apart in a north-south orientation in six areas in the Mendocino EMU (Figure 2). These areas occurred in open (i.e., non-forested) areas of Mendocino County, on known winter and summer ranges for tule elk within the Mendocino EMU. We focused survey efforts in areas of human-elk conflict, including Potter Valley and Laytonville/Sherwood Valley, and adjacent private lands, as well as other areas where reporting of elk sightings has increased in recent years. Previous road surveys, personal communications with landowners and local game wardens, and 2016 survey flights for Potter Valley also informed selection of survey areas.

We flew surveys on March 12 and 13, 2020, beginning at first light and continued until we met the daily flight-time limit of 7 h. A contract pilot flew three CDFW staff in a Bell 407 helicopter at an approximate speed of 30–60 knots and at least 40 m above ground level. CDFW staff functioned as a combined navigator-data recorder (front passenger seat) and as two observers (rear seats). A radio flight monitor was on the ground to check the status of the helicopter every 30 minutes, and an automated flight follower tracked the helicopters from a computer offsite.

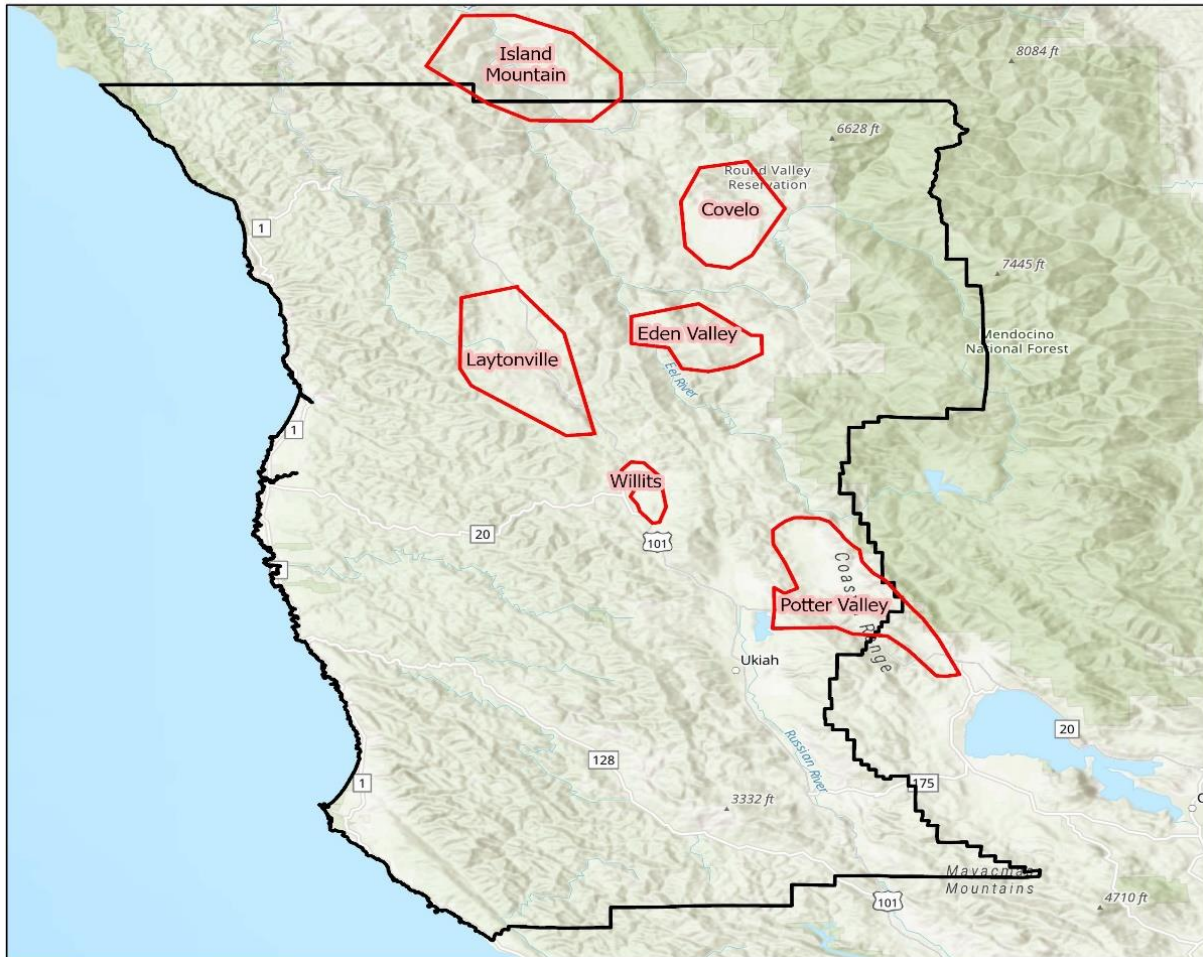
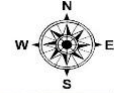
We initiated survey flights at the southernmost area and worked north, completing one area before moving to another. The navigator had an electronic tablet running GPS tracking software (Gaia) with preloaded maps of the survey area. Gaia software also recorded flight paths in survey areas. When a group of elk was spotted, the navigator-data recorder documented the speed and altitude of the helicopter, the helicopter left the transect and flew toward the group of elk, and the following information was collected (Appendix A):

