Annual Report to the Alaska Board of Game on Intensive Management for Moose with Wolf Predation Control in Unit 15A

Prepared by the Division of Wildlife Conservation
February 2016

1) Description of IM Program and Department recommendation for reporting period.

A) This report is an annual evaluation for a predation control program authorized by the Alaska Board of Game (Board) under 5 AAC 92.118

B) Month this report was submitted by the Department to the Board: March 2016

C) Program name: Unit 15A Moose

D) Existing program has an associated Operational Plan: Operational Plan for Intensive Management of Moose in Game Management Unit 15A During Regulatory years 2012-2017.

E) Game Management Unit(s) fully or partly included in IM program area: Unit 15A

F) IM objectives for Moose: Population size 3,000-3,500. Harvest 180-350.

G) Month and year the current predation control program was originally authorized by the Board: January 2012, revised at the March 2013 Alaska Board of Game (BOG) meeting.

H) Predation control is currently active in this IM area: Yes

I) The current predation control program began: November 2013.

J) A habitat management program funded by the Department or from other sources is currently active in this IM area: Yes

K) Size of IM program area (square miles) and geographic description: 1,314 mi^2, Unit 15A

L) Size and geographic description of area for assessing ungulate abundance: 1,314 mi^2, Unit 15A

M) Size and geographic description of area for ungulate harvest reporting: 1,314mi^2, Unit 15A

N) Size and geographic description of area for assessing predator abundance: 1,314 mi^2, Unit 15A

O) Size and geographic description of predation control area: Originally control efforts were limited to approximately 49 mi^2 on Salamatof and Kenai Native Associations lands in Unit 15A. During RY2015, 14 mi^2 of Kenia Peninsula Borough and State lands were added, which increased the total control area to 63 mi^2.

P) Criteria for evaluating progress toward IM objectives: An increase in calf:cow ratio and no further decline in the moose population.

Q) Criteria for success with this program: The overall program will be successful when we attain IM population and harvest objectives in Unit 15A.

R) Department recommendation for IM program in this reporting period: Reevaluate program if progress is not made towards reducing the wolf population this winter (Section 6).

Refer to one or more scaled maps in the Operational Plan for areas described in this section

2) Prey data

Date(s) and method of most recent abundance assessment for Moose:
When conditions allow, moose abundance assessments are conducted through a minimum triannual GSPE population estimate and annual composition surveys that includes 6 count areas. Moose data for RY2012 include a November 2012 composition survey and a February 2013 GSPE population estimate. Data for RY2013 is from a November/December composition survey. Data for RY2014 was collected During December 2014; however, it was limited to 1 count area (2). Data for RY2015 is from November/December composition counts (Table 1).

Compared to IM area, was a similar trend and magnitude of difference in abundance observed in nearby non-treatment area(s) since program inception: Our control area is too small to effectively make comparisons between treatment and non-treatment areas using current techniques. We have not detected any differences between areas to date.

Date(s) of most recent age and sex composition survey: November 22 – December 4, 2015.

Compared to IM area, was a similar composition trend and magnitude of difference in composition observed in nearby non-treatment area(s) since program inception: Our control area is too small to effectively make comparisons between treatment and non-treatment areas using current techniques. We have not detected any differences between the areas to date.

Table 1. Unit 15A moose abundance, age, and sex composition in the assessment area (L) since program implementation in year 1 through review in year 2017. Regulatory year is 1 July to 30 June (e.g. RY2012 is 1 July 2012 to 30 June 2013).

			Composition (number per 100 cows)			
Period	RY	Abundance (variation)	Calves	Yearlings	Males	Total *n*
	2012		25		30	372
	2012	1569 (±13.4%; 95% C.I.)				
Year 1	2013		25		29	332
Year 2	2014[a]		33		10	86
Year 3	2015		18		33	232
Year 4	2016					
Year 5	2017					

[a] During RY2014 we were only able to survey one count area (CA2) due to lack of snow cover. During RY2012, RY2013, and RY2015 we combined data from six count areas in Unit 15A.

Describe trend in abundance or composition: There are no data available for treatment areas alone. Data for RY2012, RY2013, and RY2015 (years when we completed all traditional count areas) are from a sub-sample of all of Unit 15A, and some of the count areas include portions of the treatment area. For all count areas, bull:cow ratios have been relatively stable and calf:cow ratios decreased in RY2015 compared to RY2012 and RY2013. There are no census data available for comparisons.

Table 2. Moose harvest in assessment area (M). Methods for estimating unreported harvest are described in Survey and Inventory reports.

Period	RY	Reported		Illegal[b]	Total harvest	Other mortality[a]	Total
		Male	Female				
	2012	9	0	1	9	107	116
Year 1	2013	36	0	8	36	93	129
Year 2	2014	48	0	9	48	68	119
Year [illegible]	2015	33	0	8	33	63	97
Year 4	2016						
Year 5	2017						

[a] vehicle mortality and mortuary.
[b] illegal harvest includes both reported and unreported
[c] preliminary data

Describe trend in harvest: Please refer to Figure 4 on page 6 of the Operational Plan for Intensive Management of Moose in Unit 15A. The increased harvest from RY2012 compared to RY2013 and RY2014 was primarily attributed to a change in antler configuration for a legal bull that allowed additional take. In RY2012, a legal bull had to have an antler spread of at least 50 inches or at least 4 brow tines on at least one side. In RY2013 and RY2014, a bull with no more than a spike on at least one side was added to the RY2012 definition for a legal bull to harvest. The reported harvest increased by 12 bulls from RY2013 to RY2014, but the increase is within expected annual variation so it would be premature to say we can detect a trend at this time. Data for RY2015 are considered preliminary at this time so any comparison would be premature.

Describe any other harvest related trend if appropriate: During 2012, 309 individuals reported hunting in Unit 15A and the reported harvest was 9 bulls (3% success rate). During RY2013, 525 individuals reported hunting in Unit 15A and the reported harvest was 36 bulls (7% success rate). During RY2014, 540 individuals reported hunting in Unit 15A and reported harvest was 48 bulls (9% success rate). Data for RY2015 (33 bulls) are considered preliminary at this time.

3) Predator data: Wolves

Dates and method of most recent spring abundance assessment for wolves:

Survey data for RY2010 were collected in March 2011, for RY2011 in November 2011, and for RY2012 in February 2013. All of Unit 15A was flown and the total numbers are based on the number of wolves observed and an assessment of tracks observed. A partial survey was

conducted during December 2013 and no surveys were completed during 2014 or fall of 2015 due to lack of adequate snow cover. Our limited data suggests wolf numbers have remained relatively constant since 2010 (Table 3.). The spring abundance is our best estimate of what remained post-harvest. For this report, hunting mortality is included under trapping because it is difficult to distinguish between the two. Only a few wolves are taken under the hunting regulation. We believe 10-20 wolves spend at least some of their time in the areas open to wolf control.

Dates and method of most recent fall abundance assessment for wolves:
Fall abundance was estimated by adding the estimated number of wolves removed prior to the date the wolf survey was flown to the number of wolves counted during the survey.

Other research or evidence of trend or abundance status in wolves: Interviews with trappers and information from trapper surveys reflect concurrence with estimated abundance.

Table 3. Population estimates and human caused mortalities for wolves in Unit 15A. Removal objective is 100% of pre-control fall abundance from control area (49 mi^2 RY2013-2015, expanded to 63 mi^2 in RY2016) in year 1 of wolf predation control program, and an estimated or confirmed number remaining by spring (30 April) each RY in all of Unit 15A (1,314 mi^2) of at least 15.

Period	RY	Fall abundance	Harvest removal from Unit 15A	Dept. control removal from Unit 15A	Public control removal from Unit 15A	Total removal from Unit 15A[b]	Spring abundance
			Trap Hunt				
	2010	53-63	15			15	38-48
	2011	60-62	10			10	50-52
	2012	60-65	23			23	45-50
Year 1	2013	45-60[a]	4		3	7	40-50
Year 2	2014	45-60[c]	13		0	13	35-50
Year 3	2015[d]	45-60[c]	2		0	2	N/A

[a] This is an estimate based on a partial survey of Unit 15A and other reported sightings.
[b] Harvest data was obtained from the State Winfonet database.
[c] No surveys flown, however there is no indication there were significant changes to previous year.
[d] Preliminary data.

Black Bear

There are no identified Intensive Management control efforts for black bears. The latest estimate for black bear abundance occurred in the mid-1980's. Extrapolating data from that time period resulted in a current estimate of 700-900 black bears in Unit 15A. It is not known if these data accurately portray current black bear numbers in this area, but black bears do occur throughout the unit.

Brown Bear

There are no identified Intensive Management control efforts for brown bears. The Kenai National Wildlife Refuge completed a study in 2013 estimating the brown bear population on the Kenai Peninsula during 2010. Using their density calculation ($42/1000km^2$), there were approximately 142 brown bears in Unit 15A in 2010.

The most significant action affecting brown bear mortality in Unit 15A is the recent liberalizations of hunting seasons and bag limits. Prior to Fall 2012 the hunting season was managed through a limited drawing permit season with a 1 bear/4 years bag limit. In January 2012, the BOG liberalized hunting opportunity for Kenai brown bears by adding a fall registration hunt with an unlimited number of permits and season dates of October 1 – November 30. The BOG further liberalized brown bear hunting opportunity in March 2013 including expanded season dates of September 1 – May 31, a bag limit of 1 bear/regulatory year, and maintained the unlimited number of registration permits. The BOG set a cap (to begin in calendar year 2014) on human caused brown bear mortalities of 70 human caused mortalities annually, and during January 2014 allowed for the harvest of brown bears at registered black bear baiting stations. During calendar years 2013, 2014, and 2015 the total human caused brown bear mortalities in Unit 15A were 20, 13, and 6 respectively.

4) Habitat data and nutritional condition of prey species:

Where active habitat enhancement is occurring or was recommended in the Operational Plan, describe progress toward objectives

Objective(s): Increase available moose browse through mechanical treatment and work with other agencies to develop a long term habitat management strategy. The department received funding to expand this effort in the future and is cooperating with other agencies and native organization to develop a long term plan.

Area treated and method: Timber (mainly spruce, aspen, and some birch) was harvested on about 85 acres in Unit 15A. Portions of that area were scarified and approximately 1,000 birch seedlings were planted during spring of 2013. Expenditures for this project ($100,000) are included in the "Cost" column under "Other IM activities" for FY2013 in Table 4.

Observation on treatment: Initial visits to the site indicate good survival of the planted seedlings and regeneration of early successional species has started. Moose browsing is evident in the area, but the area treated is small. We have not detected any effect on the moose population we can attribute to the treatment.

Evidence of progress toward objectives: Department staff will continue to work with other government and private companies or organizations to develop a long term habitat management strategy.

Nutritional indicators for moose in assessment area (L) of the Unit 15A Intensive

management area: Current research efforts addressing moose productivity and body condition are in the early stages and data are not summarized at this time. Preliminary data indicate that adult cow moose are in relatively poor condition in Unit 15A compared to adult cows in Unit 15C, based on body condition indices.

5) Costs specific to implementing Intensive Management

Table 4. Cost ($1000 = 1.0) of agency salary based on estimate of proportional time of field level staff and cost of operations for intensive management activities (e.g., predator control or habitat enhancement beyond normal Survey and Inventory work) performed by personnel in the Department or work by other state agencies (e.g., Division of Forestry) or contractors in Unit 15A Intensive management area. Fiscal year (FY) is also 1 July to 30 June but the year is one greater than the comparable RY (e.g, FY 2012 is 1 July 2011 to 30 June 2012.

Period	FY	Predation control[a]		Other IM activities		Total IM cost[c]	Research cost[d]
		Time[b]	Cost[c]	Time	Cost[c]		
	2012			12	35.5	35.5	150
	2013			13	136.3	136.3	250
Year 1	2014	5	34	11	30.9	64.9	150
Year 2	2015	1	10	1	10	20.0	162
Year 3	2016	1	12	1	12	24	154
Year 4	2017						
Year 5	2018						

[a]State or private funds only.
[b]Person-months (22 days per month).
[c]Salary plus operations. Salary includes 0.5 mo. WBII 0.5 mo. WBIII (incl. benefits).
[d]Separate from implementing IM program but beneficial for understanding of ecological or human response to management treatment (scientific approach that is not unique to IM). FY 15 includes 12K from AKW-5 grant for coordination of habitat enhancement for wildlife. FY 16 includes 4K in salaries spent from AKW-5 on coordination of habitat enhancement.

6) Department recommendations for annual evaluation (1 February) following Year 3 for Unit 15A Intensive Management

Has progress toward defined criteria been achieved: No, we have not detected any changes to the moose population or harvest in Unit 15A. There has been no discernable change in the calf-to-cow ratios from composition surveys completed during the past 3 years. Research conducted in Unit 15A has noted condition and productivity of collared animals consistent with nutritional stress and no discernable change to calf survival has been detected. The department completed initial habitat improvements (85 acres) and will continue discussions with private organizations and government agencies to develop a long term habitat improvement plan.

Has achievement of success criteria occurred: No, we conducted composition surveys during fall 2013 and fall 2015 (composition surveys were not conducted in 2014 due to inadequate

snow cover), and we recorded a decrease in the calf:cow ratio from 25 calves:100 cows in 2013 to 18 calves:100 cows in 2015. This decrease was recorded even though we had a mild winter (relative to snow depths) during 2014. The last moose census we conducted in Unit 15A was in February 2013 (we did not conduct a census in subsequent years due to inadequate snow cover) so we do not have additional census data to determine if there were any changes in moose numbers. We observed fewer moose during composition surveys flown in fall 2015 compared to fall 2013 (308 and 432 respectively). All indications are we have not made any progress towards achieving IM population or harvest objectives.

Recommendation for IM practice(s):

Predation Control: Continue and Evaluate

The department recommends continuing the program during the winter of 2015-16. If progress is not made towards reducing the wolf population, the department will recommend a reevaluation of the Unit 15A program and a possible suspension of wolf control activities in 2016. Wolf control activities have primarily been hampered by the size of the control area and poor snow conditions. The department issued permits for the wolf control portion of the program and the public took 3 wolves by aerial shooting between December 2013 and March 2014. A private contractor was hired to attempt ground based trapping efforts within the control area during 2014. There were no subsequent ground based IM efforts to remove wolves in the control area due to the ineffectiveness of the efforts in 2014. A total of 3 wolves have been removed by control efforts during the first 2.5 years of this program, so the predator control portion of this IM effort has been ineffective.

Habitat enhancement: Continue

A $1.0 million federal aid award for moose habitat (AKW-5 Habitat Enhancement for Wildlife) was secured for FY2015-2019. The department is coordinating with an interagency group on the Kenai Peninsula to direct some of these funds towards habitat projects in Unit 15A. The project design focuses on developing fuel breaks near communities to provide fire management agencies more options to allow wildfires to burn and use prescribed fire when conditions are appropriate. Allowing wildfires and prescribed fires to burn will promote regeneration of hardwoods for the benefit of moose and other wildlife. Project planning for these funds began in FY 2015 and creating a fuel break around the northeast corner of Sterling is scheduled for FY 2016-2017. This will be the first of several planned fuel breaks, which will ultimately enhance the ability for the Kenai National Wildlife Refuge (KNWR) to use prescribed fire on Refuge lands in Unit 15A. In FY 2015, $12,000 was spent on staff to coordinate with Alaska DNR, KNWR, and other agencies to prepare the Sterling Fuel Break for bid. This federal aid award will pay for $80,000 of contractual services in FY 2016-2017 to treat approximately 135 acres. Another $60,000 is planned for subsequent projects.

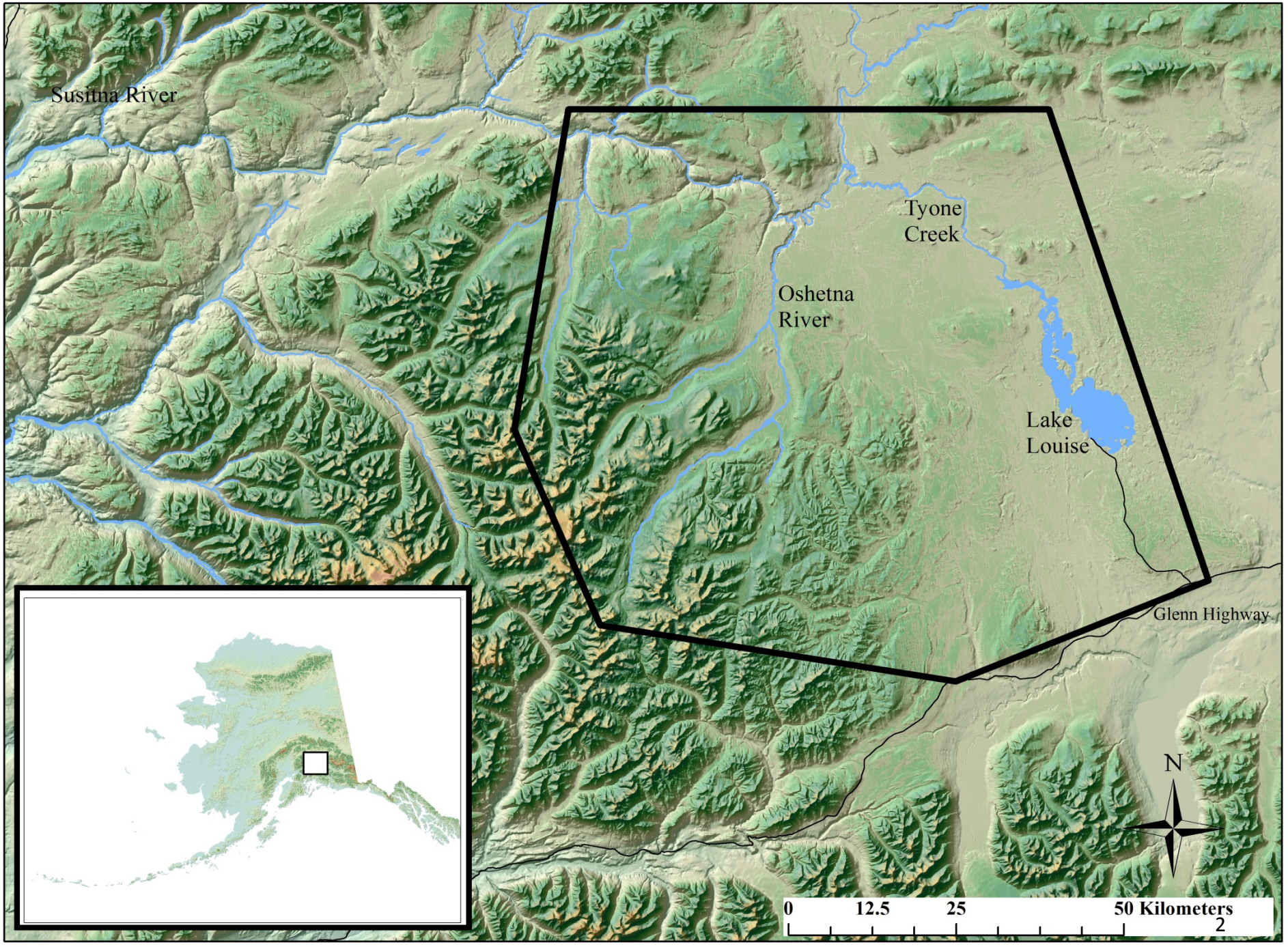
Harvest strategy: Continue

The Operational Plan states that any moose added to the population from the control efforts will be reallocated to harvest. When we detect a difference we will submit a proposal to the

board of game (either during a regular scheduled meeting or through an agenda change request) to address the surplus. The only moose currently available for harvest in Unit 15A are bulls with a spike on at least one side, or a 50 inch antler spread, or 4 or more brow tines on at least one side.

