

Blue Mountain Elk Herd: Monitoring Juvenile Recruitment and Survival

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Presentation Overview

Population Dynamics Benchmarks

Recruitment & Research History

Current Decline, Juvenile Survival, & Cause-Specific

Mortality Monitoring

Results Discussion

Next Steps

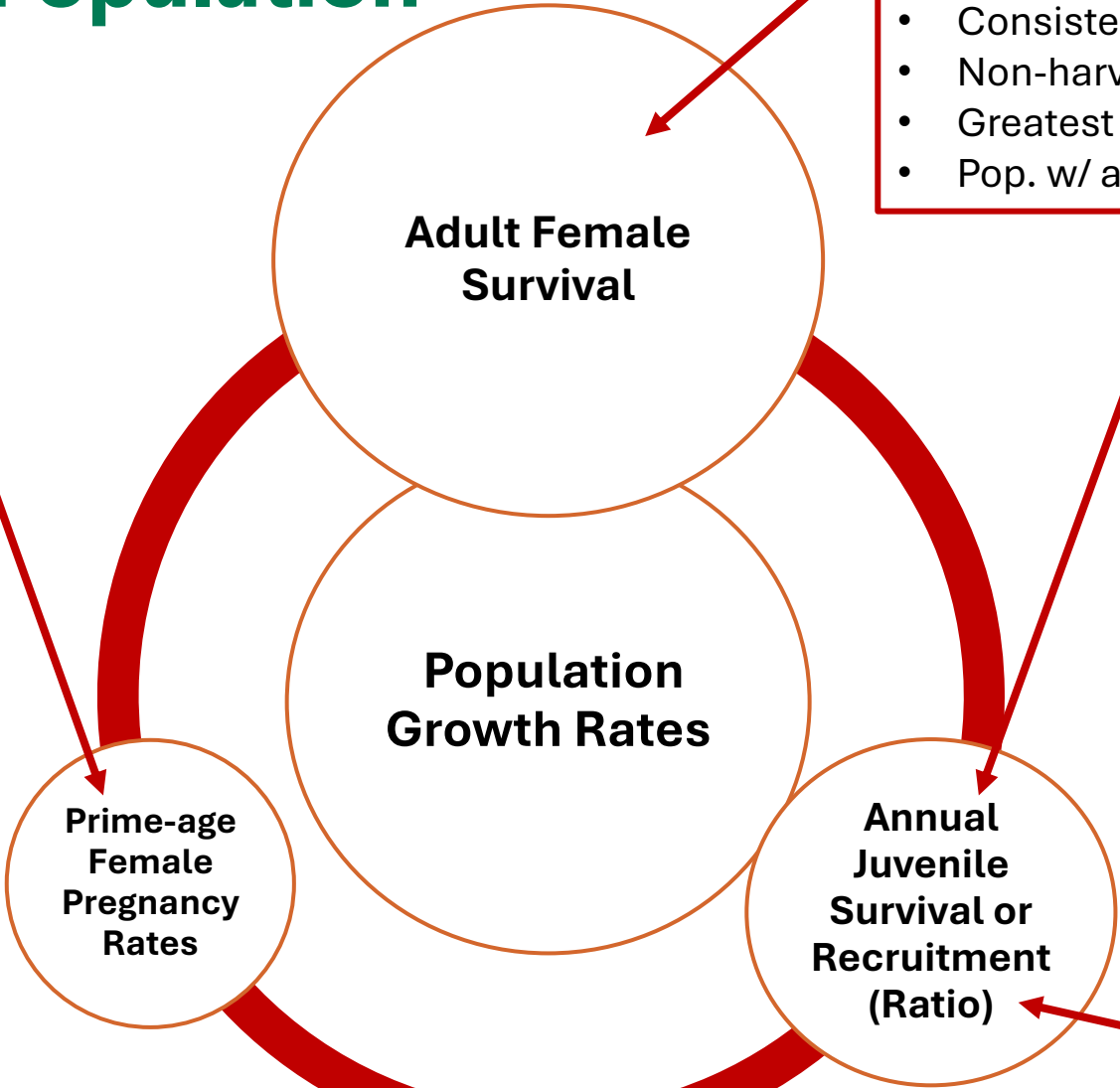
Overview of Elk Population Dynamics

Additional influencing metric

- Pregnancy rates of prime-age females = 2-14-years-old
 - Greatest impact is summer-autumn nutrition
 - Pregnancy rate of:
 - $\geq 90\%$ = excellent
 - 70-90% = marginal
 - 40-70% = poor
- Summer-autumn nutrition

Greatest influencing metric

- Consistently robust & stable
- Non-harvested population $\approx 0.87-0.93$
- Greatest impact is antlerless harvest
- Pop. w/ antlerless harvest ≈ 0.85



Most significant metric

- Highly variable
 - 0.17-0.57
- Typical juv. survival rates necessary for pop growth, if female survival is high – 0.31-0.35

Population stability occurs when –female juv. recruitment = adult female mortality