1. A waypoint
2. Elk activity (bedded, standing, moving)
3. Total number of elk
4. Number of identified cows, bulls, spikes, and calves
5. Percent cover (tree and shrubs within a 10-m radius of the initial location of the animal; recorded in 10% increments)
6. Habitat type (grass, shrub, deciduous forest, coniferous forest)
7. Observer that initially detected elk

## Mendocino County Elk Surveys

Elk Survey Polygons Mendocino County

0 6.25 12.5 25 Miles



**Figure 2: The Survey Polygons in the Mendocino EMU, Mendocino County, California.**

After the data was recorded, the helicopter returned to the transect to continue the survey.

### RESULTS

We detected a total of 536 elk in 16 groups (Table 1). These included 174 elk in Potter Valley, 37 in Willits, 63 in Eden Valley, 182 in Laytonville/Sherwood Valley, and 80 in Covelo (Tables 1–6; Fig. 3-7).

We had a delayed start on the first survey day, and inclement weather on the third and fourth survey days. Therefore, we ended up surveying a total of 5 polygons over two days, for a total flight time of 13 h. We did not survey the northernmost polygon located on the Humboldt-Trinity-Mendocino county lines.

**Table 1: Number of tule elk counted, by sex and age class, during survey flights in the Mendocino Elk Management Unit in March 2020.**

<b>SURVEY AREA</b>	<b>ADULT FEMALES</b>	<b>SPIKE-ANTLERED MALES</b>	<b>BRANCH-ANTLERED ADULT MALES</b>	<b>CALVES</b>	<b>TOTAL</b>
<b>POTTER VALLEY</b>	156	3	11	4	<b>174</b>
<b>WILLITS</b>	12	2	23	0	<b>37</b>
<b>EDEN VALLEY</b>	55	4	4	0	<b>63</b>
<b>LAYTONVILLE/ SHERWOOD VALLEY</b>	152	13	17	0	<b>182</b>
<b>COVELO</b>	61	4	15	0	<b>80</b>
<b>TOTAL</b>	<b>436</b>	<b>26</b>	<b>70</b>	<b>4</b>	<b>536</b>

**Table 2: Number of tule elk counted, by sex and age class, and associated waypoints in Figure 3, during survey flights in Potter Valley in March 2020.**

<b>WAYPOINT</b>	<b>ADULT FEMALES</b>	<b>SPIKE-ANTLERED MALES</b>	<b>BRANCH-ANTLERED ADULT MALES</b>	<b>CALVES</b>	<b>TOTAL</b>
<b>1</b>	58	3	0	2	<b>63</b>
<b>2</b>	32	0	0	0	<b>32</b>
<b>3</b>	18	0	1	0	<b>19</b>
<b>4</b>	22	0	1	0	<b>23</b>
<b>5</b>	0	0	1	0	<b>1</b>
<b>6</b>	26	0	8	2	<b>36</b>
<b>TOTAL</b>	<b>156</b>	<b>3</b>	<b>11</b>	<b>4</b>	<b>174</b>

**Table 4: Number of tule elk counted, by sex and age class, and associated waypoints in Figure 4, during survey flights in Willits in March 2020.**

<b>WAYPOINT</b>	<b>ADULT FEMALES</b>	<b>SPIKE-ANTLERED MALES</b>	<b>BRANCH-ANTLERED ADULT MALES</b>	<b>CALVES</b>	<b>TOTAL</b>
<b>7</b>	12	2	23	0	<b>37</b>

**Table 4: Number of tule elk counted, by sex and age class, and associated waypoints in Figure 5, during survey flights in Eden Valley in March 2020.**