EVALUATION OF BROWN BEAR PREDATION ON UNGULATE CALVES IN SOUTHCENTRAL ALASKA USING NECK MOUNTED CAMERAS, GPS, AND STABLE ISOTOPES

Chris Brockman: Alaska Dept. of Fish & Game
Bruce Dale: Alaska Dept. of Fish and Game
Bill Collins: Alaska Dept. of Fish & Game
Don Spalinger: University of Alaska Anchorage
Jeff Welker: University of Alaska Anchorage


Susitna River
Tyone Creek
Oshetna River
Lake Louise
Glenn Highway
N
0 12.5 25 50 Kilometers

Background

- Intensive Management
- Bear Predation
- BOG Decisions

Bear Predation on Ungulates

- Spring period (May 15-June 30)
- First six weeks following parturition
- Up to 90% mortality for calves.
- 70% - 80% of calf mortality attributed to bears.

Understand Predator-Prey relations

- Extent of predation
- Individual variability

Questions

1. How do kill rates vary between individual bears?

2. What do tissue isotopes tell us about diets in general, diets by individuals, and how do they compare with diets as seen in cameras?

Existing Methods

- Prey Based Method:
  - Calf mortality studies
  - Calf Survival
- Predator Based Method:
  - Aerial observation
  - GPS clusters

Needs

- Individual variation
- Handling time

Develop a method that will quantify intraspecific kill rates of brown bears (*Ursus arctos*) on ungulate calves (*Alces alces* and *Rangifer tarandas*).

Techniques

1. Collar mounted video cameras.

2. High frequency GPS locations.

3. Stable Isotope Analysis

Methods

Data Collected

Video Clips

- Sample Length
- Sampling Interval
- Classification: Primary/secondary

Data Collected

Video Clips

- Sample Length
- Sampling Interval
- Classification: Primary/secondary

Primary

- Resting
- Traveling
- Feeding
- Unknown
- Socializing
- Standing
- Etc.

Data Collected

Video Clips

- Sample Length
- Sampling Interval
- Classification: Primary/secondary

Primary

- Resting
- Traveling
- Feeding
- Unknown
- Socializing
- Standing
- Etc.

Secondary

- Moose calf
- Caribou calf
- Mammal
- Bird
- Fish
- Vegetation
- Etc

Data Collected

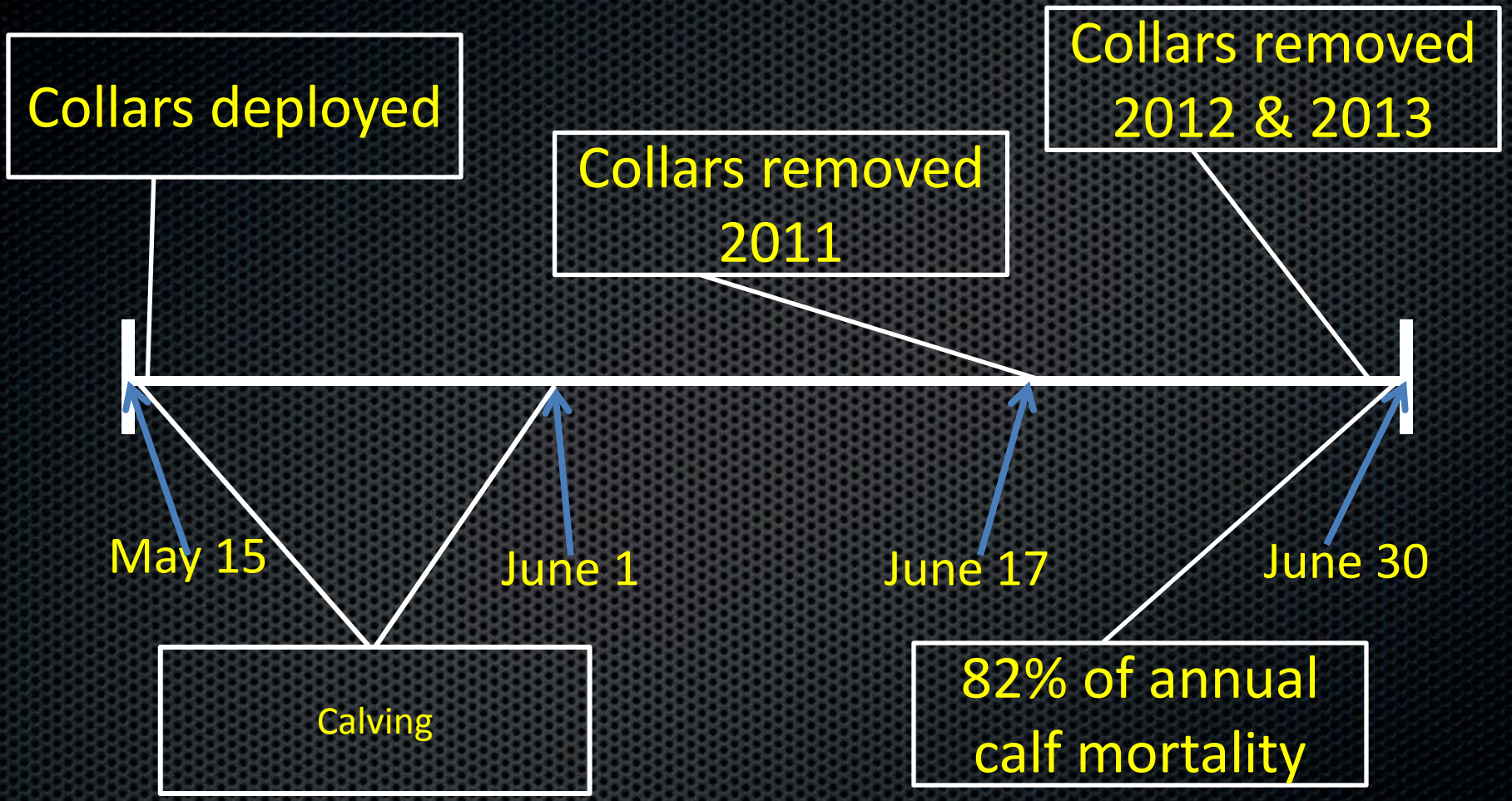
GPS

- Sampling Interval
- Link to video

Stable Isotope Samples

- Collected in the field.
- Processed at UAA

Time line


Collars deployed
Collars removed 2011
Collars removed 2012 & 2013
May 15
June 1
June 17
June 30
Calving
82% of annual calf mortality

Prototype Collars

- 17 Deployed

- 7 Collected Sufficient Video Data

Camera Data

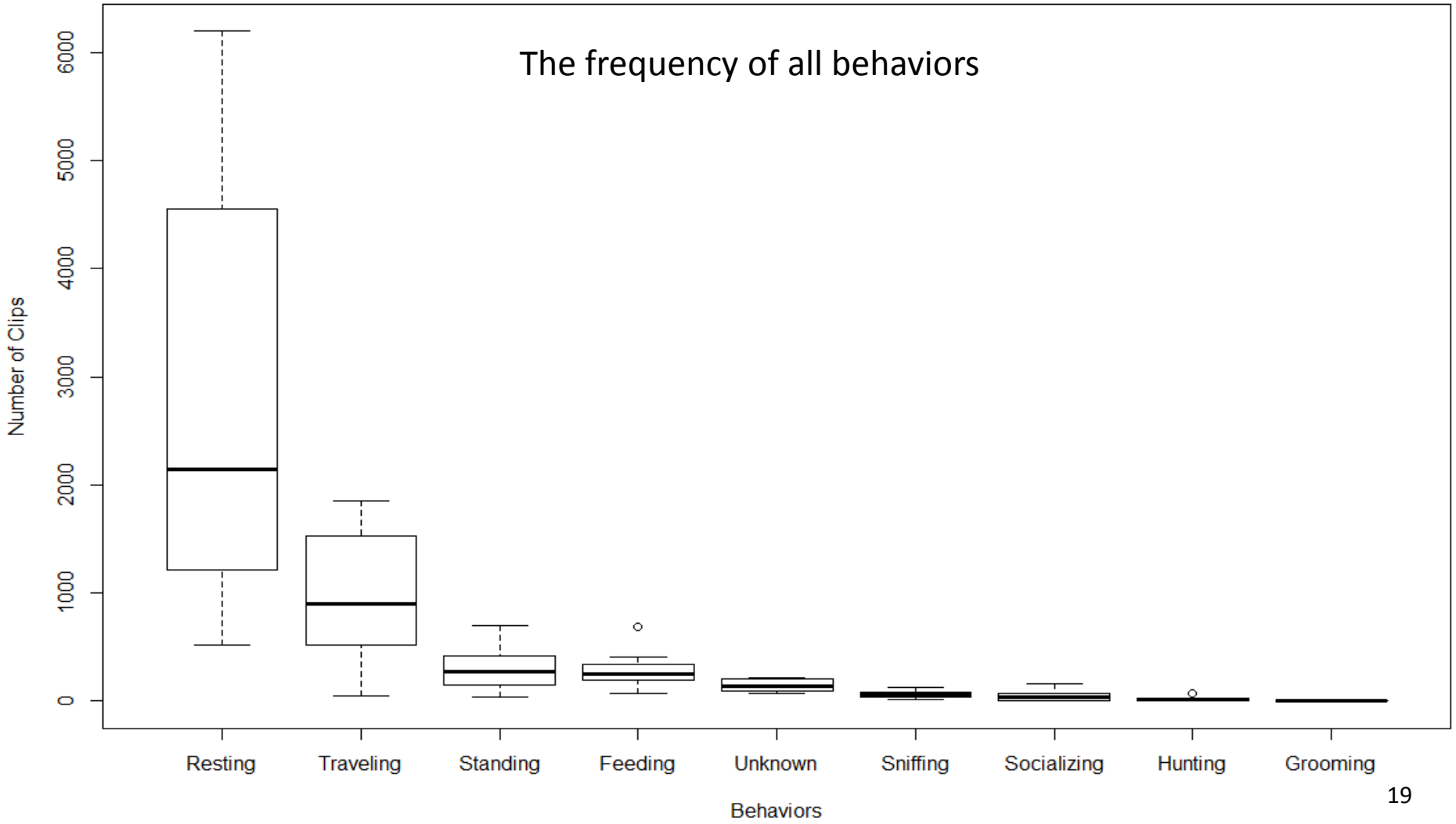
The following footage contains graphic images and violent content

Viewer discretion is advised

Clip #1 Moose calf carcass, moose calf kill…… and another.

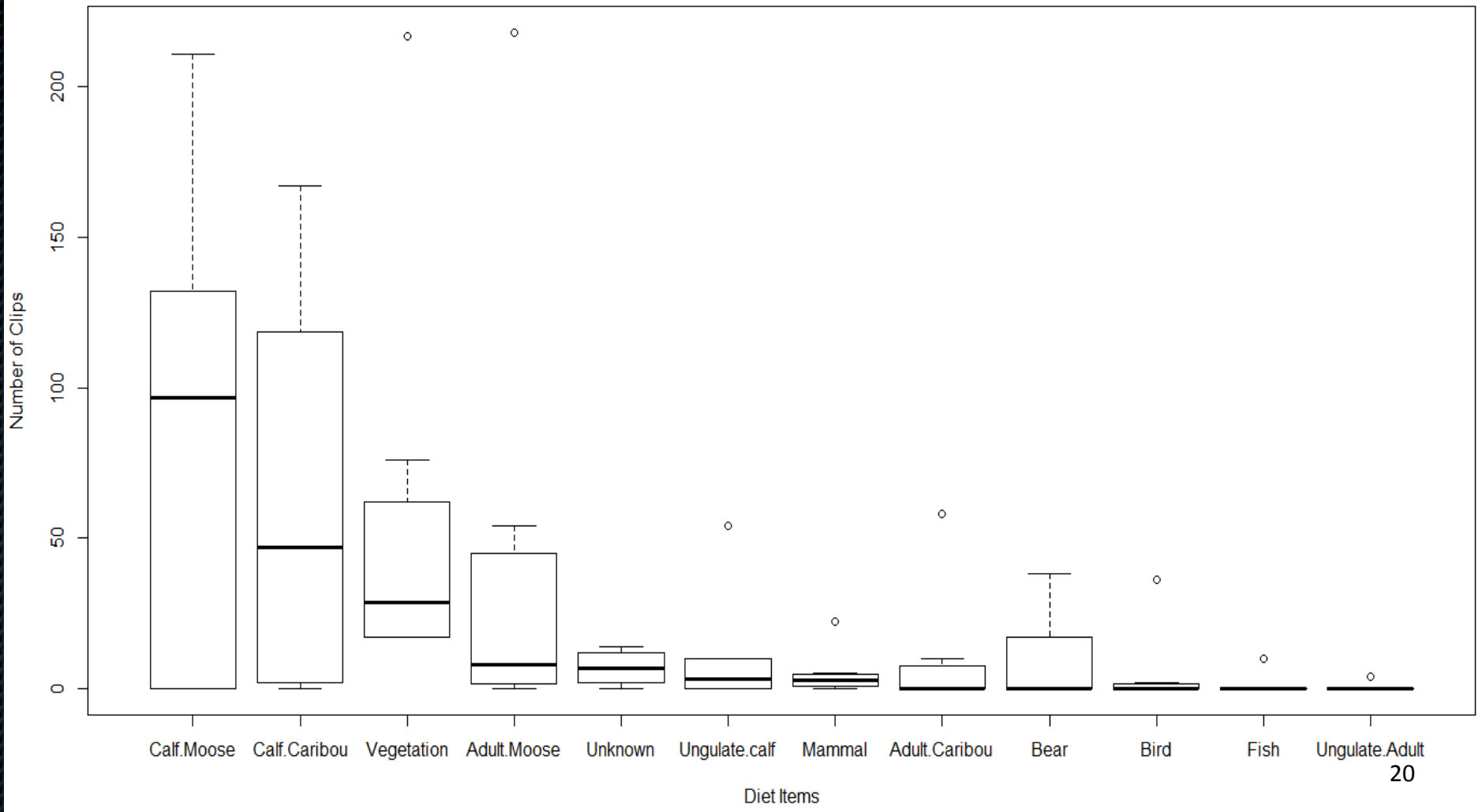
Clip #2 Caribou calf kill and carcass.

Results
Mean proportion feeding 6.2%



Composition of clips classified as feeding.

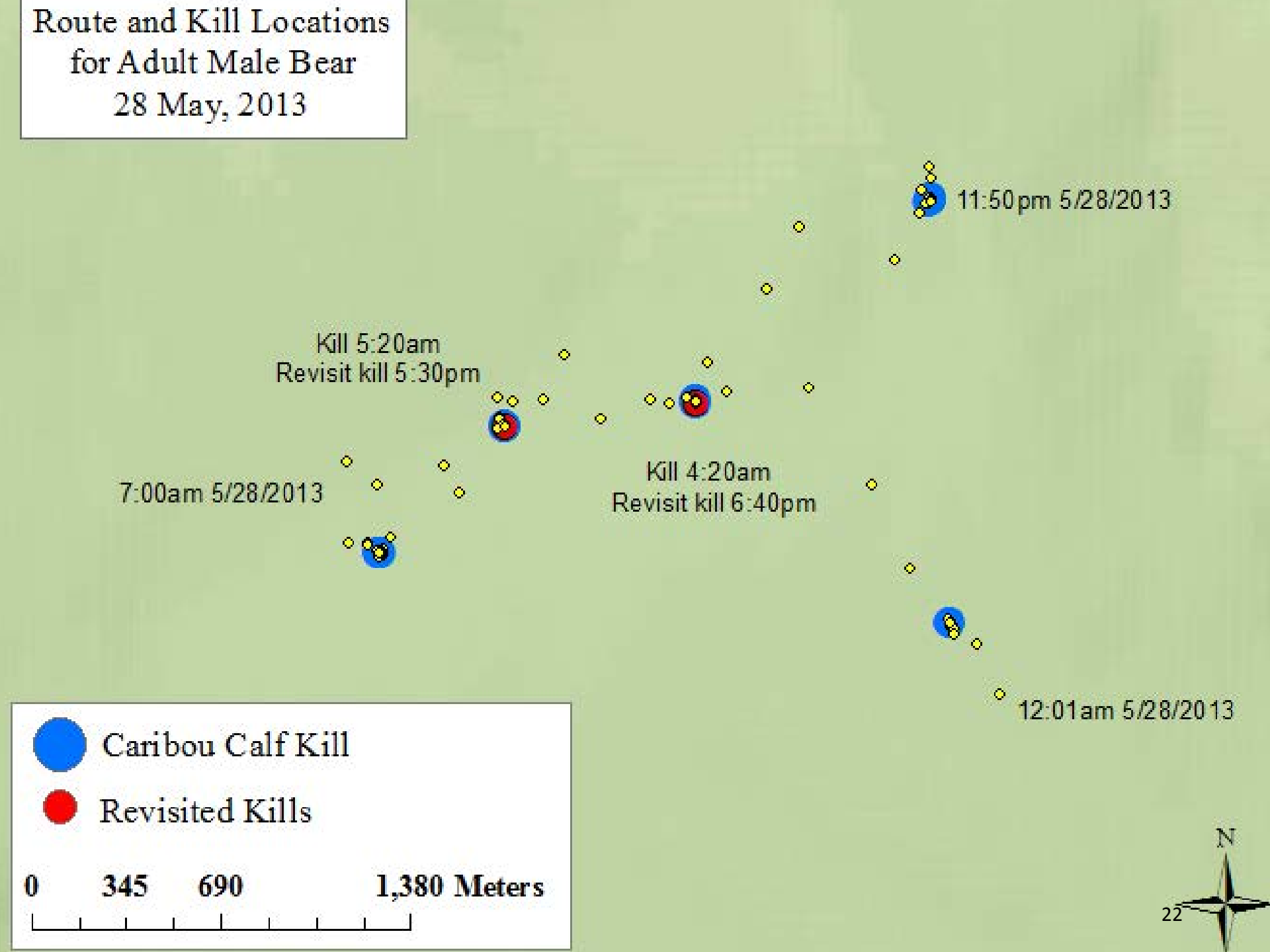
Ungulates comprised 71.3% of clips classified as feeding.