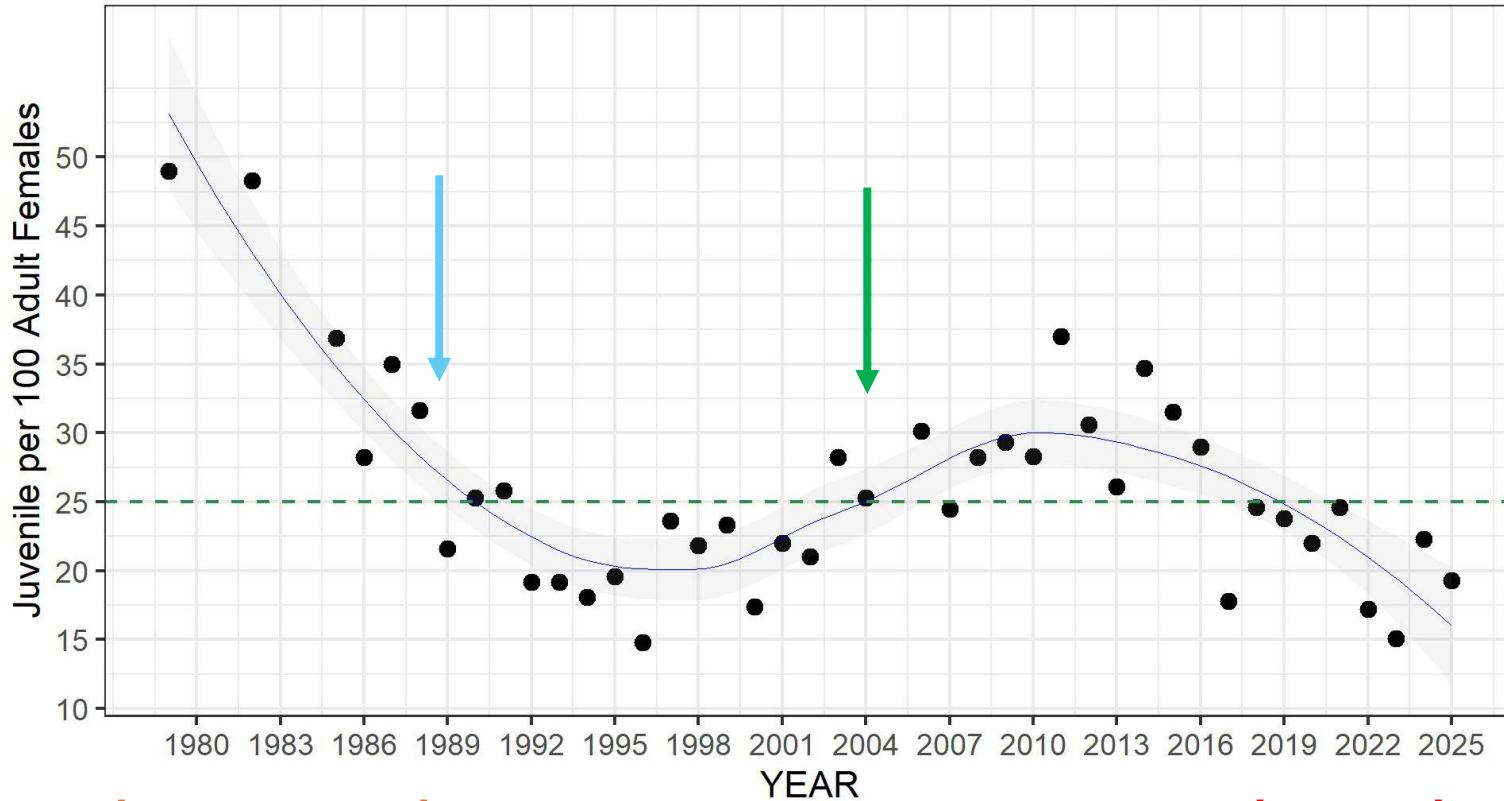
• **25 juv. : 100 adult females**

- 0.85 preg. = 0.31 = RR 25
- 0.74 preg. = 0.35 = RR 25

Recruitment Ratio: juvenile elk which have survived to ≈ 1 year of age, estimated during March aerial surveys, and expressed as a ratio of number of juvenile per 100 adult females.