<b>WAYPOINT</b>	<b>ADULT FEMALES</b>	<b>SPIKE-ANTLERED MALES</b>	<b>BRANCH-ANTLERED ADULT MALES</b>	<b>CALVES</b>	<b>TOTAL</b>
<b>8</b>	0	0	2	0	<b>2</b>
<b>9</b>	28	0	0	0	<b>28</b>
<b>10</b>	26	4	1	0	<b>31</b>
<b>11</b>	1	0	1	0	<b>2</b>
<b>TOTAL</b>	<b>55</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>63</b>

**Table 5: Number of tule elk counted, by sex and age class, and associated waypoints in Figure 6, during survey flights in Laytonville/Sherwood Valley in March 2020.**

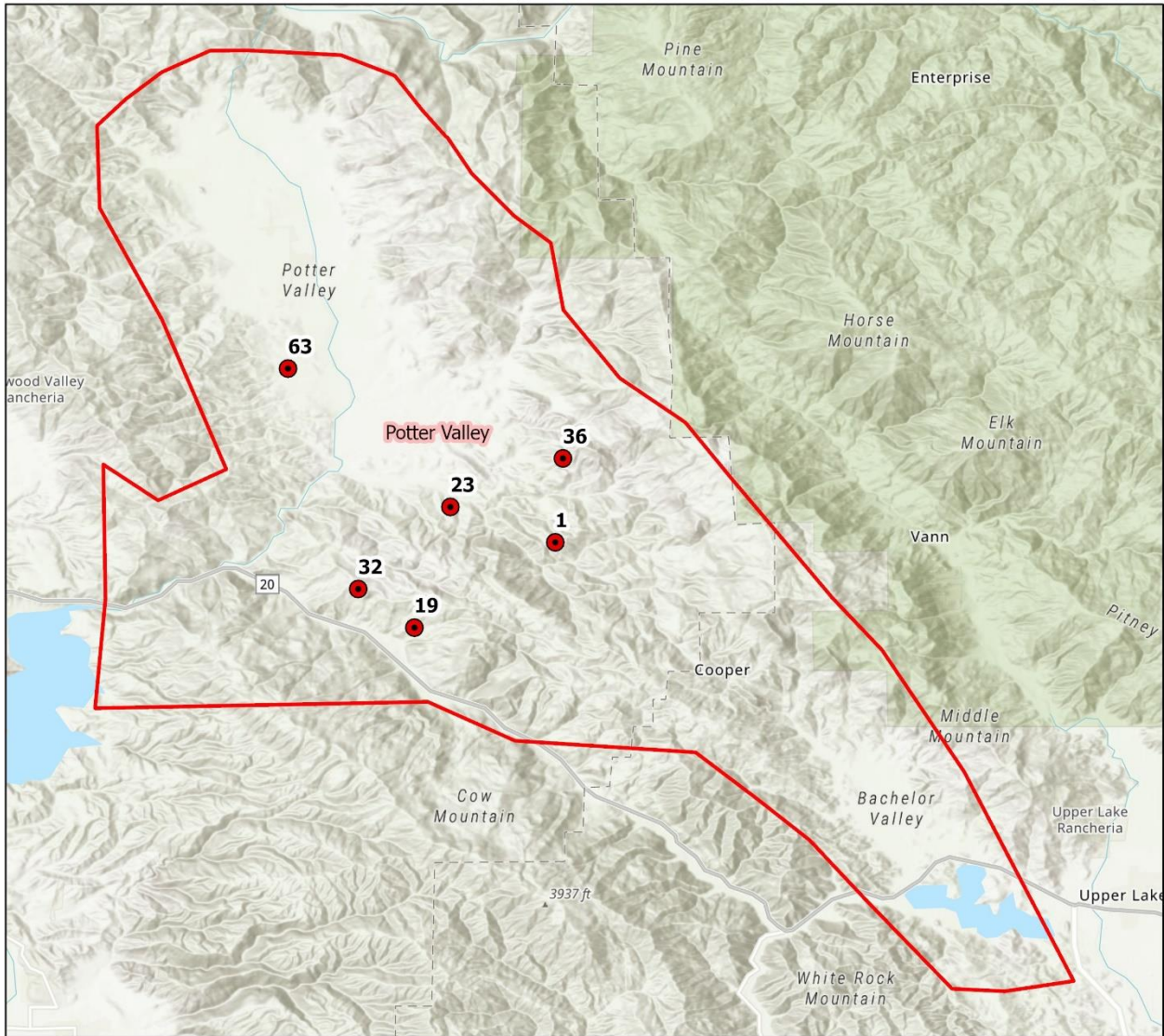
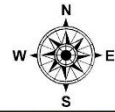
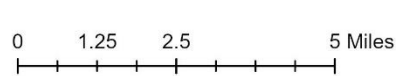
<b>WAYPOINT</b>	<b>ADULT FEMALES</b>	<b>SPIKE-ANTLERED MALES</b>	<b>BRANCH-ANTLERED ADULT MALES</b>	<b>CALVES</b>	<b>TOTAL</b>
<b>1</b>	5	2	0	0	<b>7</b>
<b>2</b>	5	0	0	0	<b>5</b>
<b>3</b>	17	1	0	0	<b>18</b>
<b>4</b>	15	3	0	0	<b>18</b>
<b>5</b>	51	1	0	0	<b>52</b>
<b>6</b>	6	0	0	0	<b>6</b>
<b>7</b>	0	2	4	0	<b>6</b>
<b>8</b>	14	1	0	0	<b>15</b>
<b>9</b>	39	3	1	0	<b>43</b>
<b>10</b>	0	0	4	0	<b>4</b>
<b>11</b>	0	0	8	0	<b>8</b>
<b>TOTAL</b>	<b>152</b>	<b>13</b>	<b>17</b>	<b>0</b>	<b>182</b>