Visual characteristics

Fresh Carcass	Old Carcass
Live prey	Muscle tissue appears dark maroon
Dead intact carcass no rigormortis	Blood is coagulated and dark
Muscle tissue and blood appears bright pink	Hair is matted, dirty or loose
Bones clean of dirt and wet. Fur clean and unmatted	Bones covered in dirt appear dry
Connective tissue clean and white in appearance	

Distance 200m = Separate kill


Route and Kill Locations
for Adult Male Bear
28 May, 2013
11:50pm 5/28/2013
Kill 5:20am
Revisit kill 5:30pm
7:00am 5/28/2013
Kill 4:20am
Revisit kill 6:40pm
12:01am 5/28/2013
Caribou Calf Kill
Revisited Kills
0
345
690
1,380 Meters
N

Ungulate calf kills per bear

	Bears						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Moose calf Kills	13	19	23	11	0	9	0
Caribou Calf Kills	1	0	5	30	7	27	11
Unknown Calf	6	0	3	3	0	6	2
TOTAL CALVES	**20**	**19**	**31**	**44**	**7**	**42**	**13**
Kill Days	16	31	28	25	27	26	11
Adjusted	26.6	25.3	41.2				

Ungulate calf kills per bear

=History of calf predation (Duty Cycled)

	Bears						
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Adjusted	26.6	25.3	41.2				

Ungulate calf kills per bear

=calves killed while cameras were functioning

	Bears						
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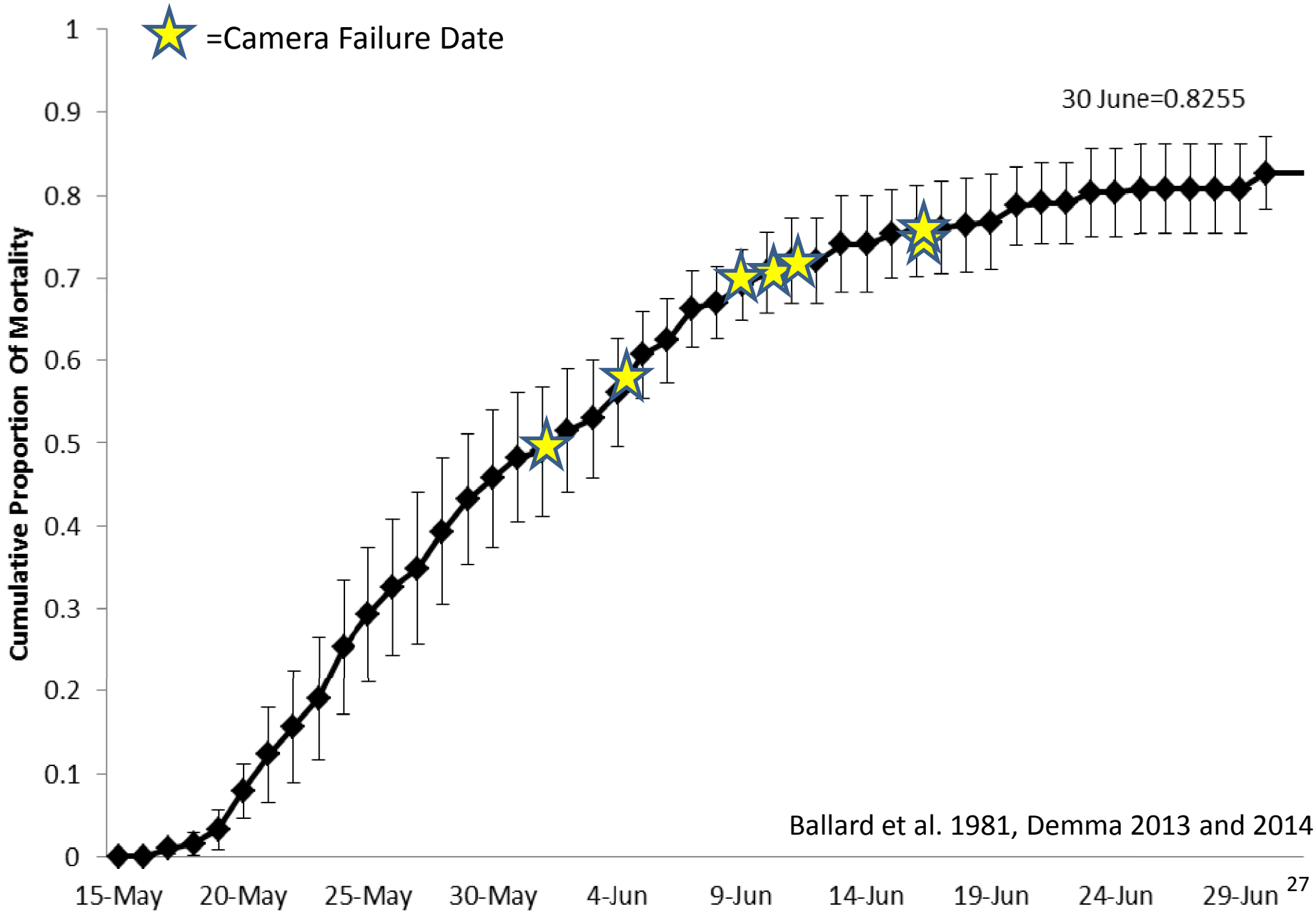
Calf Risk Model



Ungulate calf kills per bear

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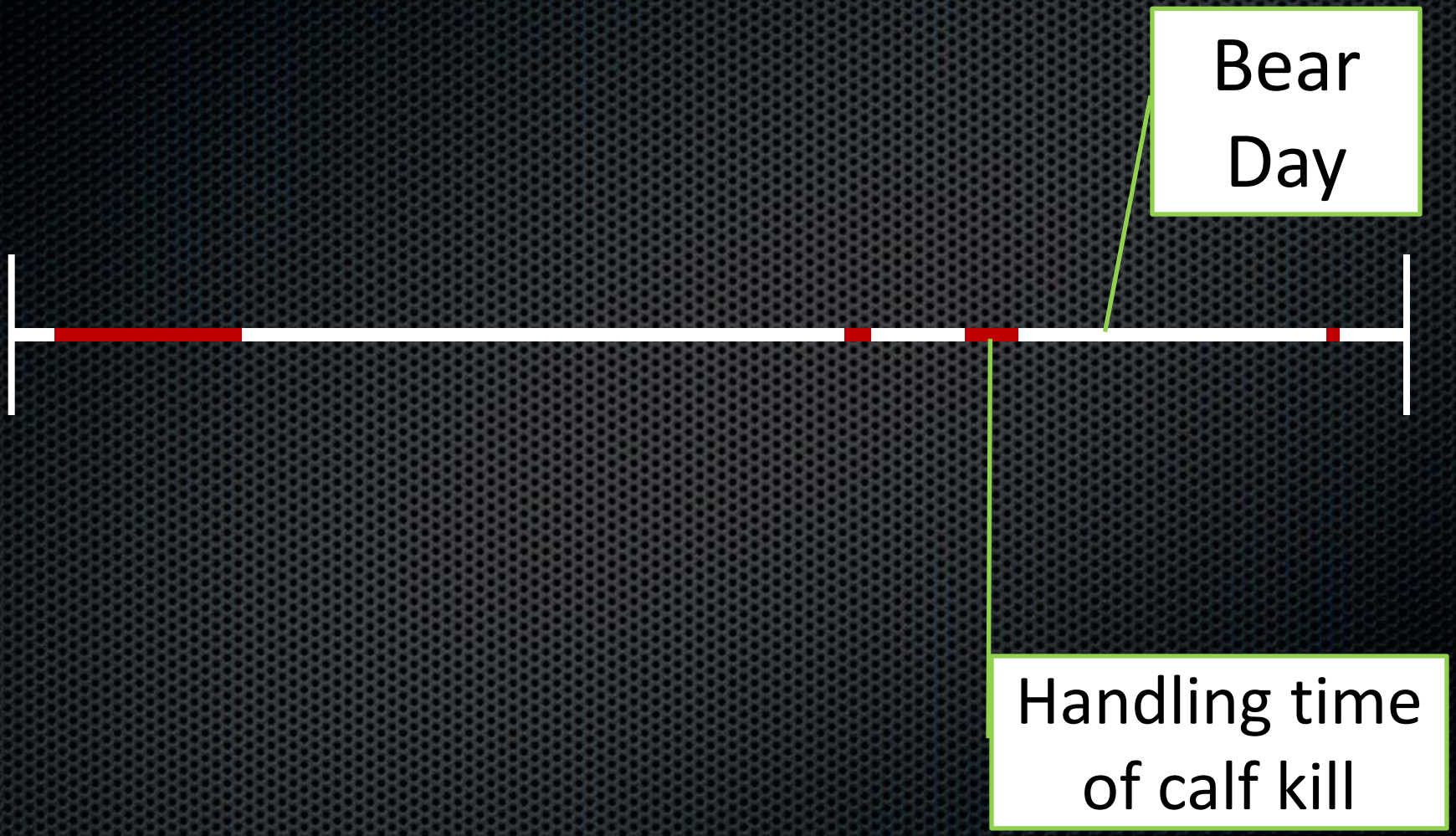
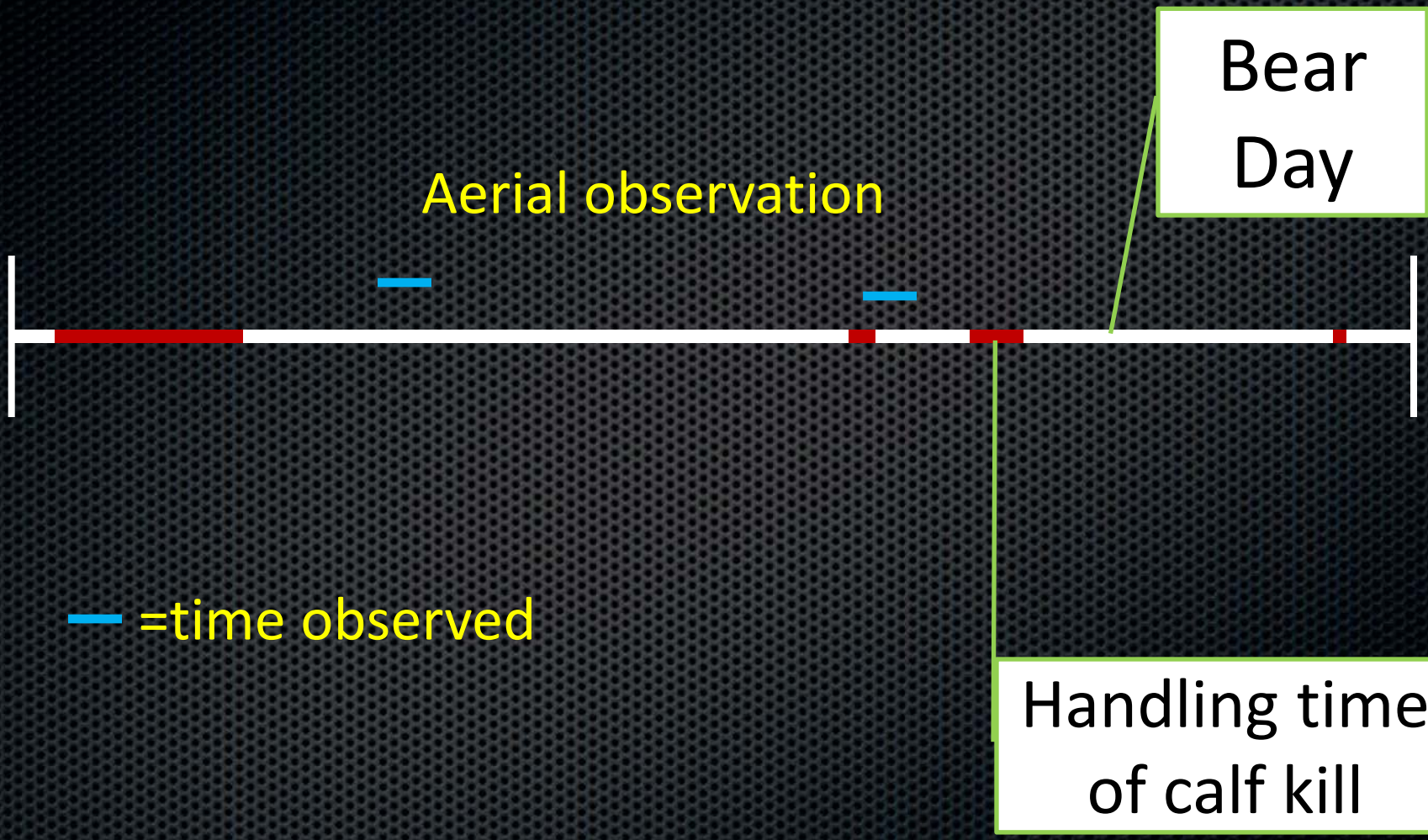
Kill Days	16	31	28	25	27	26	11
Adjusted	26.6	25.3	41.2				
Modeled calf kills	42.5	29.1	43.7	51.4	8.1	48.4	17.7