Blue Mountains Monitoring History - Recruitment

Recruitment Ratios, 1979-2025



Fowler, 1988 – Depressed Recruitment Ratios

- Low pregnancy rates: 1987 = 65%, 1988 = 68%
 - Prime-age-females (2-10 years) = 78%
- Low bull ratio & lack of adult bulls
- Drought and declining habitat conditions impacting nutrition

Spike-only-management 1989 –

- ↑ in bull ratio from 4 to 17 by 1992

Myers, 1999 – Depressed Recruitment Ratios

- Zahn - 1992 Pregnancy rates = 89%, 1-year
- 1992-1997 Recruitment average = 19.1
- Mortality investigations estimate annual survival rates average 0.47, range 0.41-0.55
- Predation by cougars identified as greatest mortality source, but was **not** population limiting

Noyes 2004 –

- Low adult bull no. ≠ low pregnancy rates

Depressed Recruitment Ratios – 20.7 (i.e., all-herd 2017-2025)

Stability thresholds:

- R Ratio - 25 juveniles:100 adult female elk
- Prime-aged female pregnancy rates – 90%
- Annual juvenile survival rates – 0.31-0.35

Abundance Declines, Continuous Low Recruitment, and Inability to Rebuild

Herdwide Abundance Decline

2017-2025 mean = 4,148 (\approx 25% below objective)

Herdwide Low Recruitment

2017-2025 mean Recruitment Ratio (R Ratio) = 20.7

More dramatic declines observed in the Northern Core GMUs: 162, 166, 175

Initial Decline of Adult Females

2016-2020: -50%, -27%, -20%, respectively

Average Recruitment Ratios

2017-2024: 15, 17, 20, respectively

Since 2017, recruitment has been insufficient to rebuild the northern portion of the BM elk herd and has been marginal in maintaining stability throughout the remaining core.



Stability thresholds:

R Ratio - 25 juveniles:100 adult female elk

Monitoring Juvenile Elk Survival and Cause-Specific Mortality

2015-2021 Game Management Plan Guidance:

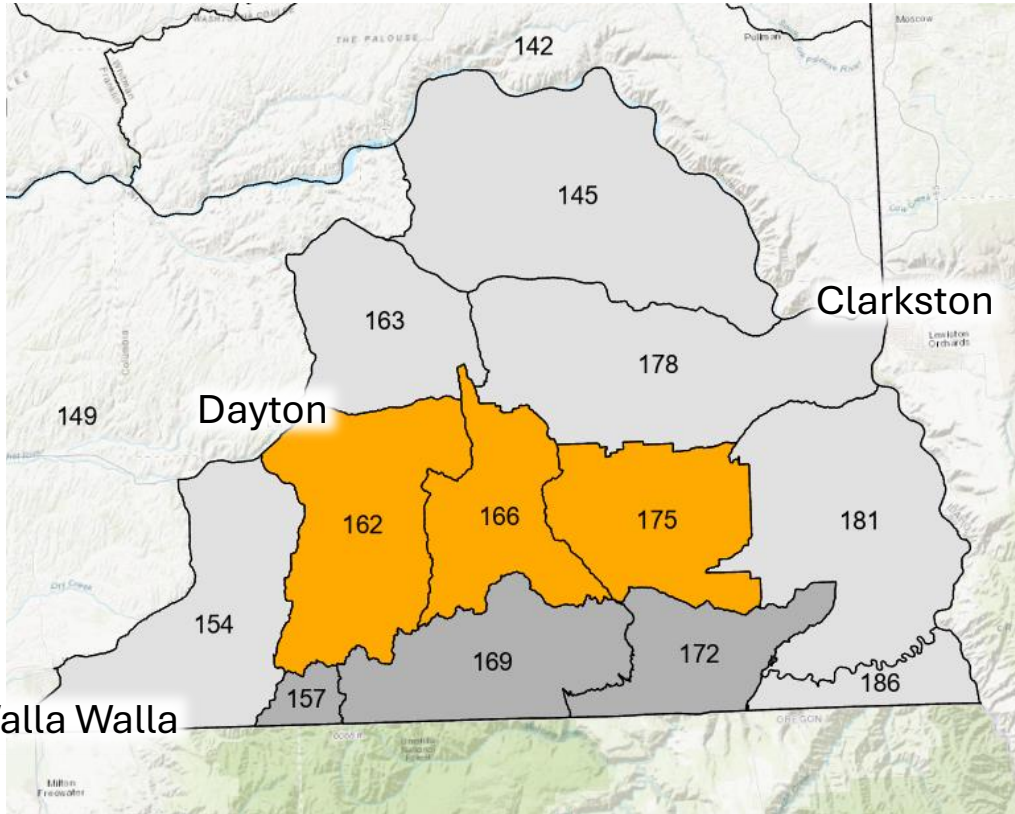
- The Blue Mountain elk herd was classified as an "At-Risk" population in 2020.
- 2021 At-Risk Assessment:** Identified juvenile survival as the most likely factor limiting herd growth.
- Predator-Prey Guidelines:** Focused on monitoring to assess whether carnivore management should be considered to support population growth.

Monitoring Objectives:

- Annually assess population performance through abundance and recruitment monitoring.
- Estimate annual juvenile elk survival rates and cause-specific mortality.
- Evaluate the impact of various mortality sources on juvenile elk survival.



