

MEMORANDUM

January 28, 1985

TO: Mike Brooks, Regional Wildlife Land Management Biologist

FROM: Frank H. Smith, Jr., Chief, Bureau of Wildlife Land Management *FHS*

SUBJECT: Ocala Deer Study

*North central FL. between
Gainesville + Orlando
more upland than BICY*

Fred, Al, Carlton and I have reviewed your report entitled "Ocala National Forest White-tailed Deer Reproduction Investigation." First, allow me to congratulate you on some very good work. I thought the report was an excellent presentation of the facts as we know them at this time.

After serious consideration, I am not going to recommend an additional collection of deer as part of the reproductive study. The reason I made this decision was that statistical analysis has indicated that further collections are unwarranted. The bottom line is that I believe we have all the reproductive information we need at the present time and the cost, in terms of manpower, equipment use and actual expense money to collect and analyze another 60 deer, is not justified based on simply reinforcing the data we currently have.

After you receive this year's information on the histological examination of ovaries, you should begin work on a draft publication on the reproductive investigation. Much of the information in your current report should be used, of course, but with some additional information and plausible speculation. In your materials and methods section, you should add some information on methods used for ovarian histological analysis. In your results and discussion section, you should add another two tables that present the reproductive information from histologic examination of ovaries from still and dog areas, and stress in the text the similarity between this data and data obtained from visual examination of reproductive tracts. You should perhaps also present the backdating reproductive information from histological examination.

I am also enclosing a copy of your paper with comments by Al Egbert for your use. Generally, Al feels your analysis and interpretation of data need expansion. You should give Drs. Stewart Odend'hal and Ernie Provost a chance to review your next draft also; they will undoubtedly have some good ideas.

The final report and recommendations on the entire Ocala deer study should be prepared after the 1985 deer track counts have been conducted. We probably need to have a meeting on recommendations in Tallahassee before this report is prepared.

M E M O R A N D U M

January 28, 1985

Page 2

Thank you and everyone else who participated in this study. All of you have done an excellent job.

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Enclosure

cc: Mr. Fred W. Stanberry

Dr. Al Egbert

Major Bill King

Mr. Carlton Chappell

OCALA NATIONAL FOREST WHITE-TAILED DEER (Odocoileus virginianus)
REPRODUCTION INVESTIGATION

Study Area

The Ocala National Forest is located in north central Florida in Marion, Lake and Putnam Counties. Today, the Forest encompasses 430,349 acres (174,230 ha.) with a net acreage of 369,952 acres (149,778 ha.) of government owned land. The Ocala is divided into two Ranger Districts, Lake George and the Seminole. The Ocala National Forest has been managed by the United States Forest Service since 1908. The Forest is managed under the multiple use-concept.

The area receives over 50 inches of rainfall annually. The driest two months are November and December, followed by April and May. There are over 100 days each year in which the temperature exceeds 90°F (32°C) (Snedaker et al., 1972).

Approximately 68 percent of the Forest is comprised of the sand pine (Pinus clausa) ecosystem, which is the world's largest continuous sand pine community. The major understory components are myrtle oak (Quercus myrtifolia), Chapman oak (Q. chapmanii), sand live oak (Q. geminata), scrub palmetto (Sabal etonia), rosemary (Ceratiola ericoides) and crooked wood (Lyonia ferruginea).

Longleaf pine (P. palustris) communities occur along well-drained ridges. Understory components are turkey oak (Q. laevis), bluejack oak (Q. cinerea), live oak (Q. virginiana), persimmon (Diospyros virginiana), deer tongue (Trilisia odoratissima) and wire grass (Aristida spp.)

The flatwoods communities occur on level poorly-drained sites. The dominant canopy layer may be longleaf pine, slash pine (P. elliottii) and pond pine (P. serotina). The flatwoods understory consists of

loblolly bay (Gordonia lasianthus), gallberry (Ilex glabra), wax myrtle (Myrica cerifera), tar flower (Befaria racemosa) and fetterbush (L. lucida).

Other ecological communities are bayheads, cypress domes, prairies and mixed hardwood communities. All of the ecological communities are represented in both the still hunt and dog hunt areas. There are no apparent habitat differences between the still hunt and dog hunt areas.