Mean Modeled calf kills 34.4 moose calf 16

Timeline for Detecting Kills

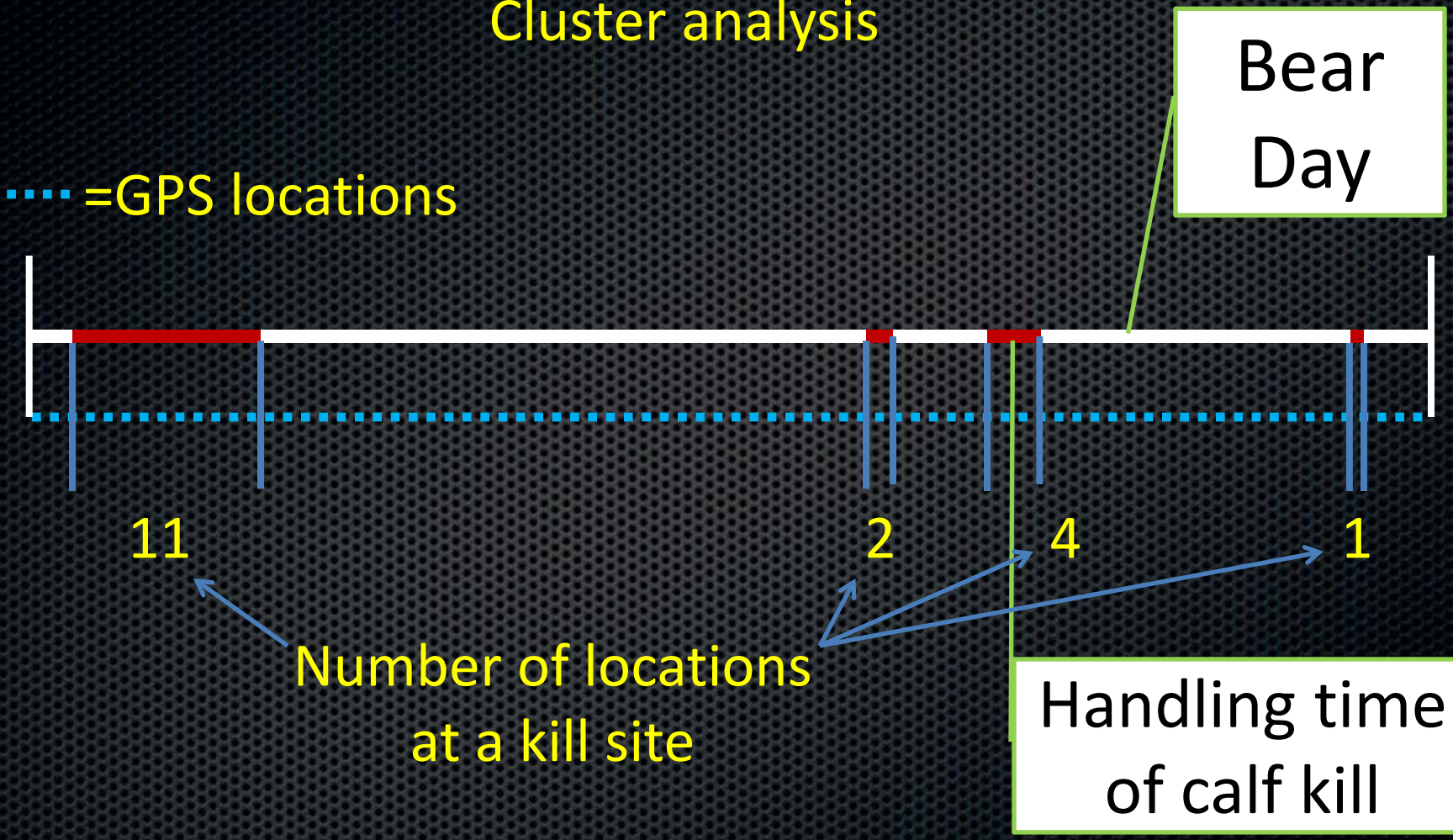


Detecting Kills

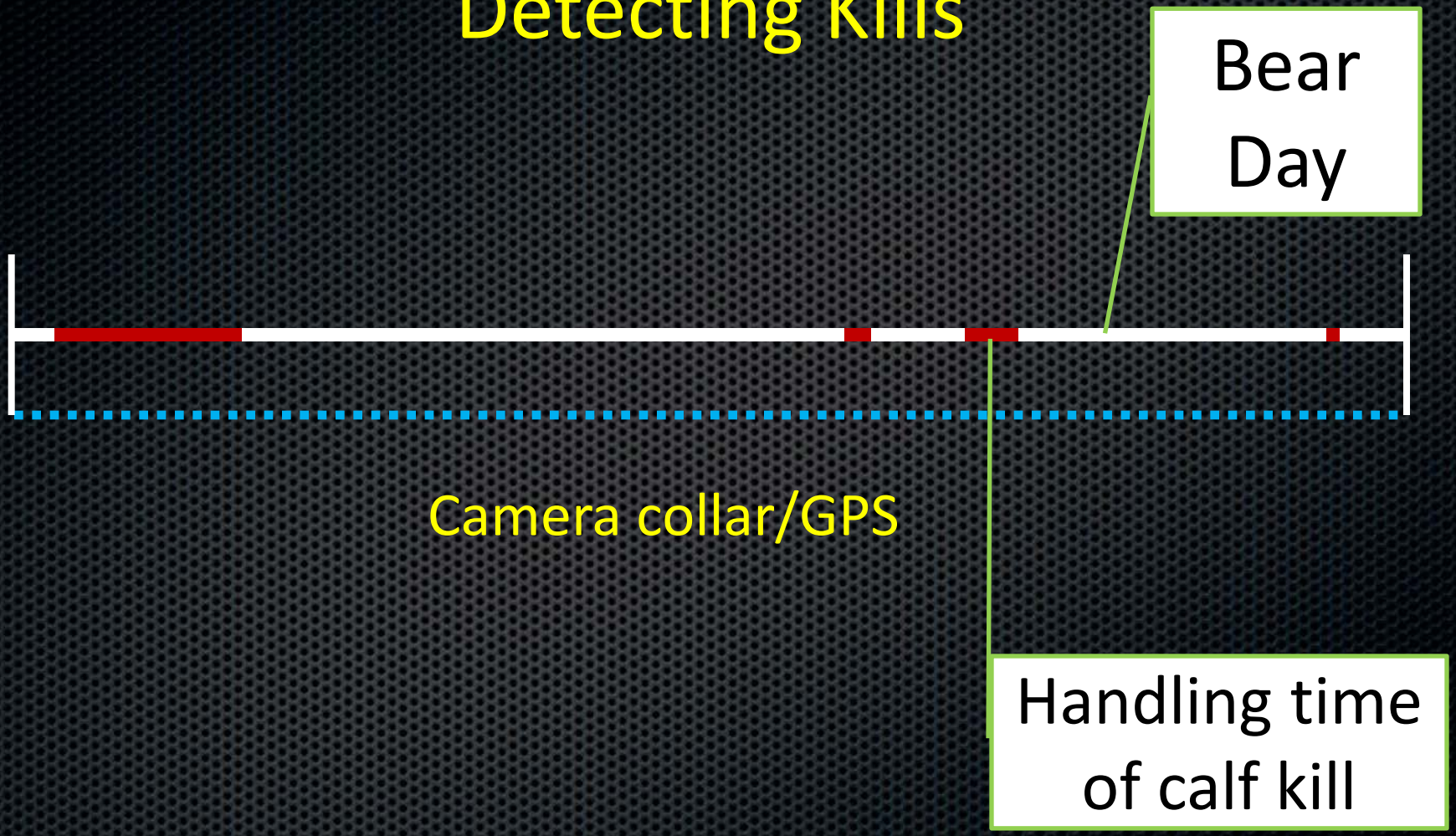


Detecting Kills

Cluster analysis



Detecting Kills



Handling Time

Minutes

	Min	Median	Max	Sample Size
Caribou Calf	10	40	855	81
Moose Calf	10	60	2280	75

Discussion

- Kill rates can be much higher than previously estimated.
  (Moose only:16 versus only 2-8)

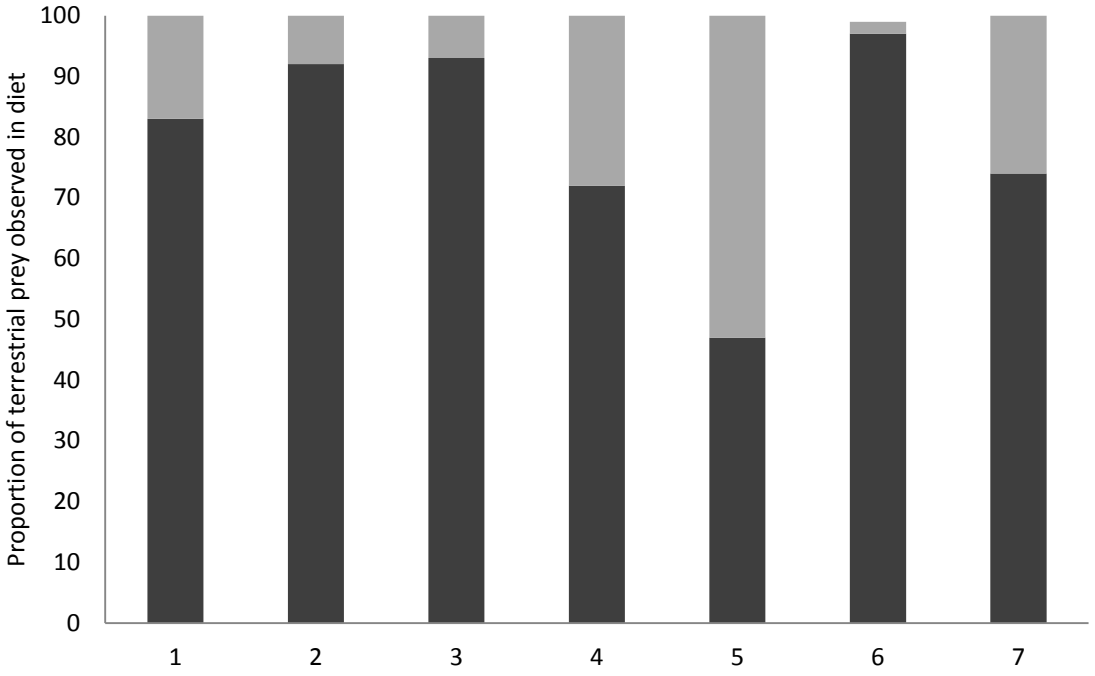
- Other studies didn't have good information on handling time and methods prevented obtaining it.

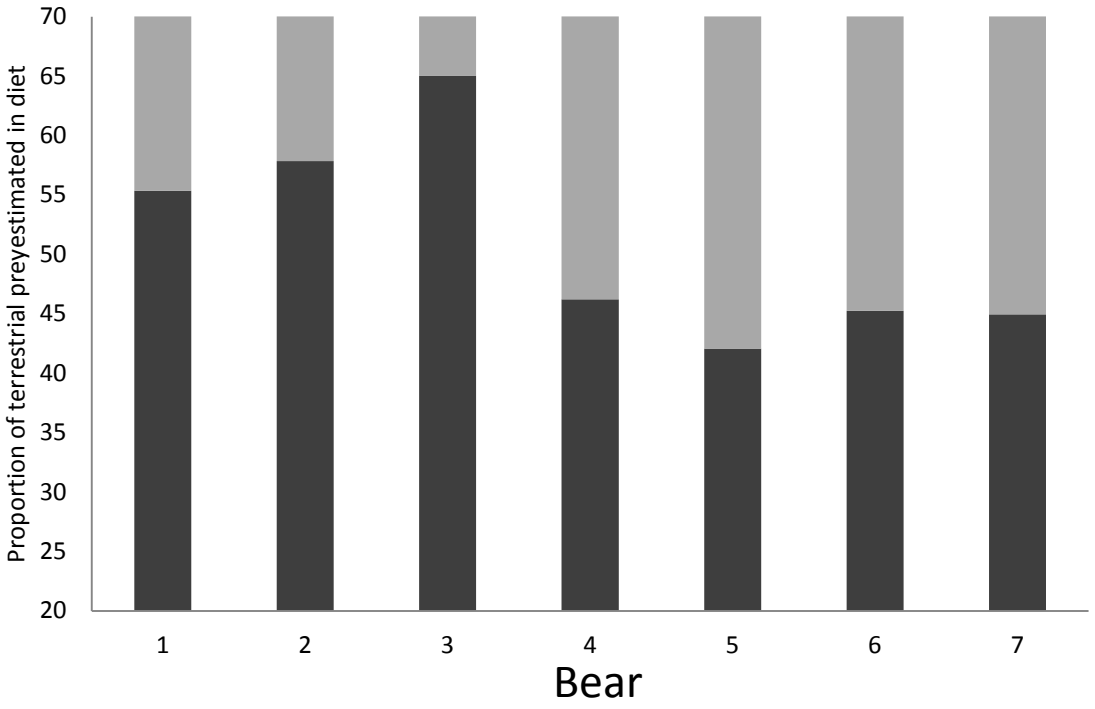
Discussion

- This method indicates that individual kill rates can exceed 50 per year.
- Kill rates can be highly variable.
- The method of camera collars provides a tool that can be applied to evaluating individual specific kill rates.

Stable Isotope Analysis (SIA)

- A technique to estimate diet from biological samples
- Different tissues represent diet over different time scales
- Affordable.
- Sample collection at sealing.



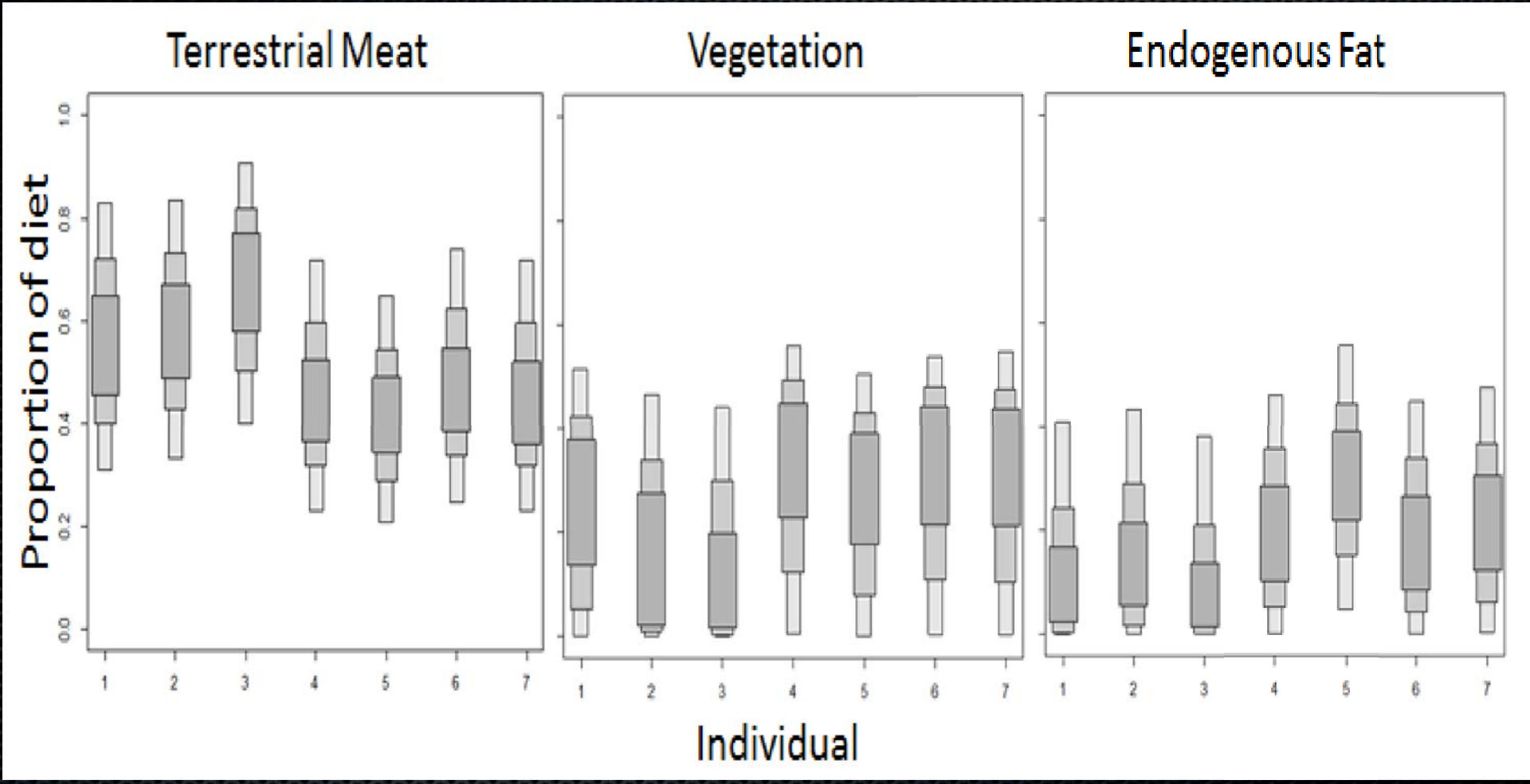


Camera Footage

SIA Estimate

Results

Spring SIA estimates of Diet



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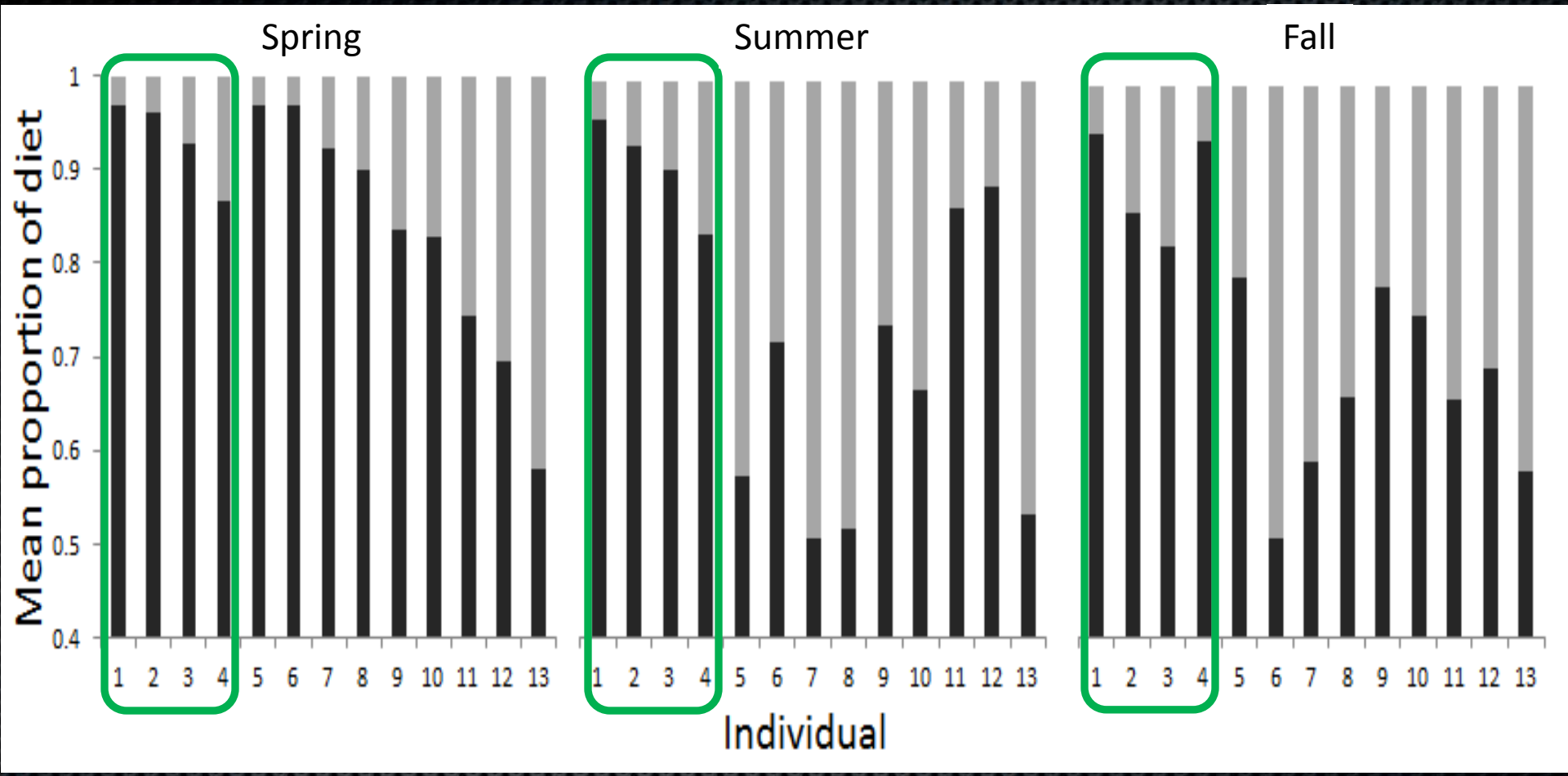