Juvenile Elk Survival & Cause-Specific Mortality Monitoring



Study Area: Northern Core GMUs

Sample Distribution: Proportional to population

- GMU 175 = 50%, GMU 166 = 25%, GMU 162 = 25%

Sample Objective:

- 80-100 neonates, increased to 125 to account for “shedding”

Capture Window: May 17th – June 15th

GPS Collaring Methods:

- **Ground Captures:** 0–~3-day-old calves
- **Aerial Captures:** ~4–11-day-old calves

Mortality Investigation:

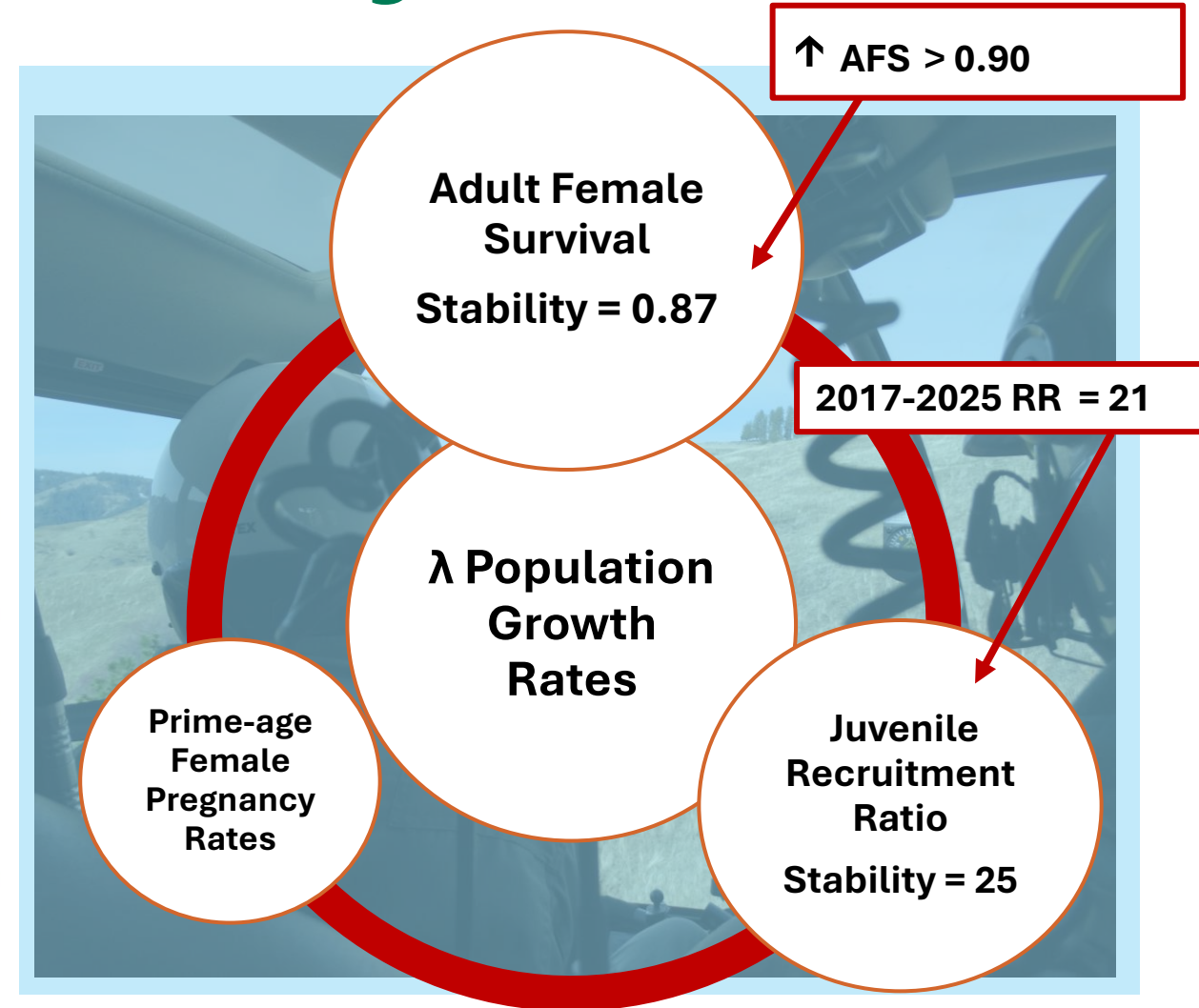
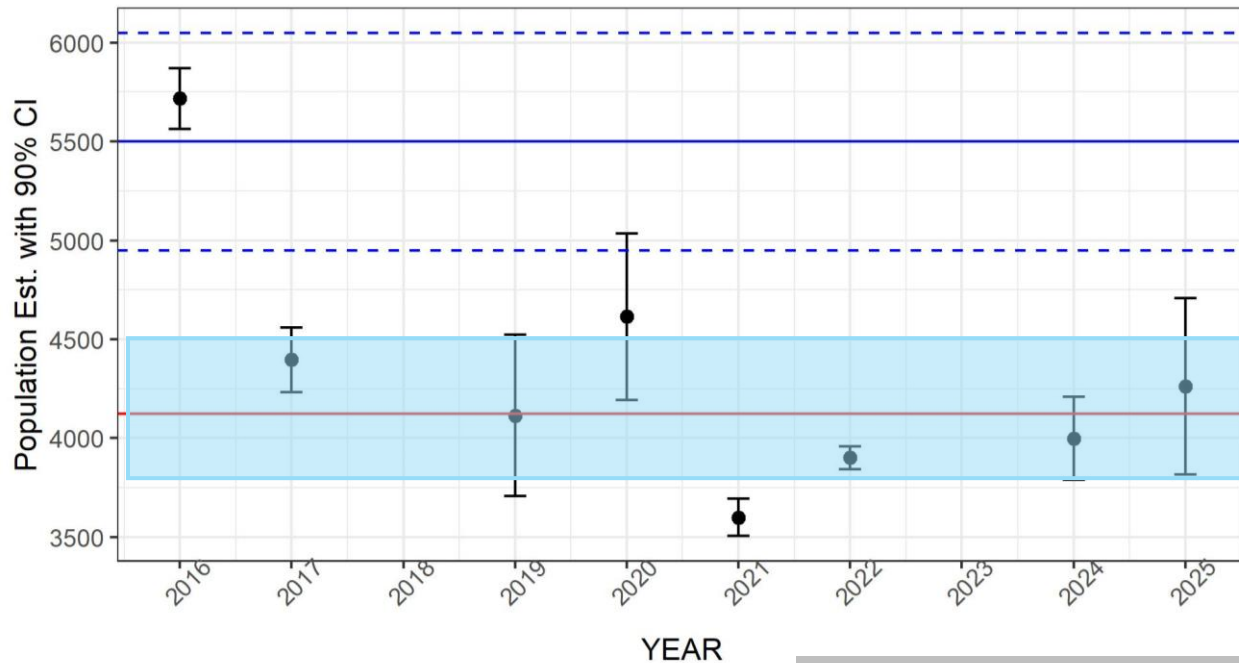
- 4-hour GPS collar delay, on-site within 24 hours of notification
- Categories: Predation, Unknown, Non-predation, Human Causes
- Mortality classification includes field investigations, single-species DNA, WADDL necropsy, and team review