The Ocala National Forest has undergone numerous hunting regulation changes since the first managed hunt 1938. Eleven hundred, twenty-six permits were issued for an 18 day season. Each hunting party was limited to 3 dogs (Lahart, 1972). Presently, the season is 58 days long. Prior to the 1980-81 hunting season, legal bucks must have a five inch antler. This five inch antler law was changed to visible antler in the 1980-81 season. The visible antler law was changed to the one inch spike, during the 1981-82 season, and is presently, in effect, today. Buck-only hunting has always been in effect.

The Ocala National Forest was open to deer hunting with dogs, except areas closed to all hunting. In the 1978-79 season, 22,537 acres (9,121 ha.) were closed to hunting with dogs (still hunting). An additional 95,125 acres (38,497 ha.) were added to the still hunt area in 1982-83 hunting season making a total of 117,662 acres (47,617 ha.). Presently, 220,156 acres (89,132 ha.) are open to the use of deer dogs. Approximately 32,134 acres (13,010 ha.) are closed to all hunting (Refuge Areas). Figure 1 delineates these different types of areas.

The Ocala deer population has fluctuated over the years but the herd has steadily declined from 1973 through 1982. The deer population was estimated at 7,840 in 1973 and 3,400 in 1982. Population estimates

are determined from track counts. Track counts are conducted during the summer prior to the fall hunting season. The following table presents the deer density for the different areas and years pertinent to this study.

Table 1. A comparison of the 1982, 1983 and 1984 preseason deer, densities for areas in the Ocala National Forest, Florida.

AREA	<u>DEER PER ACRES</u>		
	1982	1983	1984
Still Hunt Area	one/130*	one/60	one/52
Dog Hunt Area	one/135	one/87	one/91
Refuge Area**	one/19	one/11	one/11

At some point, discuss apparently different densities (including Refuge?)

*Approximately 81% of the still hunt area was dog hunted during the season prior to the 1982 census.

**Deer census was only conducted in Juniper Refuge. The figures do not represent the Bombing Range or Alexander Springs Refuge.

Materials and Methods

One hundred fifty-seven adult does were collected from January through March, 1983 and February through March, 1984. Sixty adult does were collected from the still hunt area, 67 does from the dog hunt area, and 30 adult does from the refuge areas. Deer were only collected from the refuge areas during the second year. Deer taken from the still hunt and dog hunt areas were collected at least one-half mile from any refuge area or dog hunt - still hunt boundary line. All deer collected within refuges were at least one-half mile from any area open to hunting.

Deer were taken with high-powered rifles equipped with telescopic sights. Deer were collected at night aided with a 12 volt, hand-held spotlight. Neck shots were made, when possible, to prevent crippling

loss and organ damage. Three men crews consisting of a driver, a spotter and a shooter were used.

Blood samples were obtained in the field immediately, after the animal had been shot. The deer were placed on their right sides. An incision was made between two ribs, directly behind the front shoulder, to gain clear access to heart. Blood was drawn from the heart using a 20 gauge needle and vacutainer tubes. Blood samples were placed on ice and delivered to the Animal Disease Diagnostic Laboratory at Kissimmee, Florida for chemical and physical analyses.

All deer were placed in a walk-in cooler and examined the following afternoon. All deer were weighed, examined for gross evidence of parasites and disease, and physical condition was determined. Kidney fat index was used to evaluate body condition. Rumen and fecal samples were collected from several deer for other ongoing studies. Abomasums were removed, prepared and examined according to the method described by Eve and Kellogg (1977). All deer were aged by tooth replacement and by wear of the lower mandible (Severinghaus, 1949).

Reproductive tracts were removed from all adult does. Ovaries were removed and placed in 10 percent formalin or an alcohol-formalin-acetic acid solution (AFA). Ovaries were transported to the University of Georgia for histological examination. Detectable fetuses were removed from the uterus, measured, labeled and placed in 10 percent formalin or frozen for later study. Reproductive tracts that were slightly swollen or did not appear to contain embryos were flushed with a syringe of 0.90 percent saline solution for evidence of blastocysts or embryos.