Proportions of Terrestrial prey

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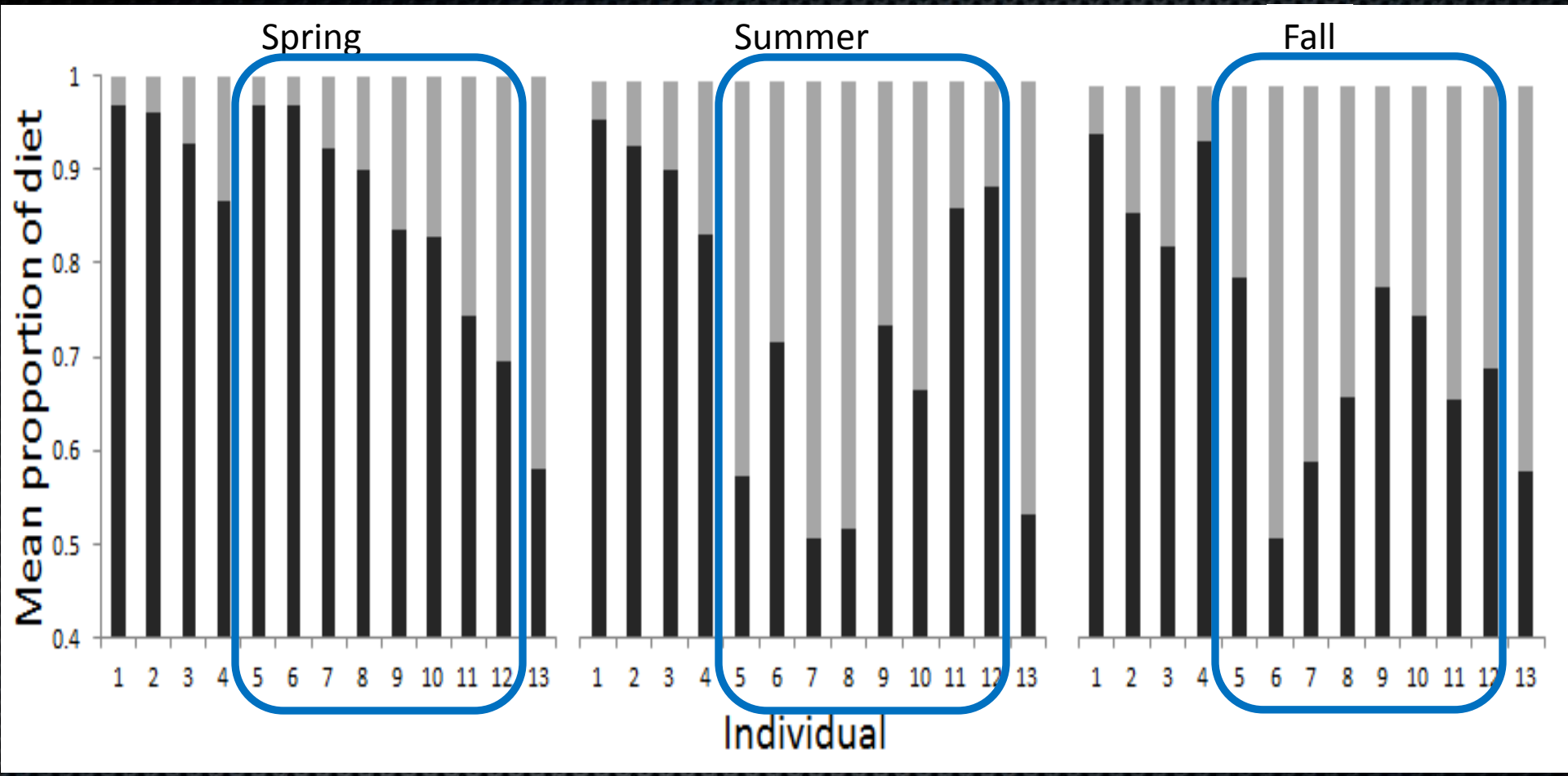

Proportions of Terrestrial prey

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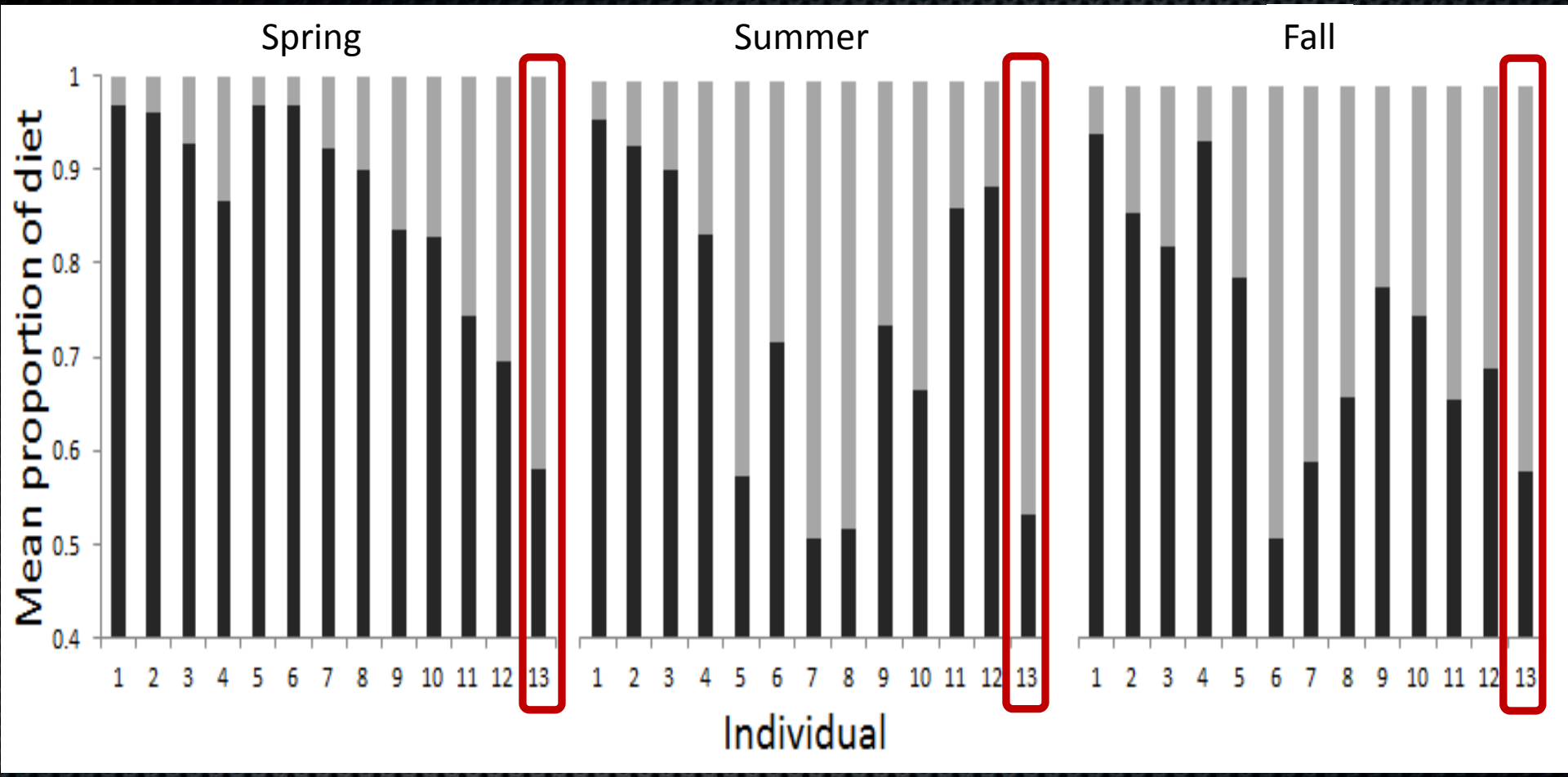


Proportions of Terrestrial prey

n=13

Discussion

- Model selection
- Spring Diet
- Seasonal variation in diet

Conclusions

- The method of combined Animal-Borne video camera and GPS is a robust method for assessing kill rates for brown bears.
- The individual kill rates can be highly variable.
- The bears in the Nelchina area rely heavily on terrestrial prey in spring, but vary substantially in diet throughout seasons.

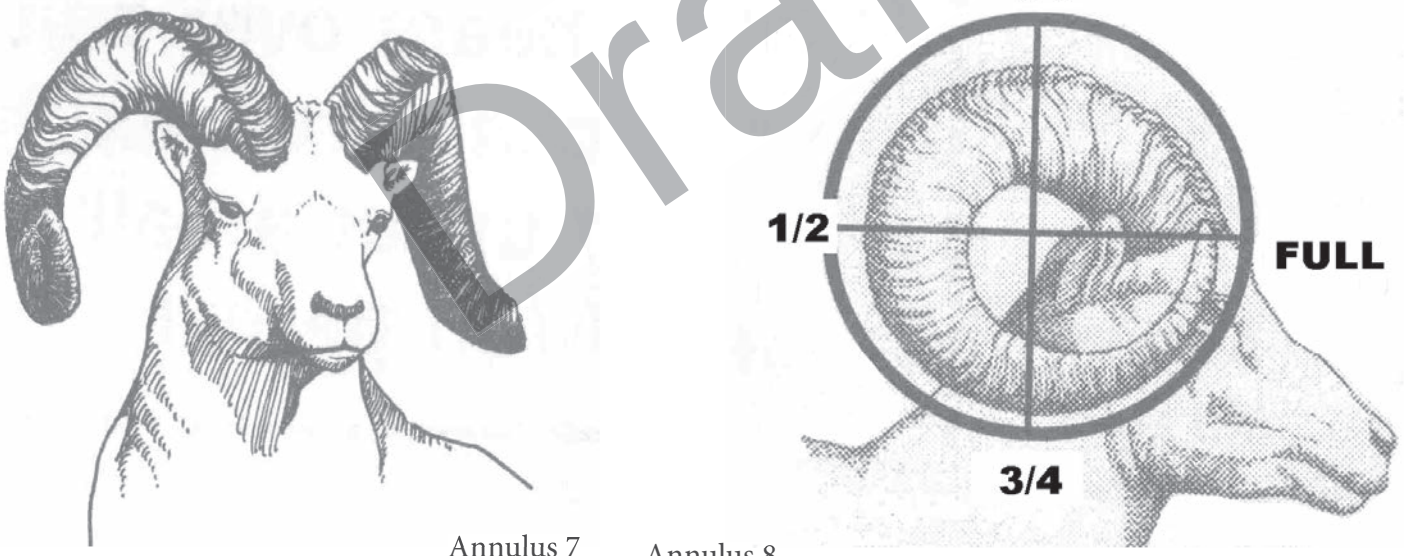
Questions

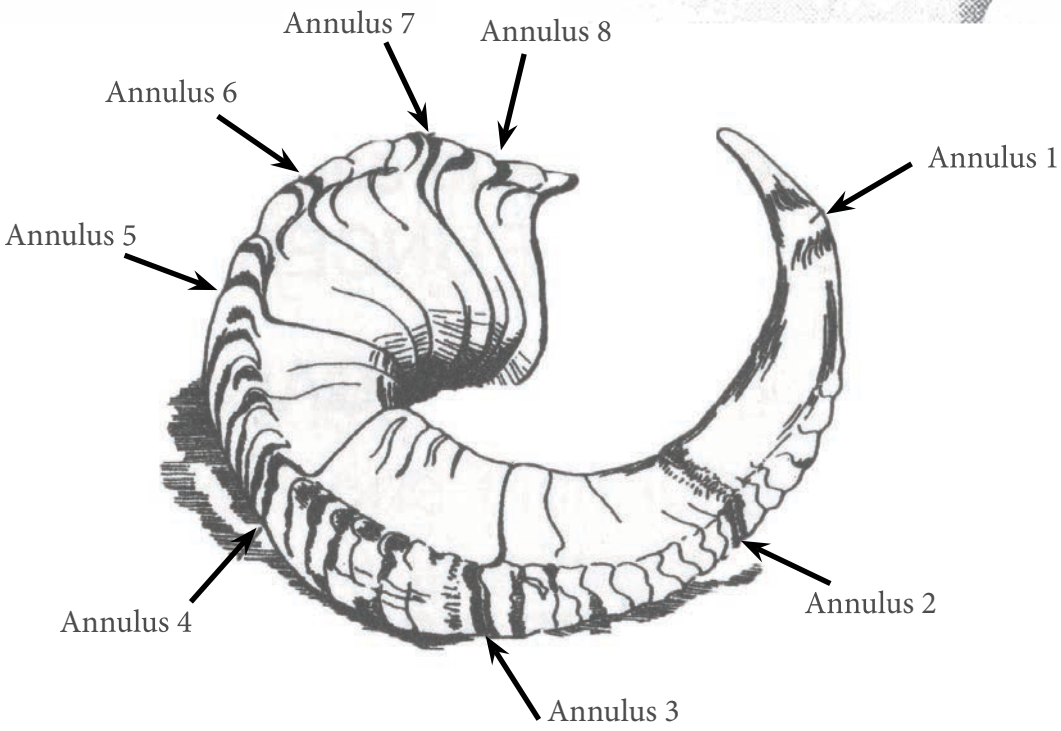
Draft **Dall Sheep**

Guide to Judging Sheep Horns Under the Full-Curl Regulation

Alaska Department of Fish and Game

2016





Draft **Dall Sheep**

Guide to Judging Sheep Horns Under the Full-Curl Regulation

Alaska Department of Fish and Game, 2016

Purpose:

The purpose of this training manual is to provide consistency in staff methods/knowledge of aging Dall sheep using horn annuli and/or determining curl legality during the sealing process. The methods within this manual for determining age and curl size of Dall sheep have been standardized and approved by the Department of Fish and Game. ***Anyone who seals Dall sheep, regardless of their experience, should study this manual.***

Project Content and Review:

Steve Bethune, Chris Brockman, Mike Harrington, Tony Hollis, Tony Kavalok, Tom Lohuis, Elizabeth Manning, Kristen Romanoff, Mike Taras, Joe Want, Cyndi Wardlow, Brad Wendling.

Definition of Full Curl-Horn

5 AAC 92.990. Definitions

(30) "full-curl horn" of a male (ram) Dall sheep means that

(A) the tip of at least one horn has grown through 360 degrees of a circle described by the outer surface of the horn, as viewed from the side, or

(B) both horn tips are broken, or

(C) the sheep is a least eight years of age as determined by horn growth annuli;

(A) The tip of at least one horn has grown through 360 degrees of a circle described by the outer surface of the horn, as viewed from the side,

Measuring the Curl

Ram horns grow in a helix, like the threads of a bolt, out from the head. Horns must be viewed along the axis of the curl to see the perfect circle. For a ram to be full-curl, the outer surface of the horn, as viewed along the axis of the curl, must complete 360º.

Because horn growth varies so much between sheep, there are **3 methods of looking at the horns** to determine whether a horn grows through 360° of a circle and is full-curl. The horns only need to be deemed full-curl by ***one*** of the methods!

1. The Perfect Circle Test
2. The Stick Test
3. The Horn Base/Horn Tip Angle Test

1. The Perfect Circle Test

In the Perfect Circle Test, the sheep head is viewed from the side at such an angle that the outer surface of the horn creates a circle. If the horn tip reaches the horn base, then the sheep passes this test and is legal.

Viewing angle is critical.

Viewing horns at different angles will change the curl's appearance. A sublegal curl can be viewed as having a full-curl when observed at an improper angle. If the horn is viewed at an improper angle, it will not fit inside a perfect circle. Instead, it will form a flattened circle or ellipse (like an egg).

Wrong view- Elliptical

Correct view- Circular

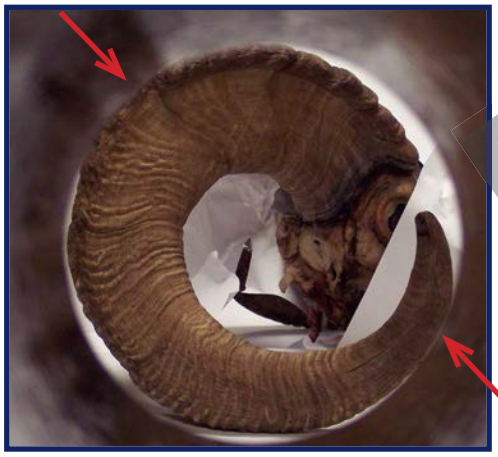
This is not a full-curl ram. If it is viewed to make it look full-curl by putting the horn tip up to the base, the circle is flattened out to an egg shape. When the horn is turned to fit inside a true circle, the tip of the horn does not reach the base of the horn.

One method used when the horns are extremely close to full-curl is to create the perfect circle view by looking through a tube and adjusing the horns until the view fits inside perfectly. You can then see clearly whether the horn tip has grown around to meet the base of the horns.

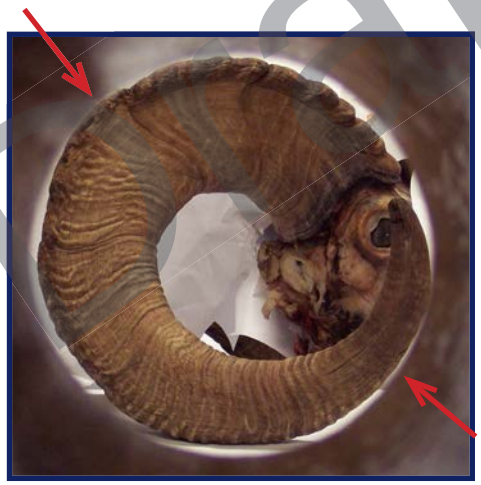
A 12 to 16 inch section of 4" black ABS tube works great when set up on a tripod or a shooting bag so it can be moved around. Black tubing is best because it makes the white space around the horns easier to see.

You can then take a picture through the tube to document the sheep horns.

When viewing through the tube you must take your time and move the horns and/or tube around until you get the horns to show a perfect circle within the tube. This is usually done by ensuring there is a slight and even amount of white space between the outer surface of the horn and inner surface of the tube. ***White paper placed behind the horns greatly helps to view the perfect circle.***



Not the right view.
Notice the area of the red arrows. There is no white space at 10 o'clock and 4 o'clock. Needs adjustment.



