

## TOPIC 1. INTRASPECIES INTERACTIONS

Intraspecies interactions occur between different individuals, sexes, and age groups in a population. Some of the interactions are sex-specific, such as male reproductive behavior in relation to the female. Some are age-specific interactions, such as female reproductive behavior in relation to the offspring. Some interactions occur primarily between individuals within an age group, such as play among juveniles.

Social hierarchies are the result of intraspecies interactions among sex and age groups. Such hierarchies may have easily-identified individuals at both extremes. The most dominant animal, such as a large male, is at one extreme, and the most subordinate one, such as a late-born juvenile that cannot compete even with other juveniles, at the other extreme. Between these two extremes, the rank-order may often be recognized, although it may change as it is not absolute, of course.

In general, the larger and stronger animals are dominant and the smaller and weaker ones subordinate. The position of dominance is usually not attained by physical fighting however, but by non-contact assertions. Seasonal changes occur in social hierarchies as a result of changes in hormone balances, reproductive status, weather, and resource availability.

Descriptions of male and female reproductive behavior follow in UNITS 1.1 and 1.2, respectively. Such descriptions are more descriptive than quantitative. It is easier to quantify the metabolic requirements for lactation than it is to quantify behavior during lactation. One important approach to quantifying such behavior is the determining of the amount of time spent in different aspects of reproductive behavior. Thus activity-time budgets show up again with changes through time as animals grow, mature, and reproduce.

Social hierarchies are discussed in UNIT 1.3. The roles of aggressive and non-contact assertions are discussed, along with seasonal changes in social hierarchies as a result of changes in both the internal and external environment.



## UNIT 1.1: MALE REPRODUCTIVE BEHAVIOR

The seasonal activity patterns of male wild ruminants are related to the reproductive cycle, with a general increase in activity levels during the rut. Males of some species breed females that are defended as a group (elk, for example), and in other species, males make no attempts to collect or defend a group; females are bred on an individual basis (whitetail and mule deer, for example).

Reproductive behavior of males during the breeding season is usually very stereotyped. The animals are, at that time, under rather marked chemical control as both hormones and pheromones are released that affect physiology and behavior. Food intake is reduced, even when ample feed is available. The fat reserve is often depleted during the breeding season as a result of increased activity levels and decreased forage intake. This results in a negative energy balance and a rapid and significant weight loss. This negative energy balance is apparently under hormonal control as a male black-tailed deer on a low plane of nutrition did not increase intake when fed ad libitum during the rutting season, but maintained a level of intake that was characteristic of the rut (Nordan et al. 1968).

Wild ruminant males are separated socially by their status in a group. Some species, such as caribou, have quite well-defined groups. Others, such as moose, have more poorly-defined groups. The males exhibit rutting behavior in late summer and fall after growth of the antlers has been completed and the velvet is shed. Then, the males become aggressive, prone to spar with objects in their habitat and combat with other males of their own species. Saplings and shrubs become targets for the relief of aggressive tendencies as male deer rub their antlers. Some people believe that such "buck rubs" are made by males rubbing the velvet off the antlers. The velvet comes off very quickly, often in a few hours, and may be accompanied by little or no rubbing (Moen 1973: 211). Dixon (1934) observed that the shedding of velvet was rapid in mule deer. Velvet-covered antles were bare within 13 hours, with some velvet that had not been rubbed off on saplings hanging in shreds from the base of the antlers. These shreds were removed by using the sharp rear hooves to dislodge them. Antler-rubbing, or "horning," then continued for as long as the antlers were retained. Bucks rub objects, especially straight saplings, that offer appropriate resistance as part of their territorial displays; saplings up to a few cm in diameter are usually chosen.

Actual breeding by the male white-tailed deer involves spending time with a female in heat, breeding the female as often as she will stand, and then going on to another receptive female. The larger, dominant males have more opportunities for breeding as they can replace a sub-dominant running with a female. In the captive herd at the Wildlife Ecology Laboratory, Cornell University, the dominant male would breed a receptive female first. After several successive breedings, a sub-dominant male may have a chance to breed a receptive female because the dominant male was exhausted. This may be partly due to confinement conditions; a six-acre yard does not allow the overall freedom of movement characteristic of free-ranging deer.

Evidence of physical combat is sometimes found in the field as antlers have become locked together, resulting in the eventual deaths of both deer. Hostile fights were observed between males only during the mating season in Texas (Michael 1968). At other times of the year, antlers were used in aggressive behavior but not maliciously; pushing contests were the common form of aggressive interaction. Geist (1963) observed more spirited sparring among yearling and two-year old bull moose than among older bulls; the older ones did more pushing with the antlers in contact.

Males are rather quiescent after the breeding season is over. Male white-tailed deer may form loosely-defined groups then with no particular social structure. They may still have antlers (Zagata and Moen 1974), but serious aggressive tendencies have waned. Their fat reserves are quite depleted, and the metabolic depression of winter sets in. Bull moose also formed loosely-organized groups in the winter, with no obvious leadership or dominance hierarchy observed (Geist 1963).