Crown to rump (C-R) measurements were taken on young fetuses (less than 64 mm) using a caliper. Forehead to rump (F-R) measurements were

taken on larger fetuses (greater than 64 mm) using a metric board. Fetuses less than 20 mm were aged according to Armstrong (1950) characteristic key. Fetuses larger than 20 mm were aged using the fetal growth curve described by Cheatum and Morton (1946), Armstrong (1950) and Harlow and Jones (1965). Aged fetuses were back dated on a Julian calendar to determine conception dates. A gestation period of 200 days was used to determine fawning dates.

Results and Discussion

~~_____~~
~~_____~~ Statistical analyses ?? indicated ^{Ref} no significant difference (0.8) between years.

~~_____~~
~~_____~~
~~_____~~ The mean age for an adult doe in the still hunt area was 3.9 years and 4.1 years in the dog hunt area. The mean age of a refuge adult doe was 5.4 years.

Old Still
Hunt?
New?
Dog?
↑

~~_____~~
~~_____~~
~~_____~~
~~_____~~
~~_____~~
~~_____~~
~~_____~~

~~_____~~ The following table illustrates the age structure of adult bucks for both the dog hunt and still hunt areas.

~~the fat index was significantly higher~~
~~(0.001) than the fat index in the dog hunt area and signif-~~
~~cantly higher (0.001) than the fat index in the adult does from~~
~~the dog hunt area had significantly higher (0.01) kidney fat index~~

~~at refuge and 1961~~ Table 3 presents the age structure, body weights and body condition of adult does for each area and year.

Table 3. Mean weights (lbs.) and mean kidney fat indexes (K.F.I.) of adult does by age class (yrs.), in the Ocala National Forest, Fla., 82-84.

1982-83											
Area	Assays										
	Age Class	1½	2½	3½	4½	5½	6½	7½	8½	9½	10½
Still	N	4	11	6	2	1	3	1	1	1	-
Hunt	Weight	105	96	103	114	135	107	118	108	77	-
Area	K.F.I.*	3.8	3.2	3.2	3.0	4.0	3.0	3.0	3.0	0.0	-
	Age Class	1½	2½	3½	4½	5½	6½	7½	8½	9½	10½
Dog	N	3	5	8	4	1	-	4	4	-	1
Hunt	Weight	81	93	91	92	90	-	111	104	-	87
Area	K.F.I.	2.0	3.0	2.9	2.8	3.0	-	3.0	3.2	-	2.0
1983-84											
	Age Class	1½	2½	3½	4½	5½	6½	7½	8½	9½	10½
Still	N	5	8	6	4	1	3	1	-	2	-
Hunt	Weight	81	95	102	105	90	112	118	-	103	-
Area	K.F.I.	2.4	3.2	3.5	3.0	3.0	3.0	4.0	-	2.0	-
	Age Class	1½	2½	3½	4½	5½	6½	7½	8½	9½	10½
Dog	N	6	6	14	6	1	2	-	1	1	-
Hunt	Weight	84	89	96	97	99	103	-	113	116	-
Area	K.F.I.	2.2	2.2	2.8	2.0	2.0	2.5	-	3.0	2.0	-
	Age Class	1½	2½	3½	4½	5½	6½	7½	8½	9½	10½
Refuge	N	3	-	10	4	2	2	3	3	-	3
	Weight	65	-	87	86	98	99	85	102	-	90
Area	K.F.I.	1.7	-	2.0	1.8	3.0	2.0	2.0	2.0	-	1.7

*Excellent (4); Good (3); Fair (2); Poor (1); No fat (0).

The following blood parameters were examined on 101 deer; packed cell volume, hemoglobin, white blood cell count, lymphocytes, neutrophils, eosinophils, epizootic hemorrhagic disease (EHD) and bluetongue virus (BT). Most blood parameters were within the normal range for free-ranging deer. Disease and Parasites of White-tailed Deer by Davidson et al. (1981) was used to determine the normal range of blood characteristics in free-ranging deer. Eosinophil counts were above normal for the still hunt, dog hunt and refuge areas. The above normal eosinophil counts may indicate that the deer were exposed to high parasite levels. There was no physical evidence of high parasite levels. The eosinophil values may be due to lab technique or small sample size. Approximately 4 percent of the still hunt deer had positive titers for EHD and 8 percent had positive titers for BT. Twelve percent of the deer in the dog hunt area tested positive for EHD and BT. Eleven percent of the refuge deer had positive titers of EHD and 15 percent had positive titers of BT. These percentage of deer have been exposed to EHD and BT at sometime during their life. This does not mean that the deer developed clinical signs, but there are vectors present to transmit the viruses. Table 4 presents the blood parameters and values for all areas, by year.