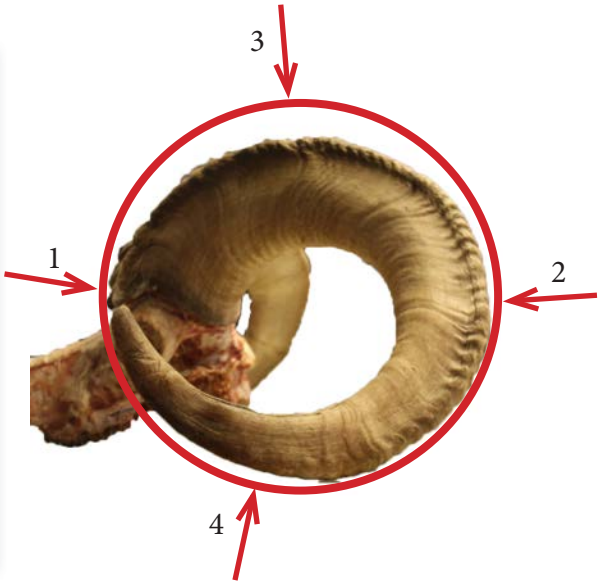
Better but still not perfect. The horns are still a bit out of the circle. The red arrows are pointing to areas where there is uneven, or no white space between the horns and the tube.

Near perfectly circular. Thin, even strip of white space around horns. Now you can determine whether the tip of the horns reach the base of the horns. This sheep is full- curl.

Alternative Method to Demonstrate "Not" Full-Curl

Some horns will never form a "perfect circle". Another way to view the horns to demonstrate that they are **not** full-curl is to:

- View the horns through a tube.
- Align the tip of the horn so it just touches the base.
- Ensure that there is a slight but even amount of white space between the base of the horn and the tube (1) and the same space at 180° from the base (2).
- Now, if there is more space at the 90° (3) or 270° (4) points the sheep is NOT legal.



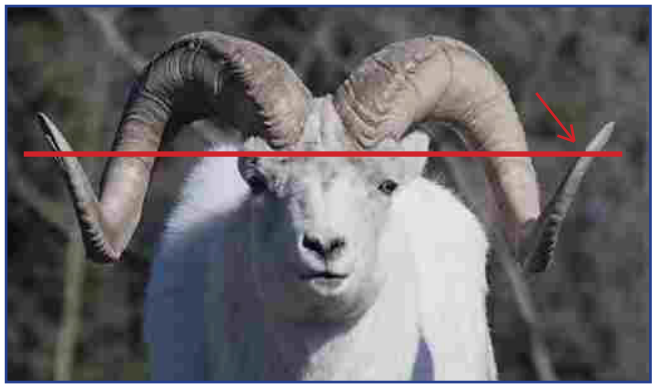
Photos on this page used with permission from fullcurl.net.

2. The Stick Test

For the stick test, a straight stick or dowl is placed beneath and across the front base of both horns and extends out past both sides of the head. If one of the horn tips reaches or surpasses the plane created by the top of the stick or dowl, then the sheep is full-curl.

The top of the stick or dowl, which is placed under the base of the horns, creates the plane that the horn tips must pass. If you use the bottom of a stick or dowl, you will be giving away a quarter inch or more depending on the thickness of the stick.

When using the stick method you must look at the sheep straight on so there is an equal amount of horn above and below the plane created by the stick held under the horn bases.



This is how it looks with head intact. With the correct view there is an equal amount of horn above and below the line.

Clearly failing the stick test on both sides.

A side view of the stick bisecting the horn with equal amounts on each side.

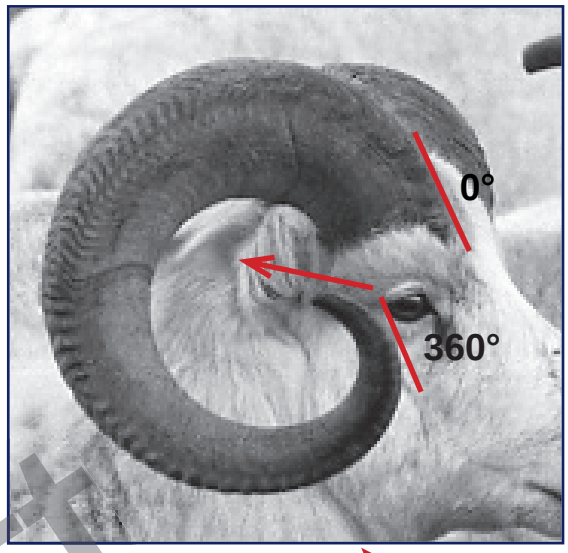
Using a fiberglass dowel.

Clearly passing the stick test.

3. The Horn Base/Tip Angle Test

Sheep horns can grow through 360⁰ of a circle without reaching the plane of the horn base. These horns usually drop low and wide and curl tightly as the ram ages.

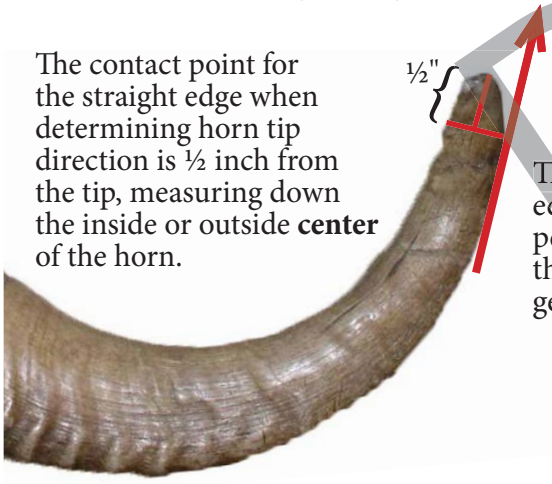
In the example at the right, the horn base angle is assigned a relative starting point of 0⁰. As you measure the angle around the horn, it is obvious that the tip of the horn on this sheep surpasses the 360⁰ angle required for it to be full-curl.



Important:

You are measuring the direction that the tip grows compared to the direction that the base grows.

When determining the direction of the horn tip using a straight edge (as in the picture below), your contact point with the horn will be ½ inch from the tip, measuring down the inside or outside center of the horn (*not the circumference*). At this point, you can draw a line across the horn or use a rubber band to mark the spot to place your perpendicular straight edge.

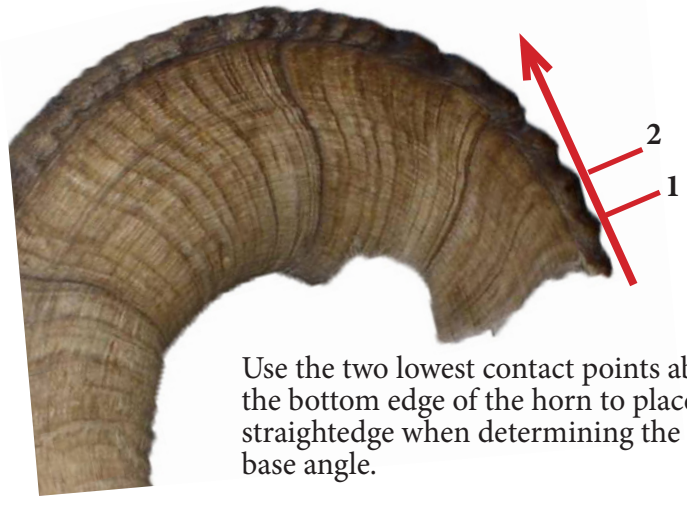


The contact point for the straight edge when determining horn tip direction is ½ inch from the tip, measuring down the inside or outside **center** of the horn.

The straight edge is held perpendicular to the ½ inch line to get the direction.

This sheep is legal. The horn tip angle is just equal to the horn base angle. These horns did not pass the stick test or the perfect circle test.

When determining the angle of the horn base, your straight edge will have two contact points (the first two ridges up from the horn base) to determine the direction.



Use the two lowest contact points above the bottom edge of the horn to place a straightedge when determining the horn base angle.

The horn tips of this sheep do not meet or exceed the angle of the horn base, so it fails this test. It is legal, however, as it passes the stick test.

(B) Both horns tips are broken

The terms broken and broomed have been used synonymously by sheep hunters for years. Broken is the only term used in regulation**.** We do not use the term "broomed."

Broken, as it applies to the horn tips of male (rams) Dall sheep, means:

1. The lamb tip is completely absent; horn tips that are chipped or cracked are not broken if any portion of the lamb tip is present;

2. Characteristics of the lamb tip include:
   a. a length of less than four inches,
   b. the inside surface of the lamb tip is often distinctly concave when compared to the remainder of the horn, and
   c. the lamb tip is the section of horn that is grown during the first 6 months of a sheep's life and is the section of horn distal of the first annulus, which is the swelling of the horn that forms during the first winter of life.

Broken

Obviously broken and jagged.

Worn smooth, but lamb tip is missing.

Horns that have broke and been worn smooth are still "broken." These horns obviously broke at some time.

Both horns broken and missing lamb tips.

This horn was either broken and worn, or just worn past lamb tip. Either way it is legal as the lamb tip is gone.

Both horns broken.

Not Broken

Lots of horn tips are rubbed and worn down. This is not broken.

Rubbed and worn down but not far enough to remove entire lamb tip. This is not broken.

Slightly damaged and worn but lamb tip still present. This is not broken.

(C) The sheep is at least 8 years old

Aging Sheep By Counting Horn Annuli

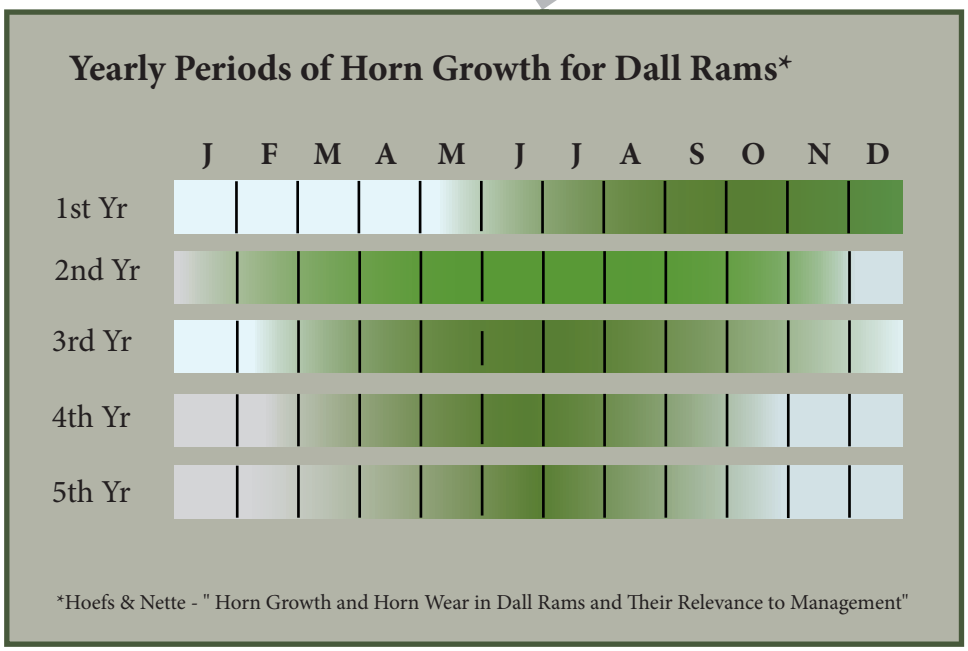
Understanding Horn Growth

In order to age sheep accurately by counting horn annuli and to convey this information to hunters, it is important to understand the sheep horn growth process. It is also important to use as many defined characteristics as possible in your determination.

Dall sheep have reasonably stable periods of seasonal horn growth. Horn growth generally starts in early spring and ends in late fall or early winter. The time between growth periods is usually marked on each end by a well defined groove referred to as a true (primary) **annulus**. By identifying and counting these annuli, the age of an animal can be determined.

- Sheep are born around the end of May.
- Growth is relatively continuous through the first year of life although there is still an annulus formed during the first winter of a sheeps life. The lamb tip represents the first summer of life and is counted as the 1st annulus.

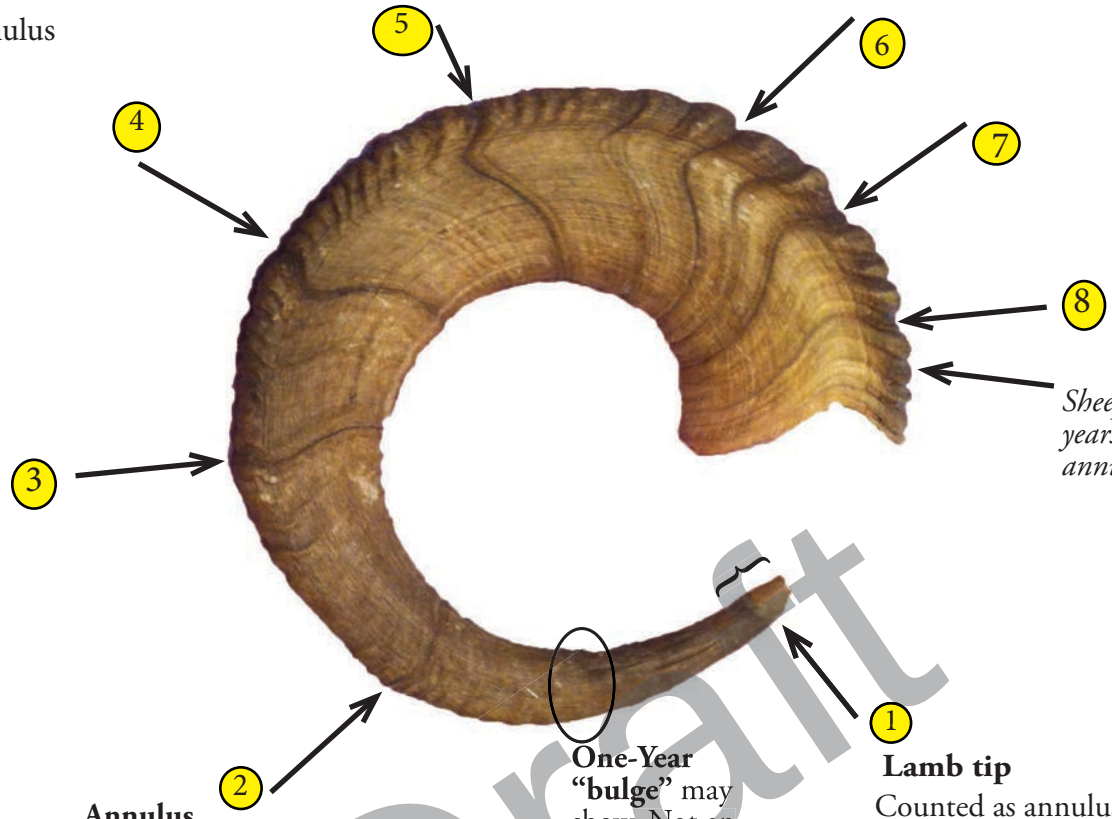
The first annulus is always present on younger rams (rams that we don't see commonly while sealing old rams) and is slowly worn through time as the ram ages, along with the rest of the horn tip. Remnants of the first annulus can still be located and identified on the majority of all sheep (ewes, lambs, and rams), including rams that are 10+ years of age.



There is a gradient in the horn growth bars because horn growth gradually increases through the growing period and tapers off as the growing period comes to a close.

- Because annuli are formed during winter, they do not actually represent the date of birth of an animal, but the year of life it is in.
- Horn growth normally slows with each consecutive year of the animal's life after age 3, therefore the horn growth segments should consecutively get smaller after the 3rd annulus. This is important to know as it will help you to detect false annuli. * *A small percentage of sheep will not follow this general rule.*

= Annulus



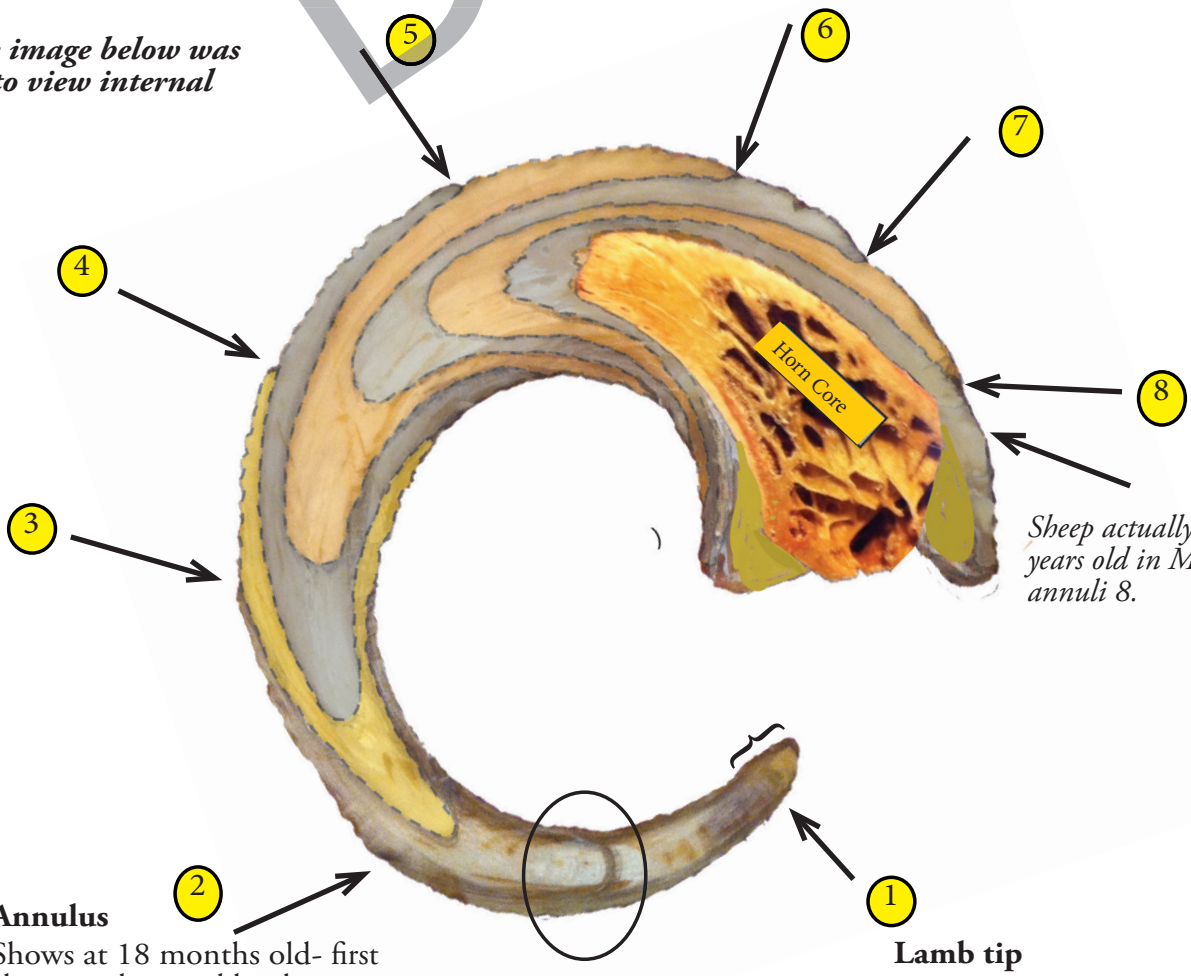
Sheep actually turns 8 years old in May- after annuli 8.