Kaplan-Meier Survival Estimates:

- 30-day time intervals
- Recruited at 300 days, just after the annual aerial survey

Abundance & Recruitment Monitoring & Results

GMU	Avg. R ratio (ARR): 2000-2016	ARR: 2017	ARR: 2019	ARR: 2020	ARR: 2021	ARR: 2022	ARR: 2023	ARR: 2024
162	30	15	21	12	18	13	7	19
166	31.4	14	17	19	16	19	14	19
175	26.1	22	16	27	24	13	19	19
All herd	27.7	17.8	23.8	22	24.6	17.2		22.3



Mark Vekasy & Mike Atchison surveying Blue Mountain elk. Photo credit: Carrie Kyle

Stability thresholds:
 R Ratio - 25 juveniles:100 adult female elk
 AFS non-harvested population ≈ 0.87-0.93

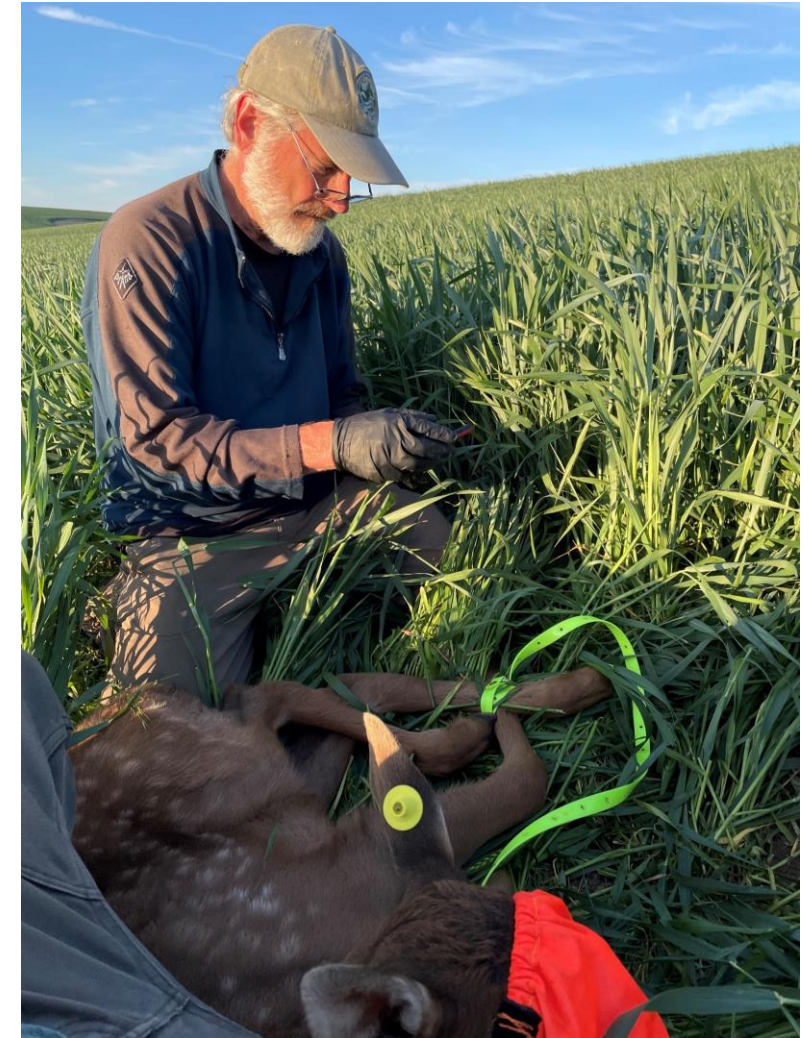
Monitoring Results - Captures

Study year	GMU 162	GMU 166	GMU 175	GMU 181
2022	33	26	65	1 ^a
2023	32	16	54	0
2024	30	18	67	0
All years	95	60	186	1

GMU Proportion: 27% 18% 55%

Study year	0 – 3 days	4 – 6 days	7 – 10 days	> 11 days	Total
2022	38	30	35	22	125
2023	36	31	16	19	102
2024	42	34	36	3	115
All years	116	95	87	44	342

N Proportion: 34% 28% 25% 13%



Mark Vekasy processing an elk calf in GMU 162.

Photo Credit: Brendan Oates

Monitoring Results – Mortality Investigations

Study year	Cougar	Bear	Cougar / Bear	Coyote	Wolf	Wolf/ Bear	Bobcat	Other	Total
2022	57	9	5	3	1	1	1	22	99
2023	34	1	1	0	1	0	0	11	48
2024	33	1	3	1	0	0	0	7	45
All years	124	11	9	4	2	1	1	40	192

Study year	Exert. Myo.	Infect.	Starv.	Unk. Consu.	Unk. Fire	Unk. Intact	Unk. Trauma	Unk.	Harvest
2022	1	5	1	7	3	5	0	0	0
2023	0	0	0	5	0	2	3	1	0
2024	0	3	0	1	0	0	2	0	1
All years	1	8	1	13	3	7	5	1	1