**Table 6: Number of tule elk counted, by sex and age class, and associated waypoints in Figure 7, during survey flights in Covelo in March 2020.**

<b>WAYPOINT</b>	<b>ADULT FEMALES</b>	<b>SPIKE-ANTLERED MALES</b>	<b>BRANCH-ANTLERED ADULT MALES</b>	<b>CALVES</b>	<b>TOTAL</b>
<b>12</b>	0	2	13	0	<b>15</b>
<b>13</b>	31	1	0	0	<b>32</b>
<b>14</b>	30	1	0	0	<b>31</b>
<b>15</b>	0	0	1	0	<b>1</b>
<b>16</b>	0	0	1	0	<b>1</b>
<b>TOTAL</b>	<b>61</b>	<b>4</b>	<b>15</b>	<b>0</b>	<b>80</b>

# Potter Valley Survey Polygon

● Elk Observations     Elk Survey Polygon

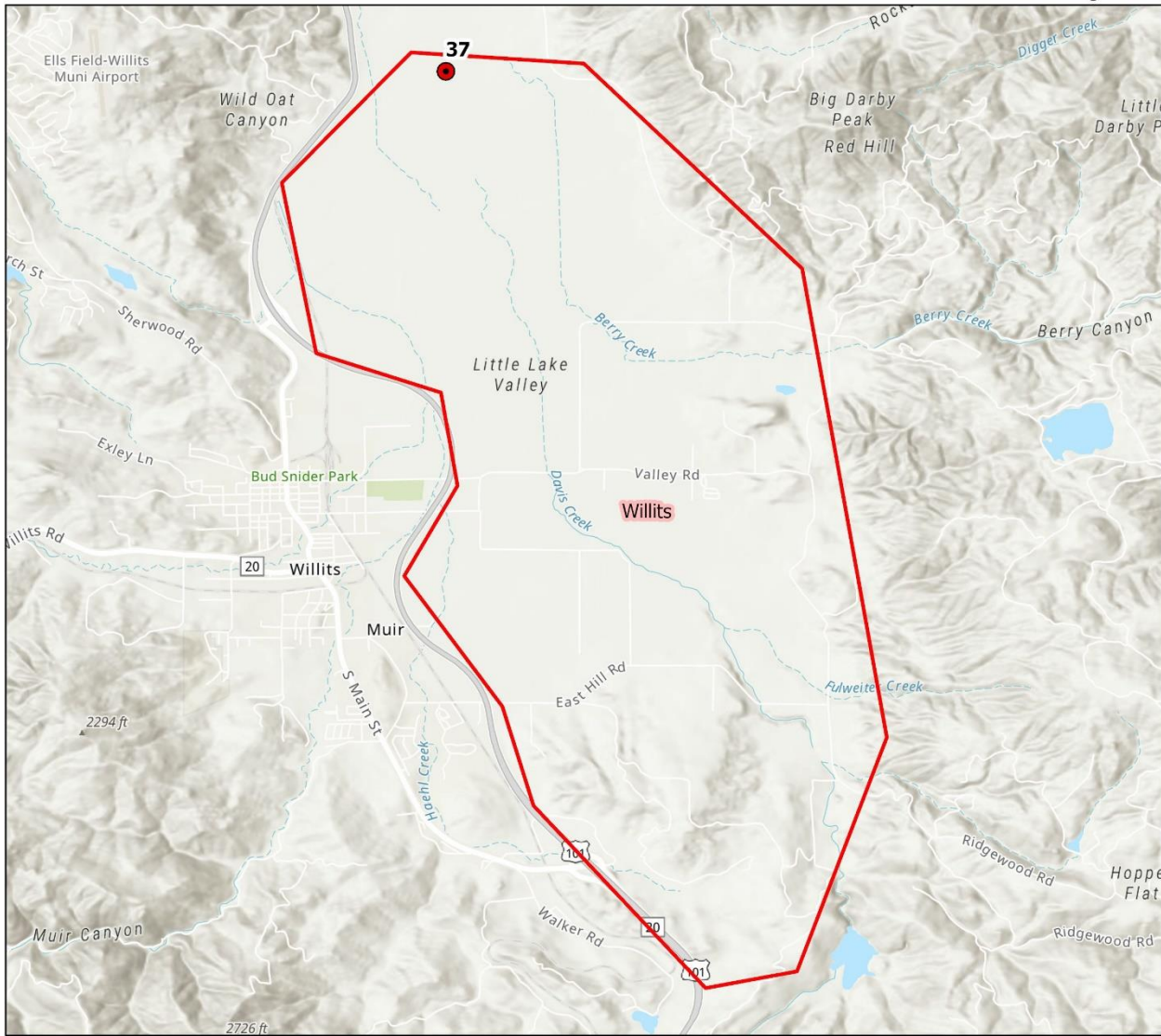
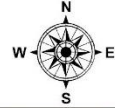
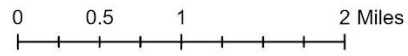