Annulus
Shows at 18 months old- first clear annulus on older sheep.

One-Year "bulge" may show. Not an annulus.

Lamb tip
Counted as annulus 1 if present.

The horn in the image below was cut lengthwise to view internal conical growth.



Sheep actually turns 8 years old in May- after annuli 8.

Annulus
Shows at 18 months old- first clear annulus on older sheep.

One-year "bulge"

Lamb tip
Counted as annulus 1 if present.

Sheep Horn Graphics Courtesy of Joe Want

Horn Aging Terminology

Annulus:

- A groove created from the annual stoppage in horn growth. It completely encircles the horn.
- The upper surface of the groove is rough.
- The lower surface of groove is smooth.
- Deep, thin groove.

} **see image 1 on next page**

- Marks the beginning of a set of repeating ridge patterns. For example, in the latter annuli segments, a false annuli or other prominent feature tends to repeat in the segment of the following years as well. **See image of repeating patterns on page 13.**
- On annuli 3 and up, a fingernail will catch in the groove when scratching toward the tip of the horn. Running the fingernail around the groove in this manner may produce a white dander around a true annuli.
- The amount of growth between annuli normally decreases each year of the animal's life after age 3. **A small percentage of sheep will not follow this general rule.*

False Annulus:

A ring that appears to be an annulus but is not. False annuli can go all the way around the horn. They usually occur on both horns in the corresponding location. These rings can be deceiving so you should ask yourself if they meet **all** of the above characteristics of an true annuli. If they do not, they are false annuli.

Lamb Tip:

The section of horn distal of the first annulus, which is the swelling of the horn that forms during the first winter of life.

Characteristics:

- A length of less than four inches.
- The surface of the lamb tip is smooth (no ridges along outer surface) and the inside surface is often distinctly concave when compared to the rest of the horn.
- Faint groove may be present at first annulus.
- Sometimes it is missing or rubbed down in older rams.

First Annulus:

The terminus of the first summer of horn growth and the ending point of the lamb tip. The first annulus may be difficult to locate and identify on older rams or it may be partially or completely worn away as a sheep ages.

Characteristics:

- Groove around the horn may not be visible in older rams although a faint one may be present.
- There is a slight increase in horn circumference (distinct swelling) at ending of lamb tip.
- The outer circumference of the horn is smooth on each side of the "bulge."

Second Annulus:

The annulus that is created in second winter, when a ram is 18 months old.

Characteristics

- Groove completely encircles horn.
- Swelling is often present on both sides of the groove.
- Outer circumference of horn wrinkled on both sides of the groove.
- Groove is usually shallow.

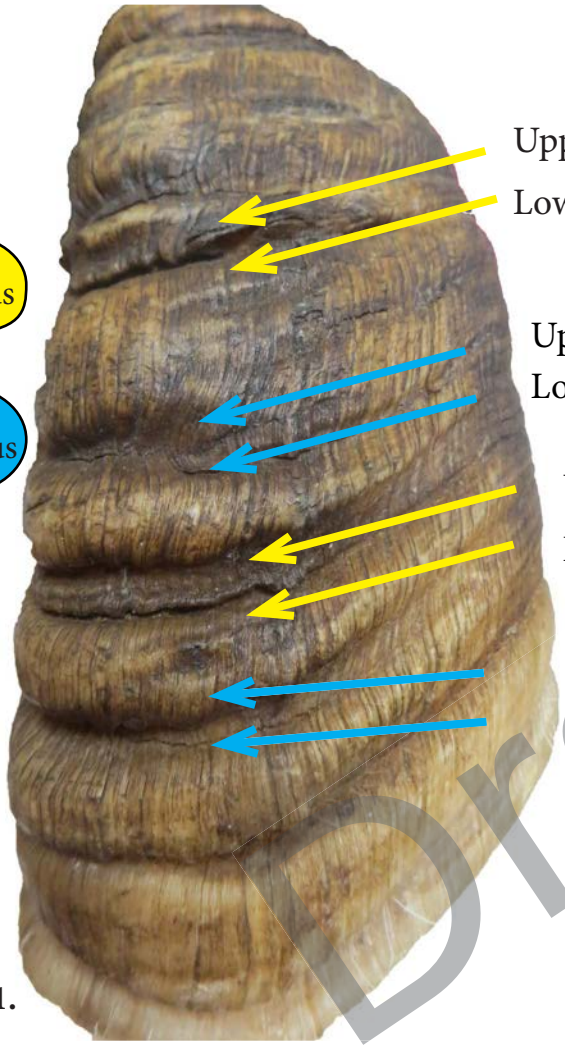
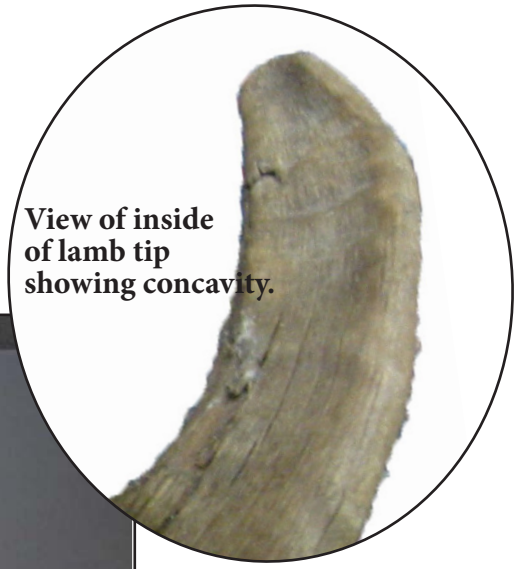
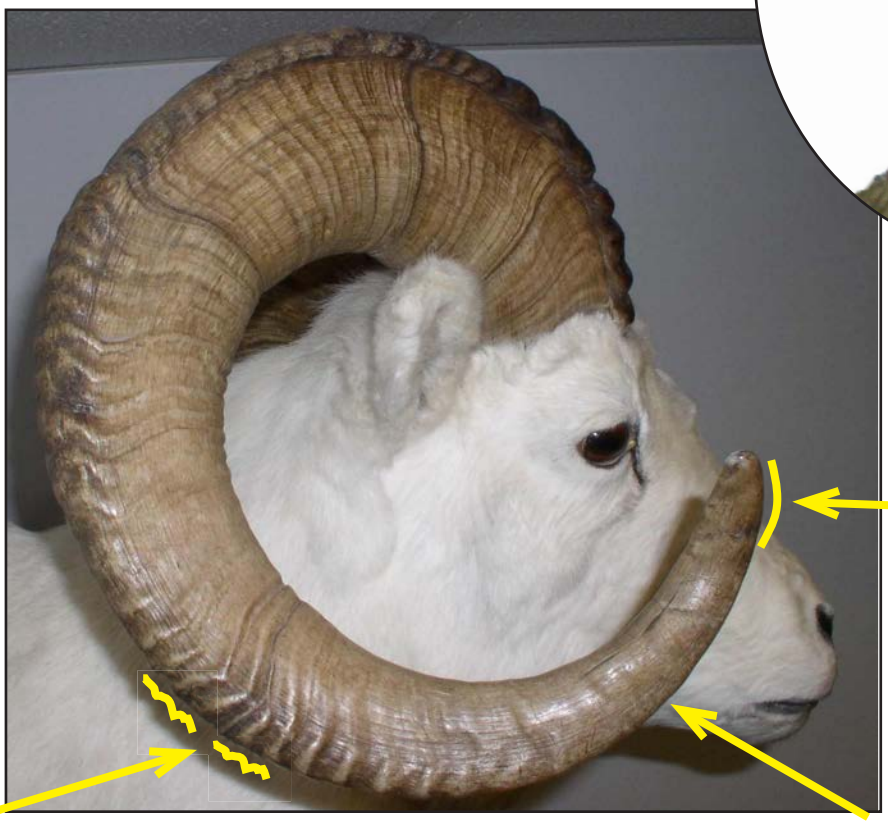


Image 1.



View of inside of lamb tip showing concavity.

Lamb tip may show concavity on the inside if not worn down.



Lamb tip

2nd annulus

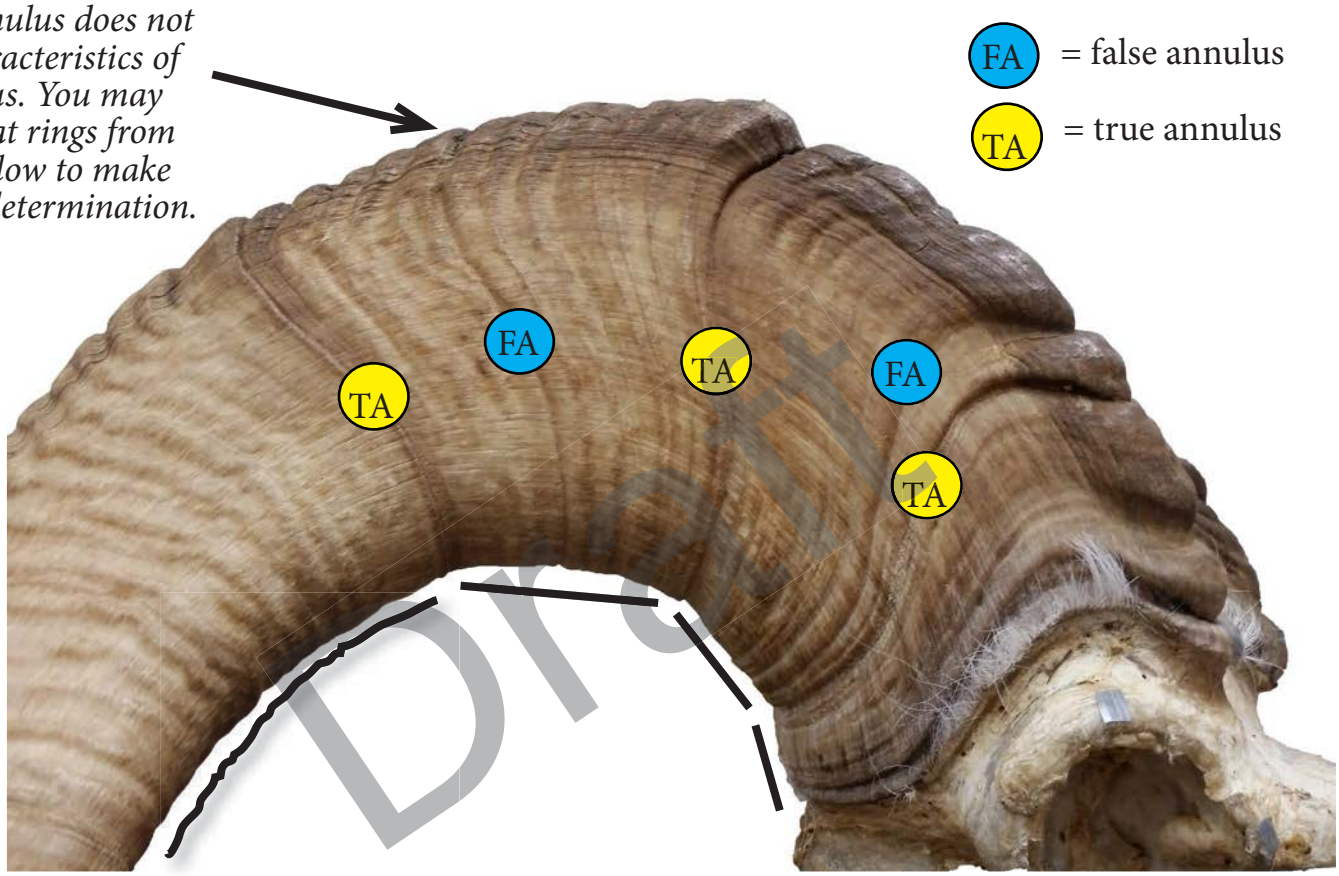
Ridges on both sides of the annulus.

Sometimes you see a bulge created at the 12-month point in an animal's life. It might look like an area where the horn is swollen. **This is not an annulus.**

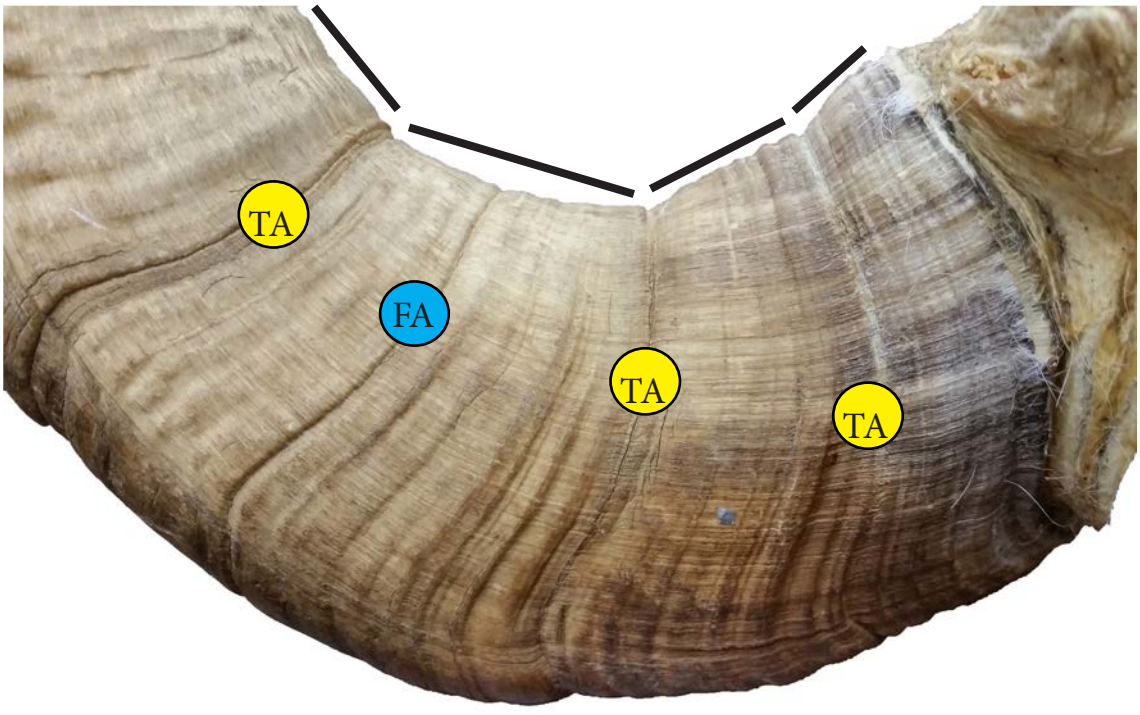
As you count annuli and get closer to the base of the horns, it is very helpful to look from the underside.

Notice horns have a relatively smooth continuous curve on the outside, but on the inside/underside, each annulus results in an abrupt change of plane to the curvature of the horn.

This false annulus does not meet the characteristics of a true annulus. You may have to look at rings from above and below to make an accurate determination.