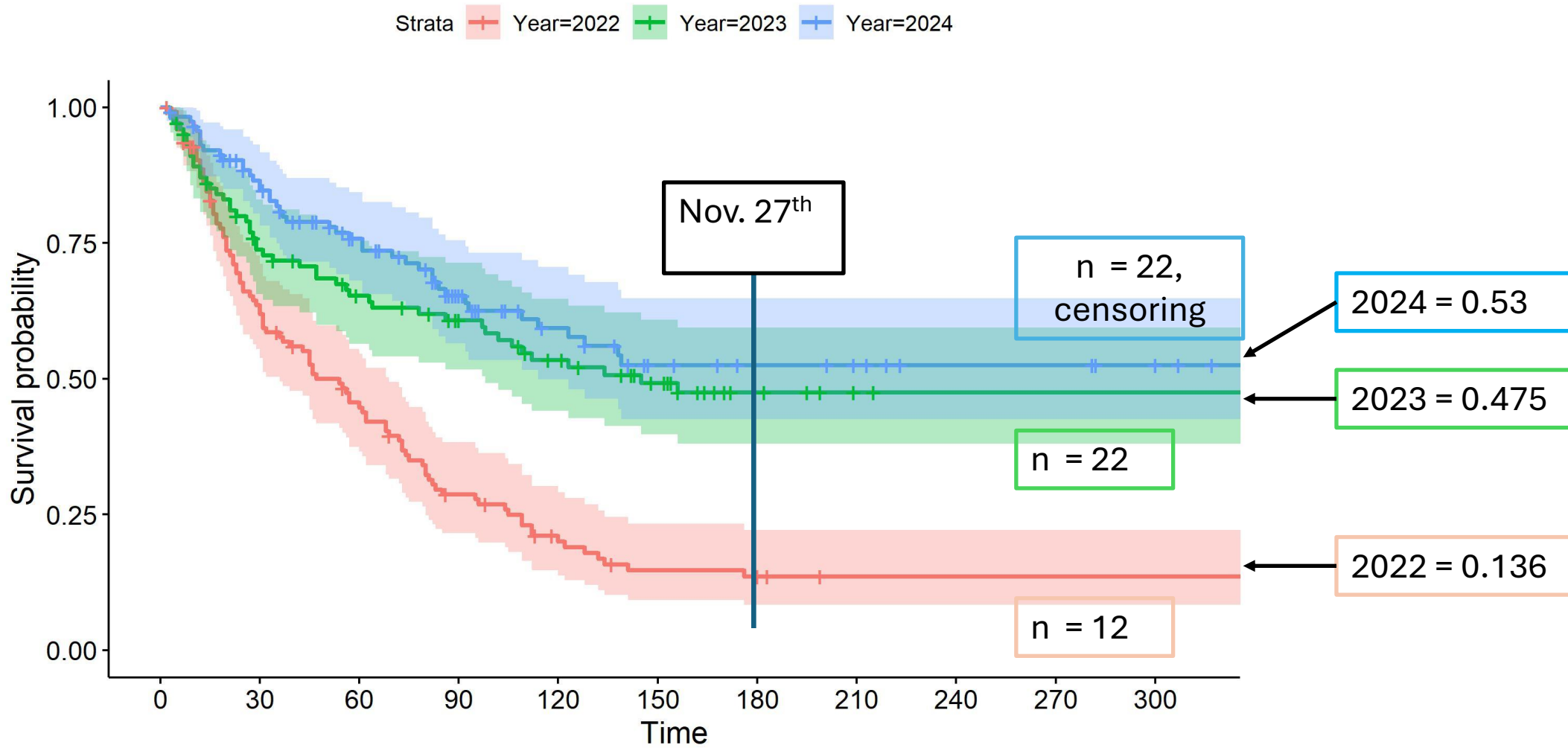


Mortality site investigation which illustrates a classic cougar cache.

Photo Credit: Jack Gavin

Censoring due to premature collar shedding:
13-2022, 35-2023, 62-2024

Monitoring Results – Survival



Stability thresholds:
Annual juvenile survival rates – 0.31-0.35

Monitoring Results: Survival & Predation Comparison

Study	Years of Study	Sample Size	Survival Rate	Proportion Predation*	Proportion Cougar*	Recruitment Ratio
BM, 2022	2021-2022	125	0.14	77.8	57.6	17.2
BM, 2023	2022-2023	102	0.48	77.1	70.8	15.1
BM, 2024	2022-2024	115	0.53	84.4	73.3	22.3
BM, Overall	2021-2024	342	0.37*	79.8	66.8	18.2*
Myers, 1993	1992-1993	12	0.41			19.2
Myers, 1994	1993-1994	35	0.45			18.1
Myers, 1995	1994-1995	53	0.47			19.6
Myers, 1996	1995-1996	43	0.55			14.8
Myers, 1997	1996-1997	48	0.48			23.6
Myers et al., 1999 Overall 1999	1992-1997	242	0.47*	77.6	48.8	19.0*
Johnson et al., 2019 (SW)	2001-2007	156	0.57	79.0	55.0	NA
Johnson et al., 2019 (NE)	2001-2007	460	18 – **	92	73	NA

Stability thresholds:

R Ratio - 25 juveniles:100 adult female elk

Annual juvenile survival rates – 0.31-0.35

Discussion: Predation

SY 2022: Low Survival Observed

- The low survival rate may have been influenced by environmental conditions such as drought and fires, which exacerbated cougar predation and other sources of mortality.
- The emergency rule was enacted to increase the cougar bag limit in PMUs associated with the Blue Mountains from 1 to 2 cougars. However, despite the rule change, quotas remained in place and did not result in a significant increase in harvest. (i.e., 2022-23 and 2023-24 seasons)
- We do not believe that this adjustment altered cougar density or contributed to any improvement in calf survival.

SY 2023 & 2024: High Survival Observed

Climate conditions were more typical for the study area, and survival rates were sufficient to suggest potential population growth.

Overall, these data do not indicate that predation is a primary limiting factor for the Blue Mountains elk population.

Monitoring Results: Survival & R. Ratios Comparison

Study	Years of Study	Sample Size	Survival Rate	Proportion Predation*	Proportion Cougar*	Recruitment Ratio
BM, 2022	2021-2022	125	0.14	77.8	57.6	17.2
BM, 2023	2022-2023	102	0.48	77.1	70.8	15.1
BM, 2024	2022-2024	115	0.53	84.4	73.3	22.3
BM, Overall	2021-2024	342	≈ 0.37*	79.8	66.8	≈ 18.2*
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Myers et al., 1999 Overall 1999	1992-1997	242	0.47*	77.6	48.8	19.0*
Johnson et al., 2019 (NE)	2001-2007	360	18 – **	92	73	NA

Average
pop. est.
4054

Average
pop. est.
4375

Stability thresholds:
R Ratio - 25 juveniles:100 adult female elk
Annual juvenile survival rates – 0.31-0.35