**Figure 3: Location and number of tule elk counted during survey flights in Potter Valley in the Mendocino Elk Management Unit in March 2020.**



# Willits Survey Polygon

● Elk Observations     Elk Survey Polygon

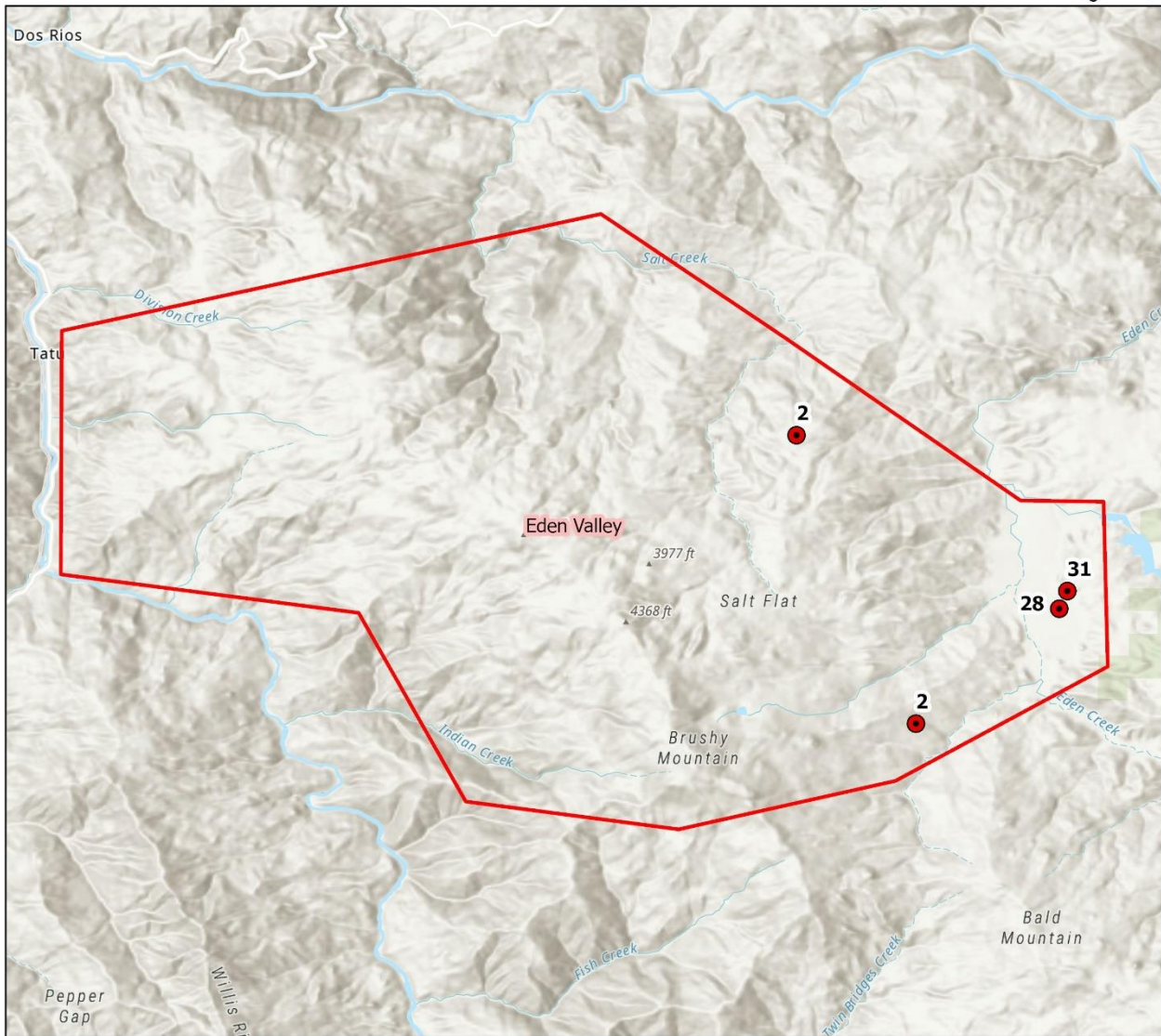
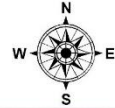