Table 4. Blood characteristics and values of white-tailed deer, Ocala National Forest, Florida, 1982-84.

Assay	<u>1982-83</u>		<u>1983-84</u>		
	Still Hunt	Dog Hunt	Still Hunt	Dog Hunt	Refuge
<u>Chemical</u>					
Hemoglobin	18.6	19.8	18.7	21.8	20.2
<u>Bacteriology</u>					
Hematocrit	48	52	47	50	43
White Blood Cells	2,483	1,150	2,469	2,311	1,950
<u>Differential</u>					
Lymphocytes	1,332	710	1,511	1,965	1,059
Nuetrophils	822	375*	851	511	808
Eosinophils	275*	81	420*	298*	251*
<u>Virology</u>					
EHD	N/A ¹	N/A	3.8% ²	12.5%	11.5%
Bluetongue	N/A	N/A	7.7%	12.5%	14.8%

*Not within the normal range for free-ranging deer.

1 - N/A indicates that the sample size was too small.

2 - Percent of the deer herd that possess positive titers of EHD or BT.

A total of 66 abomasums were collected in January, February and March during the two year period. The APC values of the deer herds in each area indicate that they are within or below carrying capacity. The refuge areas possessed the highest APC values. Abomasums collected in the winter will not yield as high parasite loads as samples obtained in late summer or early fall. Table 5 contains results of abomasal parasite counts conducted each year.

Table 5. White-tailed deer, APC values, Ocala National Forest, Florida, 1982-84

Area	<u>1982-83</u>		<u>1983-84</u>	
	<u>Adults</u>	<u>Juveniles</u>	<u>Adults</u>	<u>Juveniles</u>
Still Hunt	333 (10)*	511 (7)	368 (10)	845 (4)
Dog Hunt	282 (5)	279 (3)	344 (9)	344 (5)
Refuge	--	--	676 (11)	1,350 (2)

*Sample size

~~This does from the still hunt area exhibited a 93.2 percent~~
~~pregnancy rate. 83.6 percent of the dog hunt and 93.2 percent of~~
~~the refuge deer were pregnant.~~ The percent pregnant was slightly higher
the second year in both the dog and still hunt areas. This increase is
probably due to the fact that the collection of deer began a month
later the second year.

~~The still hunt area had 1.0 fetuses per doe in the~~
~~1982-83 season. This was significantly higher (0.02) than 1.00 fetuses per doe~~
~~in the dog hunt area. The still hunt deer from the refuge areas had 0.92 fetuses~~
~~per doe, which was significantly lower (0.0000) than both the dog hunt or~~

[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]

[REDACTED] The still hunt area had 48 percent males and 52 percent females. Both the dog hunt and refuge areas had a 50:50 (male:female) fetal sex ratio. A few of the fetuses from these areas were not old enough to determine the sex.

yet not in the dog area!

[REDACTED]
[REDACTED] No evidence of triplets were documented for any area during this two year study. [REDACTED]

[REDACTED]
[REDACTED] 20% of the dog hunt does were carrying twins. [REDACTED]
[REDACTED] incidence of twins were recorded in does from the refuge area.

Tables 6, 7, 8 and 9 present Ocala's deer herd reproductive capabilities.

was this difference statistically significant?

Table 6. Embryo counts from white-tailed deer in Ocala National Forest, Florida, 1982-83 and 1983-84 breeding seasons.

AREA	Age Class	N	No. Preg-nant	% Preg-nant	EMBRYOS			Embryo per doe	Percent Singles	% Twins
					Male	Fe-male	Un-knowns			
Still	1½	9	8	88.9	3	4	1	0.89	100.0	0.0
Hunt	2½+	51	48	94.1	33	35	8	1.49	41.7	58.3
Area	Total	60	56	93.3	36	39	9	1.40	50.0	50.0
Dog	1½	9	9	100.0	6	5	0	1.22	77.8	22.2
Hunt	2½+	58	47	81.0	24	25	13	1.07	68.1	31.9
Area	Total	67	56	83.6	30	30	13	1.09	69.4	30.4
*Refuge Area	1½	3	2	66.7	2	0	0	0.67	100.0	0.0
	2½	27	26	96.3	12	14	0	0.96	100.0	0.0
	Total	30	28	93.3	14	14	0	0.93	100.0	0.0

*Data represents only the 1983-84 breeding season.