Specific behavioral acts have been described for some species. Geist (1971) describes several male reproductive behavior acts for bighorn sheep. Some of these are listed and defined below.

Spontaneous ejaculation	Non-contact ejaculation with stiff-legged striding or short forward steps.
Sniffing rear	Sniffing and nuzzling of the rear of a ewe after approaching in low-stretch. Rams also sniff subordinate males.
Tongue-flicking	Flicking of the tongue preparatory to licking the body.
Lipcurl (Flehmen)	Raised head and upward curling of upper lip by rams after nuzzling and licking urine of ewes.
Mount	Copulation-type posture by male on either female or male sheep, with pelvic thrusts.

The lipcurl, or Flehmen (a German word introduced into the literature in 1930; Altieri and Müller-Schwarze 1980) is a rather stereotyped response of ungulates to urine (Henderson et al. 1980). Geist (1963) cites early speculations of Walther concerning the role of lipcurl in relation to testing the urine of females. An interesting pattern of responses in black-tailed deer is given in Henderson et al. (1963: 539); the annual cycle of general responses and Flehmen by male black-tailed deer to female and male urination is a rather characteristic sine wave. Peak responses occurred in November, during the breeding season.

Sniffing the rear of a female is a common male response during the rut. Geist (1963) observed it, mainly during the rut, in moose. Licking of the cow's genitalia was much less common. Cervids and pronghorn males paw the ground during the rutting season. The scrapes of deer and rutting pits of moose are similar male acts in their beginning, but deer do not appear to wallow in the scrape as moose do in the pit. Moose rutting pits were made by pawing the ground with the front hooves, urinating in the wallow, and then wallowing in it (Geist 1963). Bull elk 2 1/2 years and older also dig; their penial region palpitated while digging, and they would stop to ejaculate in the dirt, and on the forelegs and throat (Struhsaker 1967).

The culmination of rutting behavior is breeding of the female, or of several females through the rutting period. After that, the males are passing time, growing antlers, and gaining weight in spring and summer in preparation for another breeding season.

#### LITERATURE CITED

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- Struhsaker, T. T. 1967. Behavior of elk (Cervus canadensis) during the rut. *Zt. Tierpsychol.* 24(1):80-114.
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## REFERENCES, UNIT 1.1

## MALE REPRODUCTIVE BEHAVIOR

## BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS-----	AUTHORS/EDITORS--	YEAR
aubo	ucap	beca	567	odhe	a herd of mule deer	linsdale,jm; tomi	1953
aubo	stac	hapa	238	anam	prnghrn antlp & its mngmnt	einarsen,as	1948
aubo	qupr	oton	166	obmo	muskoxen,biol,taxon,canada	tener,js	1965

## SERIALS

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMNAA	77--2	390	417	cerv	soc behav, repro per, n am de vos,a; brokx,/		1967

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMNAA	97--2	257	266	odvi	char rubs, scrapes, social	kile,tl; marchint	1977
ANBEA	26--1	179	183	odvi	reprod behav captive w-t d warren,rj; vogel/		1978
JOMAA	35--1	129	130	odvi	rutting behavior of the wh	pruitt,wo,jr	1954
JOMAA	46--2	314	327	odvi	soc be, herd, hypogon male	thomas,jw; robin/	1965
JOMAA	48--1	146	147	odvi	rubbi, conif, successi yrs de vos,a		1967
JOMAA	52--3	616	620	odvi	auto-erotic behavior, male	marchinton,rl; mo	1971
JOMAA	55--3	656	659	odvi	antler shedding in midwest	zagata,md; moen,a	1974
NAWTA	7----	334	342	odvi	tech det rut period in ny	cheatum,el; morton	1942
NFGJA	2---2	239	241	odvi	observa, breeding behavior	severinghaus,cw	1955
PCGFA	18---	140	152	odvi	telem, movem, behav, flori	jeter,lk; marchin	1964
SWNAA	13--4	411	420	odvi	aggressive behavior, w-t d	michael,ed	1968
VJSCA	24--3	112	112	odvi	breeding behav, captv male	buckland,de; abl/	1973
VJSCA	26--2	60	60	odvi	aspts, reprod behav, capt	vogelsang,rw; wa/	1975