**Figure 4: Location and number of tule elk counted during survey flights in Willits in the Mendocino Elk Management Unit in March 2020.**

# Eden Valley Survey Polygon

● Elk Observations     Elk Survey Polygon

0 0.63 1.25 2.5 Miles

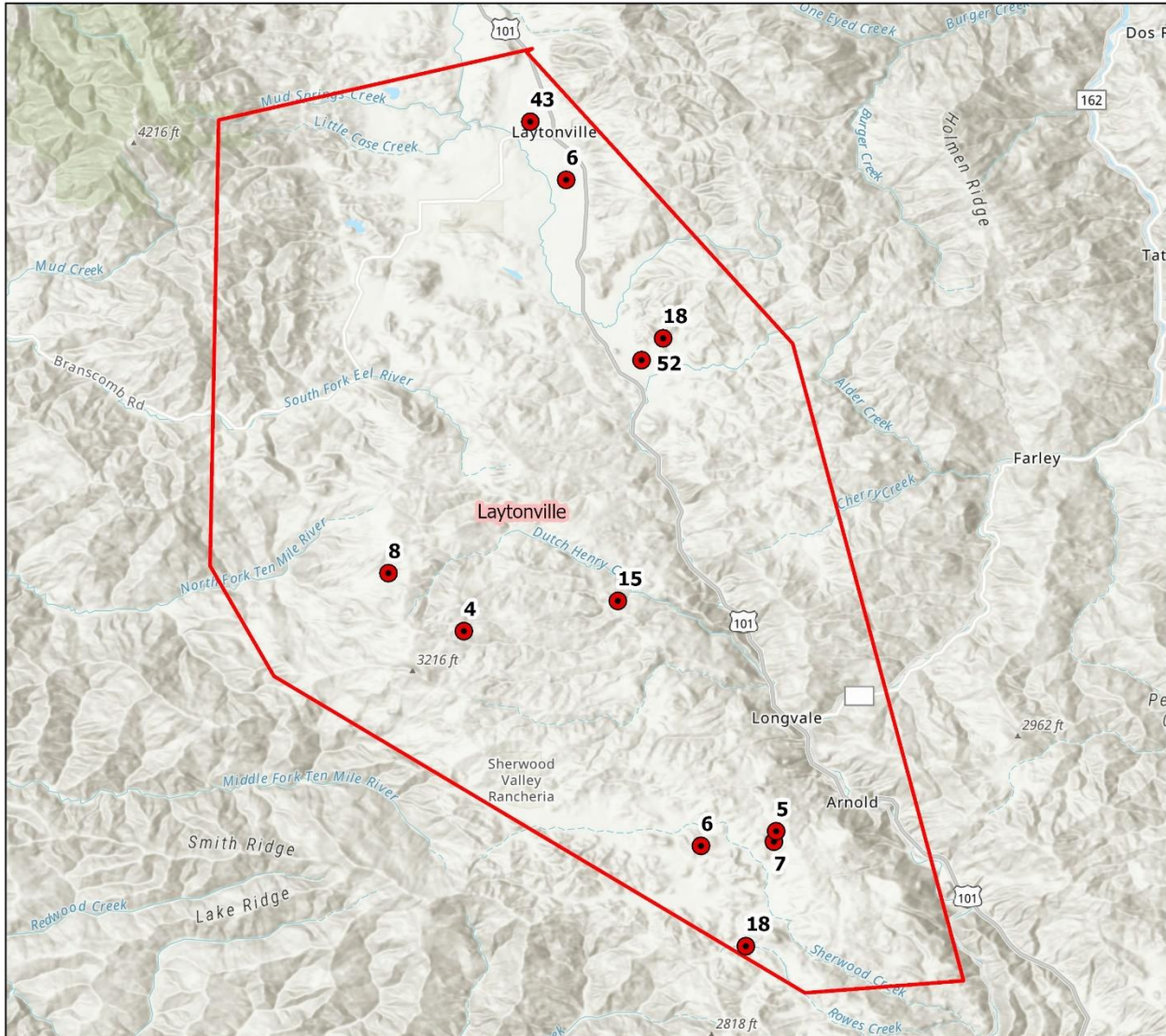
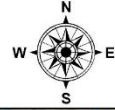