** The false annulus labeled below has a slight angle change associated with it on the underside of the horn, but it does not meet other characteristics of a true annulus. Looks at as many features as possible.*



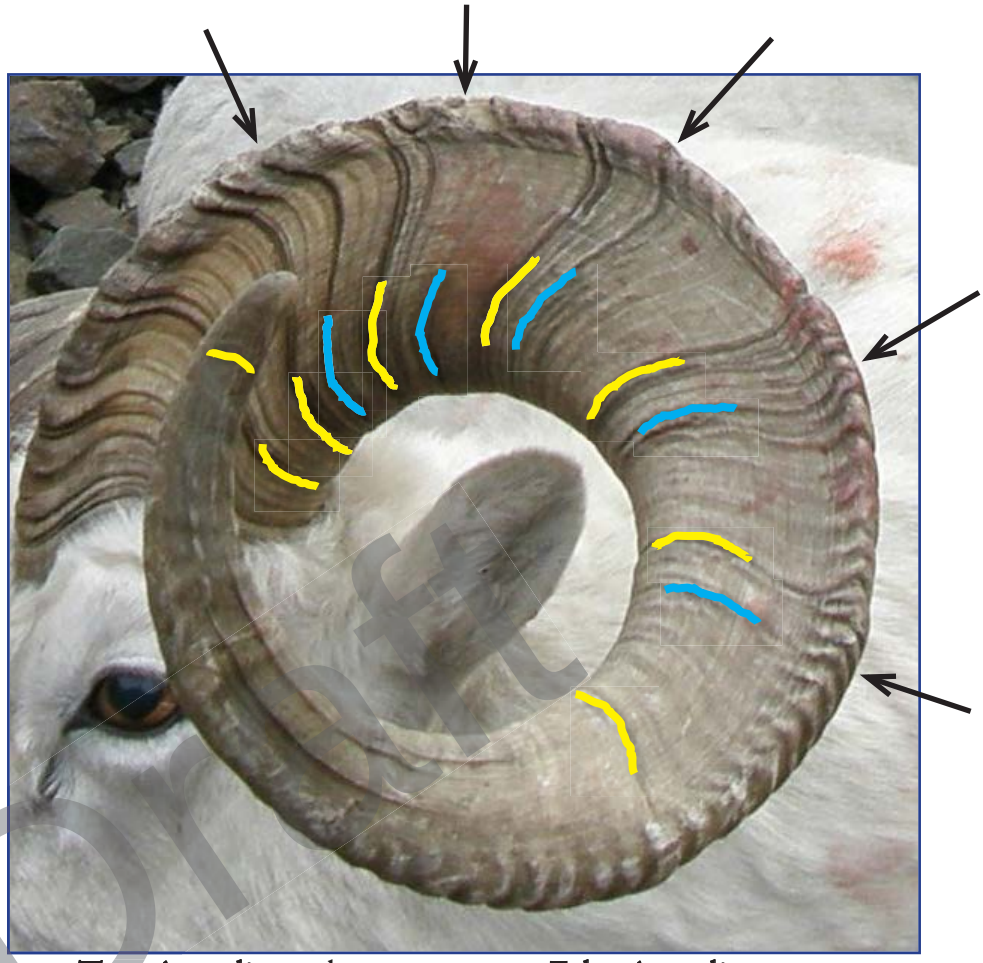
Repeating Patterns

Ridges and false annuli

A distinct pattern of ridges between true annuli tend to repeat themselves in the middle section of the horn. For example, if there is a false annuli in one section, it tends to repeat itself in the following growth segments. Knowing this will provide you with one more bit of information and help you better identify false annuli.

In the sheep horns on the right the arrows are pointing to a false annuli that repeats itself in each growth segment.

** Note how well defined the false annuli can appear. That is why you need to use all of the clues when making age determinations.*



True Annuli are shown marked with **yellow**.

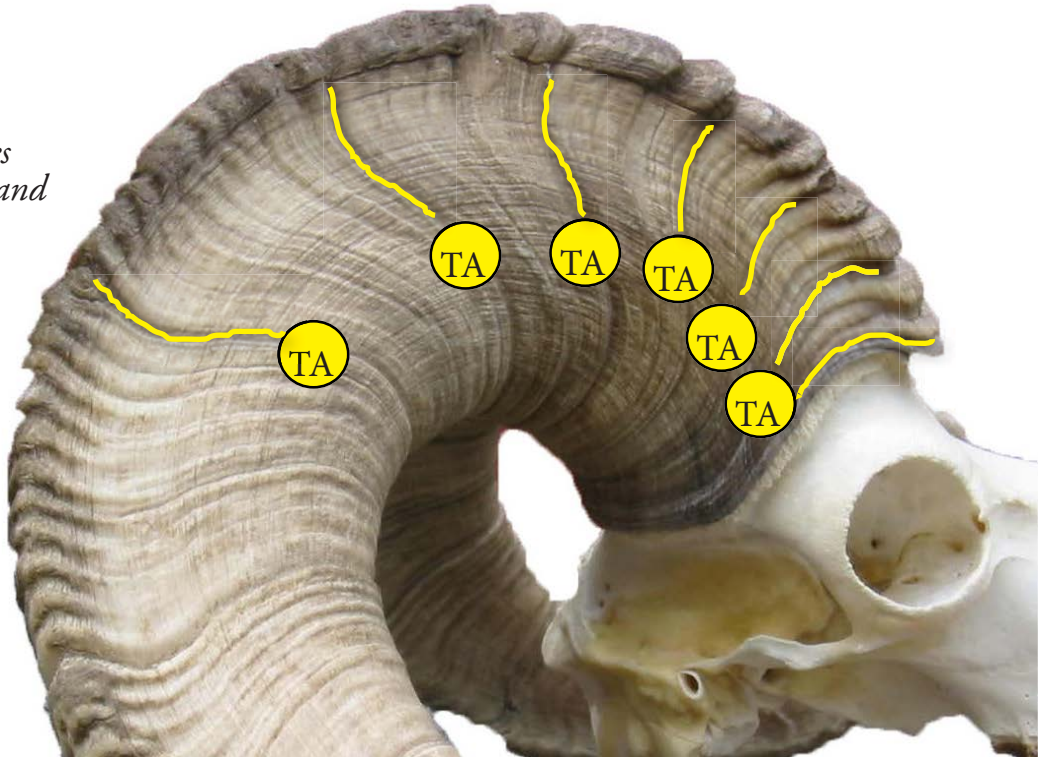
False Annuli are marked with blue.

Decreasing Segment Size

As a sheep ages, annual horn growth slows. This causes the growth segment between annuli to successively get shorter. The growth segments near the base of the horns are usually closer together than the segments further out near the tip. If you are not seeing this pattern, you may be looking at false annuli.

** There is a small percentage of sheep that will not fit this description. Use as many clues as possible to determine true and false annuli.*

TA = True annulus

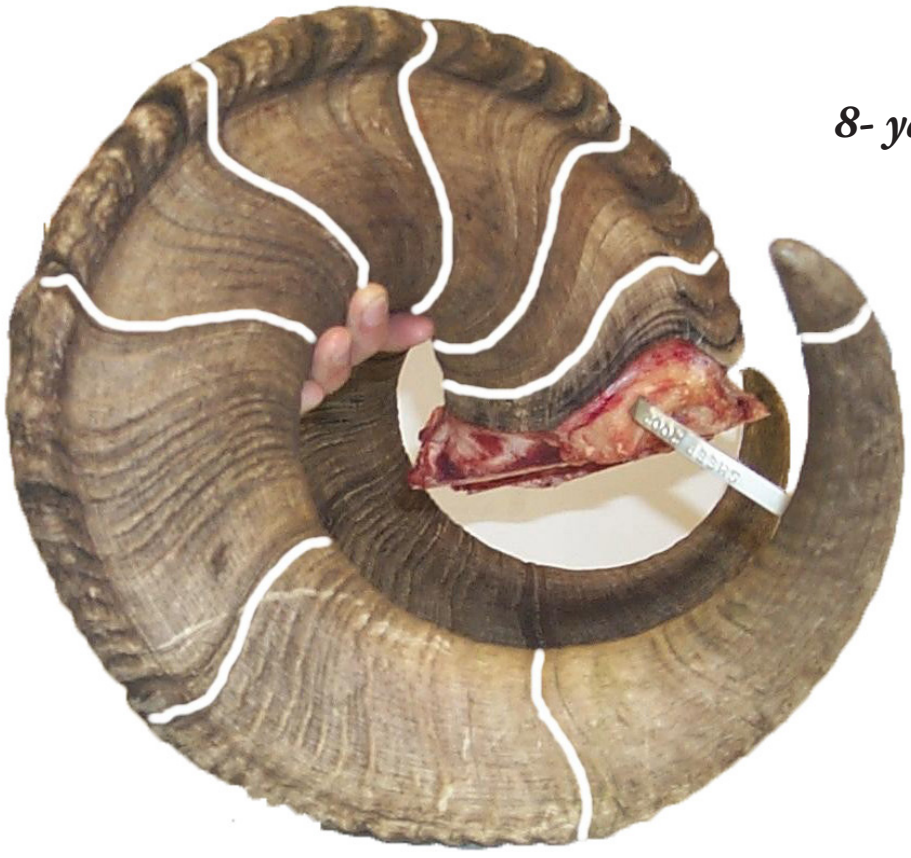


Steps for Aging By Counting Annuli

1. Locate lamb tip (it may be missing). This is your first annulus. Designate it as "1".
2. Try to locate the “one-year bulge” which may or may not be present between the lamb tip and the second annulus. It may appear as a bulge, or may have a ring present, but this is not an annulus. Note it but do not count it.
3. Locate the second annulus. This is usually the first clear one. Designate it as “2” and continue counting the annuli toward the base of the horn.
4. Identify and mark each true annulus. Use tape or chalk. Do not use a marker.

Notes

- You may have to look on the underside of the horn to verify that the annulus goes all the way around.
- You may have to look on the underside of the horn to see the distinct plane changes in horn arc.
- Each successive annulus will represent another annual growth cycle.
- There will be a segment of growth below the last annulus for sheep that are harvested in the fall.
- There are no hidden annuli below the hairline of sheep around 8 years old and younger. Old rams that have very little annual horn growth may have annuli beneath the hairline, but an annulus cannot be added to the number that you count, assuming there is one below the hairline.



8- year-old ram

Sex Identification

Ewes (Females)

Horns:

- Thinner at base
- Shorter
- Slightly curved

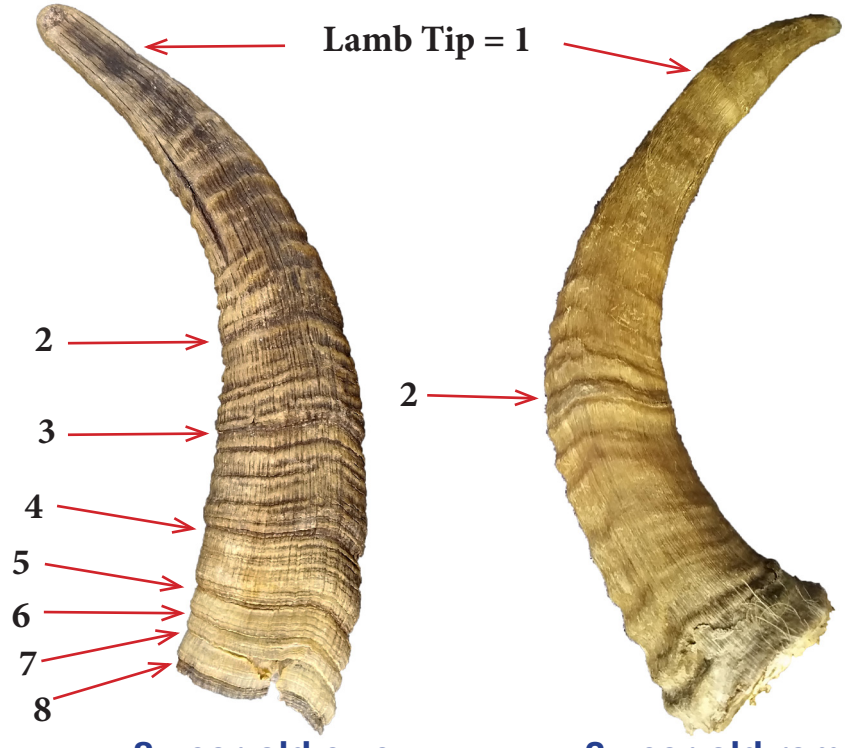
Young Rams (Males)

Horns:

- Thicker at base
- Longer with age
- Curve out away from bases
- Narrow distance between bases

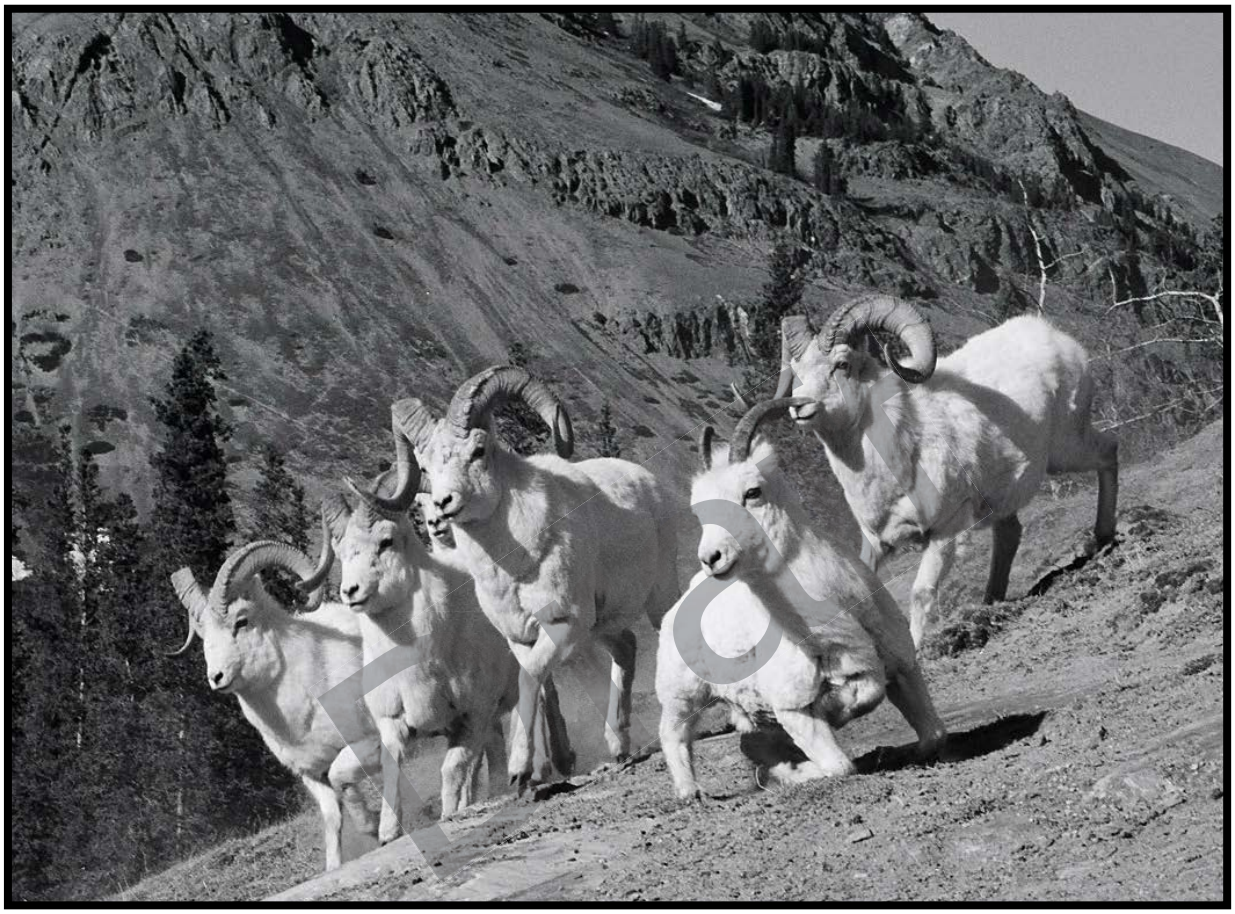
There could be possible confusion in horns of animals that are about 18-months to 2-years old. But after a year, ram horns grow much faster and this will be evident by looking at the size of the horn compared to the annuli.

The picture on the right shows a 7-year-old ewe compared to a 2-year-old ram. These show the distinct difference between the two, with the ewe horns being slender and slightly curved and the two-year-old ram horns being larger than the 7-year-old ewe horns.



Look closely at the horns to view the annuli. See the "Aging Horns" section in this manual for details.

If there are three or more annuli on horns this size, then it is a ewe.



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For more information about the production of this manual please contact: mike.taras@alaska.gov, 907-459-7230.

EXECUTIVE SUMMARY RC 4

Dall Sheep – DRAFT Guide to judging sheep horns under the full-curl regulation

In 2014, the Division of Wildlife Conservation (DWC) formed a committee to review and recommend procedures and protocols for evaluating and determining legal rams under the full-curl bag limit definition and regulation. The purpose for this effort was to improve consistency in staff methods / knowledge for evaluating legal rams during the sealing process. The methods described in the document for determining curl size and age have been standardized and approved by ADF&G.

The committee, which includes DWC staff with considerable experience evaluating legal rams, created and produced this document (RC 4) as a guide to standardize methods to improve consistency statewide for judging sheep horns under the full-curl regulation. This document has been reviewed by the Division's Management Coordination Team, sheep managers, and sheep research biologists and more recently by the Alaska Wildlife Troopers. Others, including members of the Alaska Wild Sheep Foundation, Alaska Professional Hunters Association, Safari Club International, and the Board of Game's Sheep Sub-committee led Sheep Work Group, and the Big Game Commercial Services Board have had opportunities to review and provide comments.

The review of this draft document for staff to evaluate ram horns has been done with the understanding that this document is an internal guide for standardizing legal ram determination and improving consistency in evaluating rams under the full-curl regulation. Following this project, the department intends to create a sheep hunter's guide for determining legal rams under this regulation as well. There will also eventually be educational materials available on the department's website available to hunters, guides, and others to use as a resource for learning about sheep, evaluating legal rams, and judging potential trophy rams. The Division plans to produce a handbook similar to what has been done for mountain goats and bears.

The draft document (RC 4) contains the definition of a full-curl horn found in regulation. Following this, there is a description of the three methods that will be used to determine if rams are legal under the definition. These include 1) The perfect circle test, 2) The stick test, and 3) The horn base / tip angle test. All three are described with pictures and diagrams including examples of horns that do not meet the standards. If a ram meets the minimum of any one of the three tests, then it will be judged as meeting the full-curl definition. If a ram does not meet the minimum for any one of the three tests, it either has to be "broken" on both horn tips or be at least eight years of age. The department and the Alaska Wildlife Troopers have recognized that there needs to be a legal definition of "broken" and there is a proposal to consider a definition of "broken" provided by the committee. This proposed definition is provided in the current draft of the document. It will be finalized once the Board of Game has reviewed the proposal and provided their comments and recommendations. The remainder of the document is focused on determining the age of a ram based on horn annuli. This includes explanations, pictures, and diagrams to describe the characteristics and morphology of horn growth for locating and identifying annuli. This section of the document is intentionally more detailed to provide staff with more guidance

and information because determining the age of rams is generally considered to be more complicated and challenging than the other methods to identify legal sheep under the full-curl regulation.

The last part of the document has a description with pictures showing characteristics of young rams and ewes. This is primarily informational but may have application for staff that may need to evaluate smaller sheep horns (e.g., ewe horns) for any reason.