Monitoring Results: GMU Survival & R. Ratio Comparison

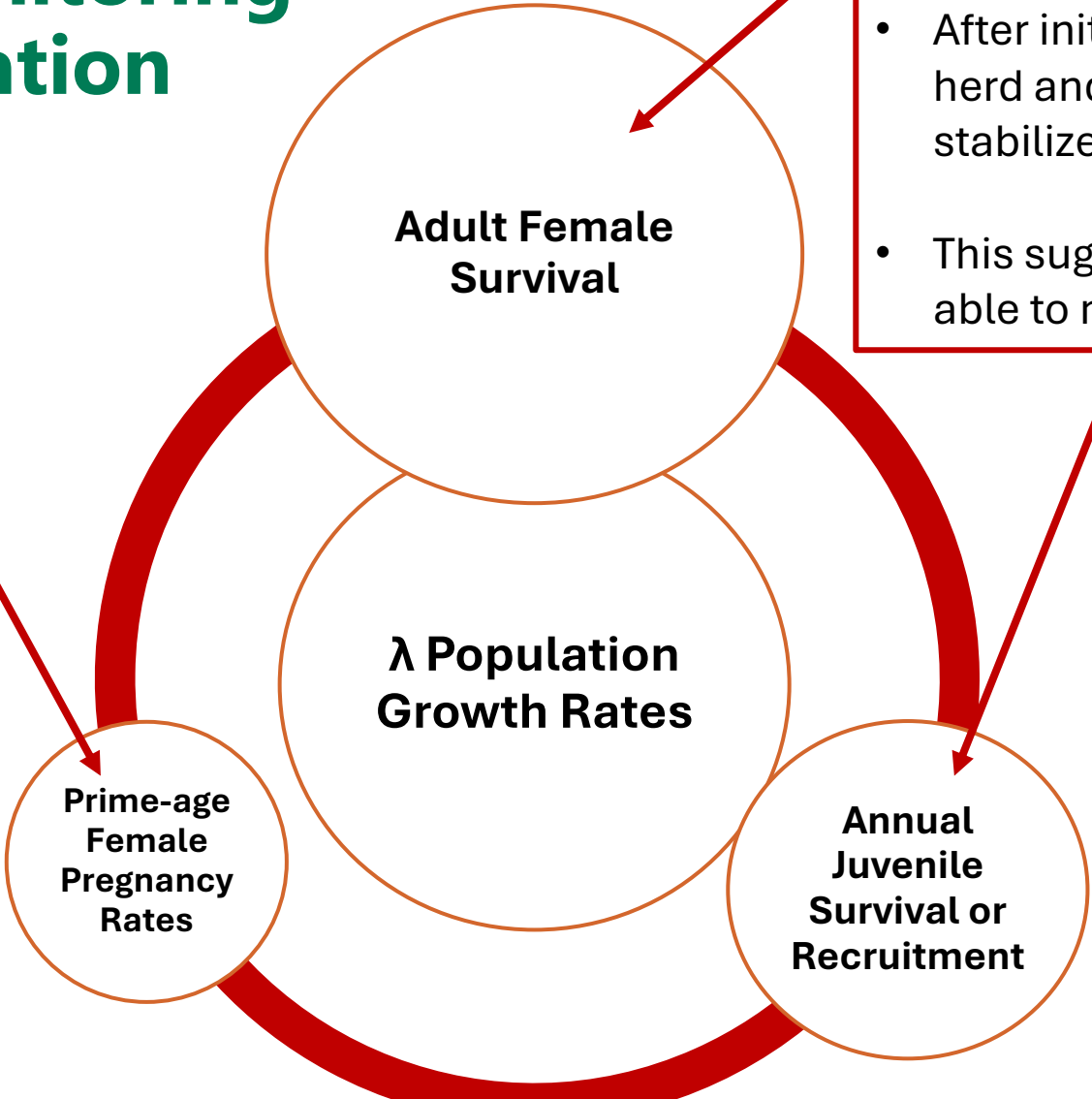
	GMU 162			GMU 166			GMU 175		
Study Year	n	Survival	RR	n	Survival	RR	n	Survival	RR
2022	33	10.3	13	26	26.3	19	66	10.4	13
2023	32	22.1	7	16	10.4	14	54	68.7	19
2024	30	20.5	19	18	64.2	19	67	64.0	19

Stability thresholds:
 R Ratio - 25 juveniles:100 adult female elk
 Annual juvenile survival rates – 0.31-0.35

Overview of Monitoring Results & Population Dynamics

Findings

- Overall sufficient juvenile and adult survival for population stability or growth, but poor recruitment ratios population stagnation.
- suggests reduced prime-aged adult female pregnancy rates (i.e., < 90%)



Findings

- After initial population reductions all-herd and GMU abundance estimates stabilized at lower levels in some areas
- This suggest adult survival is high and able to match poor recruitment

Findings

- We illustrated highly variable survival amongst juvenile elk
 - 0.136-0.53, Average = 0.37
- Annual survival estimates are divergent from annual recruitment ratios - avg. 18.2 (i.e., GMU 2022 – 2024)

Stability thresholds:
 R Ratio - 25 juveniles:100 adult female elk
 Prime-aged female pregnancy rates – 90%
 Annual juvenile survival rates – 0.31-0.35

Discussion: Pregnancy Rates

SY 2023-24 – High survival and low recruitment observed

- suggesting poor pregnancy rates in prime-age females, which is typically linked to nutritional limitations.
- Poor recruitment and pregnancy rates have been documented by Zahn (1992) and Myers (1999) and discussed in Fowler (1988).
- Qualitatively, this issue may be more pronounced in the eastern portion of the Blue Mountain core range.

Photo credit: Matt Wilson



Next Steps

- Additional research will be conducted by DFW – Science Division.
- Research objectives are still to be determined and will inform adjustments to our management strategies.
- The potential start date for this research is by 2025 or 2026.



Photo credit: Brendan Oates

Questions



Photo credit: Brendan Oates