**Figure 5: Location and number of tule elk counted during survey flights in Eden Valley in the Mendocino Elk Management Unit in March 2020.**

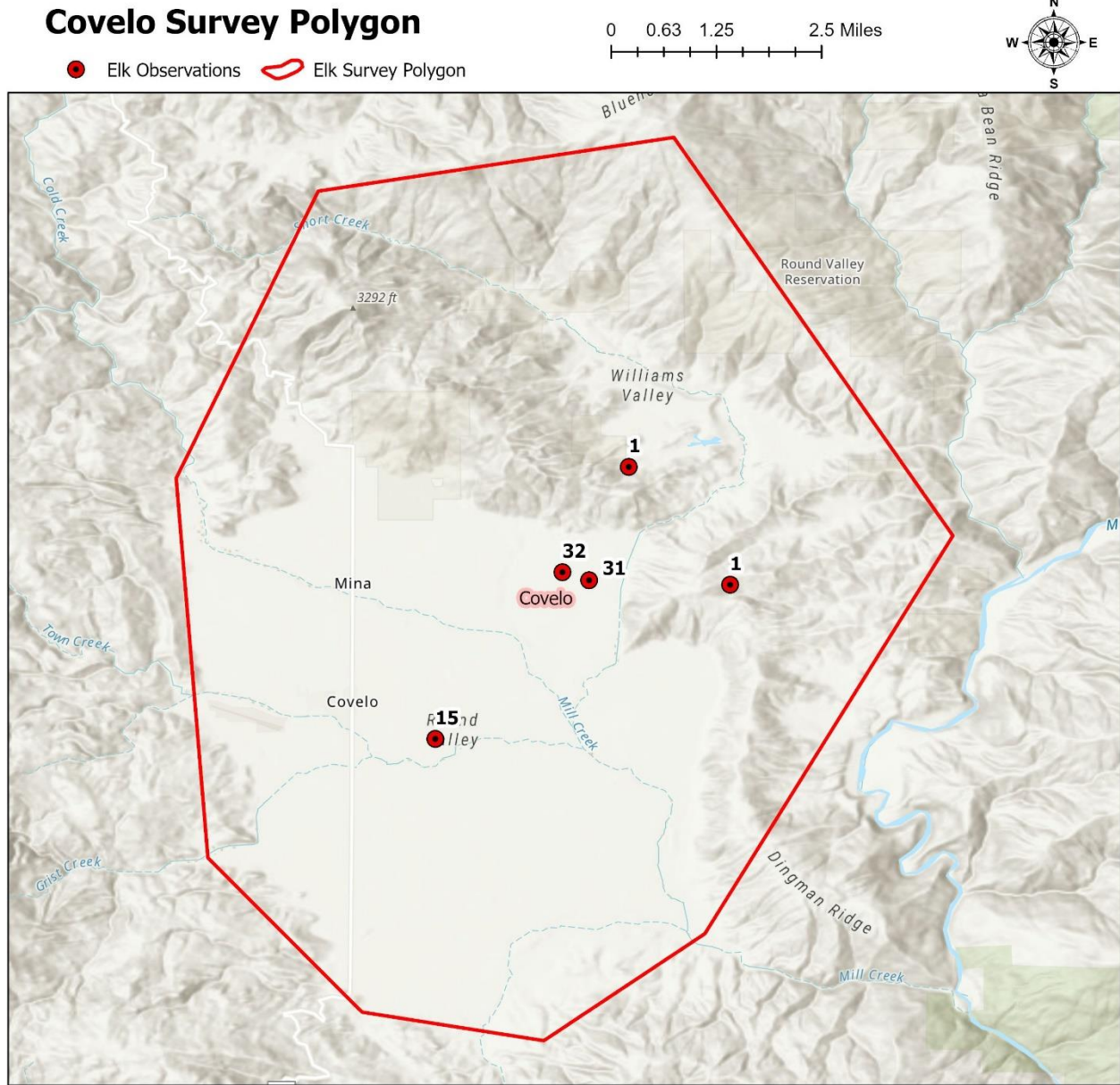
# Laytonville Survey Polygon

● Elk Observations     Elk Survey Polygon

0 1.25 2.5 5 Miles



**Figure 6: Location and number of tule elk counted during survey flights in Laytonville/Sherwood Valley in the Mendocino Elk Management Unit in March 2020.**



**Figure 7: Location and number of tule elk counted during survey flights in Covelo in the Mendocino Elk Management Unit in March 2020.**

**DISCUSSION**

The 2018 CDFW Elk Conservation and Management Plan established a population objective of 800–2,500 tule elk with a minimum ratio of 25 bulls per 100 cows in the Mendocino EMU. Most of the 2020 survey polygons were in interior Mendocino County in open areas inhabited by tule elk. Although our minimum count from 2020 survey flights was below the overall population objective, we think this is a function of moderate to low detection probabilities that made it difficult to observe elk in forested portions of survey areas, particularly outside of valleys. We especially think we missed lone bulls or small groups of bulls in those areas.

We were unable to get an accurate composition of the population to estimate ratios of adult males to adult females and adult females to juveniles. Four newborn calves were observed while surveying the first polygon in Potter Valley, which is early in the year and important to document. Older calves (approximately 1 year old), both male and female, were lumped in with the count of adult females because their relatively large body size and lack of antlers made them difficult to distinguish from adult females at this time of year. Some adult males had dropped their antlers already, but others had not. Therefore, there was bias where older male calves and smaller adult males may have been counted as adult females. In the future, surveying in late August–January when juveniles and adults can be easily distinguished by age class and sex will result in more accurate estimates of population composition.