Table 7. White-tailed deer reproductive data by age class, still hunt area, Ocala National Forest, Florida, 1982-83 and 1983-84 breeding seasons.

Age Class (Years)	N	Percent in Age Class	Number Pregnant	Percent Pregnant	Fetuses Per Doe
1½	9	15.0	8	88.9	0.89
2½	19	31.7	19	100.0	1.42
3½	12	20.0	12	100.0	1.58
4½	6	10.0	5	83.3	1.67
5½	2	3.3	2	100.0	2.0
6½	6	10.0	6	100.0	1.33
7½	2	3.3	2	100.0	2.00
8½	1	1.7	1	100.0	2.00
9½	3	5.0	1	33.3	0.67

Table 8. White-tailed deer reproductive data by age class, dog hunt area, Ocala National Forest, Fla., 1982-83 and 1983-84 breeding seasons.

Age Class	N	Percent in Age Class	Number Pregnant	Percent Pregnant	Fetuses Per Doe
1½	9	13.4	9	100.0	1.22
2½	11	16.4	11	100.0	1.09
3½	22	32.8	19	86.4	1.18
4½	10	14.9	7	70.0	0.70
5½	2	3.0	1	50.0	0.50
6½	2	3.0	1	50.0	1.00
7½	4	6.0	4	100.0	2.00
8½	5	7.5	3	60.0	1.00
9½	1	1.5	0	0.0	0.00
10½	1	1.5	1	100.0	1.00

Table 9. White-tailed deer reproductive data by age class, refuge areas, Ocala National Forest, Florida 1983-84 breeding season.

Age Class	N	Pregnant in Age Class	Number Pregnant	Percent Pregnant	Fetuses Per Doe
1½	3	10.0	2	66.7	0.67
2½	0	0.0	0	0.0	0.0
3½	10	33.3	10	100.0	1.00
4½	4	13.3	4	100.0	1.00
5½	2	6.7	2	100.0	1.00
6½	2	6.7	2	100.0	1.00
7½	3	10.0	2	66.7	0.67
8½	3	10.0	3	100.0	1.00
9½	0	0.0	0	0.0	0.0
10½	3	10.0	3	100.0	1.00

The mean conception date for the 1983-84 breeding season was November 14, which is significantly earlier (0.001) than the December 1 mean conception date for the 1982-83 breeding season. The mean conception date for December 10 is the first date when conception date is also significantly earlier (0.0001) than the mean conception date for the 1982-83 breeding season. There is a significant difference in conception dates between dog runs and refuge areas. The mean conception date for the 1983-84 breeding season was June 10 in the dog runs and June 20 in the refuge areas. The dog runs present a higher density (one deer per 11 acres), which may be attributed to the higher breeding success. McCallough (1979) state that a significant difference in peak breeding between North and South Mississippi. He suggested that these

differences may be attributed to differences in habitat, climate or hunting methods (still vs. dog). There are no significant difference in climate or habitat between the dog hunt and still hunt areas. ~~The difference of 17 days between the~~ ~~conception dates of the dog hunt and still hunt areas~~ ~~is~~ ~~not~~ ~~significant~~ ~~in~~ ~~hunting~~ ~~areas~~.

Prior to opening day of hunting season, which is the second Saturday in November, 53.3 percent of the still hunt does, 19.4 percent of the dog hunt does and 3.3 percent of the refuge does had conceived. Approximately 33.3 percent of the still hunt does, 73.1 percent of the dog hunt does and 83.3 percent of the refuge does bred after the first nine days of the hunting season or did not breed at all. This is notable, because past harvest records indicate between 50 and 55 percent of the bucks harvested are taken during the first nine days. When determining buck-only harvest, one should consider breeding dates (Jacobsen, 1979). ~~The peak breeding period~~ ~~is~~ ~~not~~ ~~significant~~ ~~in~~ ~~hunting~~ ~~areas~~

~~that is of~~ ~~the~~ ~~hunting~~ ~~areas~~ ~~is~~ ~~not~~ ~~significant~~ ~~in~~ ~~hunting~~ ~~areas~~ ~~(Jacobsen, 1979)~~

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What about differences in body condition?
Differences in turning rates?
Differences in day sites

Things that need elaboration on all three treatment

why?
These dog hunt and adjacent still hunt and refuge areas were examined closely. The dog hunt area north of state road 40 is somewhat pie-shape, which borders dog hunt on one side and the other two sides are adjacent to still hunt areas. This dog hunt area was compared to the old still hunt, which borders it to the east. There was no significant difference in age of does, weights or number of fawns produced. The still hunt bred significantly earlier (0.02) and had a significant higher (0.05) kidney fat index than the dog hunt area.