Roosevelt elk were not counted in this survey as they occur in heavily timbered areas along the coast in Mendocino County, where dense canopy cover was not conducive to seeing elk during aerial surveys. A recent elk survey in this area was conducted in the Sinkyone Wilderness State Park on December 18, 2019, where a total of 22 elk were counted consisting of 20 adult females and 2 calves. To obtain an estimate of the total number of elk in the Mendocino EMU, these elk need to be accounted for using a survey method that can be implemented in forested areas, such as ground-based surveys, camera traps, or fecal DNA capture-mark-recapture.

This was the start of an effort to conduct at least 3 years of surveys and the minimum count generated from this survey will serve as a baseline for comparison to future surveys, to help establish a population trajectory. Previously, the only area in Mendocino County that had been surveyed for elk by helicopter was Potter Valley: in February 2016, 203 elk were counted in Potter Valley, consisting of 136 adult females, 38 calves, and 29 adult males. Compared to the 2016 survey, we counted 29 fewer elk in 2020 in Potter Valley, however, neither minimum count provides enough information to determine whether this is a statistically significant change. Future surveys will aim to incorporate more statistically robust methods (e.g., distance sampling, sightability, or mark-resight) for estimating abundance as well as estimates of uncertainty needed to produce confidence intervals.

In sum, we need to survey the Mendocino EMU for at least three years to obtain a population trajectory and estimate to inform future management and regulated harvest. While helicopter surveys may do well to count elk in non-forested areas of the EMU, other methods are more appropriate for forested areas on the coast. We will work to implement population-monitoring methods for inland and coastal elk to produce a more accurate estimate of tule and Roosevelt elk populations throughout the EMU.

## **LITERATURE CITED**

California Department of Fish and Wildlife. 2018. Elk Conservation and Management Plan. Sacramento, CA.

## APPENDIX A: DATA SHEET

Project:													
Date:			Front Left:				% Cover= Tree and shrubs at 10m Radius, 10% increments Activity= First animal sighted (B = Bedded, S = Standing, M = Moving) Habitat Type= Dominate veg (G = Grass, S = Shrub, D = Deciduous, C = Conifer)						
Start:			Front Right:										
End:			Back Left:										
Weather:			Back Right:										
First Sighting							Composition					Distance	Notes
Wpt	Speed	Altitude	Activity	% Cover	Hab Type	Obsrvr	Total	Bulls	Calves	Cows	Unclass		