The Bombing Range (no-hunting) was compared to the dog hunt area surrounding the Bombing Range. Examining data collected only in 1984 for both areas. ~~There is a significant difference between the~~

~~number of fawns produced, body weights and kidney fat index. The dog hunt~~
~~area bred significantly earlier than the Bombing Range.~~
~~The dog hunt area had a significantly higher kidney fat index than the~~

Comparing one year of data from the Bombing Range to two years of data from surrounding dog hunt area, there was evidence of more significant difference between these two areas. These additional significant differences may be due to the larger sample size, in the dog hunt area, which increases chances of detecting significance through statistical analysis. ~~There was marginal significance in fawn production and weight.~~

where is this shown?
The dog hunt does had significantly higher kidney fat index than the Bombing Range does. ~~It is possible that deer in these dog hunt areas~~
~~move to these adjacent still hunt and refuge areas during hunting season,~~
~~and only return to their normal home range after hunting season.~~ why?
This hypothesis cannot be proven, without an investigation of deer movement during hunting season.

Summary

One hundred fifty-seven adult does were collected from the still hunt, dog hunt and refuge areas.

Overall the blood parameters were within the normal ranges for all areas.

The pregnancy rate was 93.3 percent for still hunt does, 83.6 percent for dog hunt does and 93.3 percent for refuge does. All three areas had approximately a 50:50 (male:female) fetal sex ratio. Adult does in the still hunt area demonstrated a 50 percent incidence of twinning, 30.4 percent of dog hunt does carried twins and there was no evidence of twinning in the refuge areas.

There was no evidence of significance in mean conception dates between the dog hunt and refuge areas. Fetuses

per doe was 1.40 for still hunt, 1.09 for dog hunt and 0.93 for refuge areas. The mean conception dates for the still hunt, dog hunt and refuge areas were November 14, December 1, and December 10, respectively.

Recommendations:

(1) It is recommended to collect 30 adult does from each the still hunt and dog hunt areas beginning mid-February, 1985. The information obtained from this study could have possible management implications for Florida and many other southeastern states. A third year of reproduction data should reinforce the present data. The collection of 60 adult does can be done feasible and within a two week period. Statistically a third year doe collection is not warranted. The mean conception dates did not vary more than one or two days between years for either area. Fetuses per doe were the same for both years in the still hunt area and slightly increased in the dog hunt area the second year. Although a third year collection is not statistically warranted, the additional year of data would enhance the credibility of the study. The histological ovarian analysis should also be taken into account when it is completed.

(2) The present data indicates that hunting season should be postponed to later in the year. Approximately 47 percent of the still hunt does and 81 percent of the dog hunt does had not bred prior to the opening day of hunting season. More than 50 percent of the adult bucks harvested are taken during the first nine days of the hunting season. When the majority of the hunting mortality occurs prior to the peak of breeding this results in deer breeding on later estrous cycles, low fertility

and low herd recruitment.

(3) A future investigation may be warranted to examine the movement and use of adjacent still hunt and refuge areas by deer in the dog hunt area.

A good quantitative treatment. Analysis and interpretation must be substantially massaged & greatly expanded.

- (1) No discussion of why still hunts > Dog hunt does & refuge does
- (2) Differences in CFT
- (3) Differences in timing
- (4) Differences in density (all three treatments)
- (5) Discussion of dog vs still hunt techniques & how these relate to findings
- (6) Is the differences in pregnancy rates & ~~in fetal counts~~ due only to ~~delay on breeding~~ ~~harassment~~?
sex ratios?
- (7) Unit herds that bred on delayed shows up supposed to produce mostly bucks
- (8) What role does body condition play in breeding chronology? Still hunt vs refuge

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