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	28--1	312	313	odhe	submissive signaling in mu	koutnik,dl	1980
CAFGA	20--3	181	282	odhe	life history, california	dixon,js	1934
CAFGA	26--2	137	166	odhe	calif deer, rcky mt mule d	mclean,dd	1940
CAFNA	84--1	57	58	odhe	aberran beh, dominant male	milller,fl	1970
CGFPA	7----	1	26	odhe	literature review,behavior	dorrance,mj	1966
JCECD	6---3	537	547	odhe	annual cycle of flehmen in	henderson,r; alt/	1980
JCECD	6---5	905	909	odhe	seas change, flehmen,urine	altierl,r; müller	1980
JOMAA	38--1	116	120	odhe	gest per, breed & fawn beh	golley,fb	1957
JOMAA	38--2	247	253	odhe	observatns, behavr, penned	browman,lg; hudso	1957
JOMAA	42--4	522	526	odhe	aggressive behavio in deer	cowan,imct; geist	1961
JOMAA	59--3	463	476	odhe	soc behav, breed syst, des	kucera,te	1978
SZSLA	21---	89	96	odhe	nutritio requireme, growth	nordon,hc; cowan/	1968

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	27--1	211	225	ceel	adaptive aspects, fighting	clutton-brock,th/	1979
ANBEA	28--4	1163	1174	ceel	beh factrs, male repr succ	gibson,rm; guinn	1980
BEHAA	16--1	84	92	ceel	charactr of estrus, captiv	morrisson,ja	1960
BEHAA	69--3	145	170	ceel	roarng, evol honest advrti	clutton-brock,th/	1979
EKIAA	6---1	100	102	ceel	biol signal field, roaring	nikol'skii,aa; n/	1975
HOBEA	3---4	375	396	ceel	testost, social sexual beh	lincoln,ga; guin/	1972
JBLPA	6....	83	95	ceel	[kinetics, stag roaring]	bubenik,a; brna,j	1967
JEZOA	182-2	233	250	ceel	role of antlers, behavior	lincoln,ga	1972
JOMAA	37--2	165	170	ceel	odhe, territorialism in de	graf,w	1956
JRPFA	S11--	71	103	ceel	social, sexual behav, stag	lincoln,ga; youn/	1970
JRPFA	S19--	271	285	ceel	reproductive performance	mittchell,b	1973
JRPFA	S19--	475	489	ceel	sexual signifcance of rut	lincoln,ga; guine	1973
JRPFA	54--2	325	334	ceel	factors affecting fertilit	guinness,fe; alb/	1978
JWMAA	9---4	295	319	ceel	roosvlt elk, olympic penin	schwartz,je,II; /	1945
JWMAA	24--1	15	21	ceel	on afognak island, alaska	troyer,wa	1960
JZOOA	163-1	105	123	ceel	seas reproduc change, stag	lincoln,ga	1971

ceel continued on the next page

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ZETIA	24--1	80	114	ceel	behavior, during the rut	struhsaker,tt	1967
ZOOLA	41--8	65	71	ceel	pattnrs,hrd beh,free-rngng	altmann,m	1956

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
BEHAA	20--3	377	416	alal	behavr no amer moose in bc	geist,v	1963
CAFNA	87--3	321	321	alal	associatn of calf and bull	lynch,gm; labonte	1973
CAFNA	90--4	475	476	alal	behavior of calf, ontario	croskery,p	1976
IUNRA	24...	690	....	alal	social organization	geist,v,ed; houst	1974
JOMAA	39--3	412	416	alal	pre-rut behav, newfoundlan	dodds,dg	1958
JOMAA	40--3	420	424	alal	group dynam, rut seas, wyo	altmann,m	1959
JWMAA	13--3	313	313	alal	obser of courting behavior	thompson,wk	1949
JWMAA	35--1	63	71	alal	radiotelemet, ne minnesota	van ballenberghe/	1971
MUZPA	25---	1	44	alal	moose of isle royale	murie,a	1934
NCANA	101--	307	323	alal	review of rutting behavior	lent,pc	1974
NCANA	101--	371	377	alal	behav chng w/ age, domesti	knorre,ep	1974
TLPBA	14--1	76	104	alal	time-energ budget of a moo	belovsky,ge; jord	1978
ZOBEA	12--2	219	250	alal	etholog observatns, n amer	geist,v	1966
ZOOLA	41-14	105	118	alal	ecol, beh, pop dynam, wyom	denniston,rh,II	1956

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	12--1	159	163	rata	rutting behavi in reindeer	espmark,y	1964
ANBEA	13--2	259	264	rata	rut beh, barr-gr carib pop	lent,pc	1965
ANBEA	18--2	256	258	rata	conseques of travel, rut	henshaw,j	1970
CAFNA	87--4	357	369	rata	movmnt, rut behavr, quebec	bergerud,at	1973
JWMAA	24--3	250	258	rata	behav bar grnd, calvng gnd	devos,a	1960
JWMAA	31--1	150	159	rata	results, tagging, manitoba	millier,dr; robert	1967
NATUA	224--	1036	1037	rata	antlers, bones of contentn	henshaw,j	1969
UABPA	3----	1	44	rata	behavior, barrn gr caribou	pruitt,wo,jr	1960



CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
CGFPA	3----	1	28	anam	literature review,behavior	prezlow,ej	1965
CGFPA	17---	1	16	anam	some behavior patterns of	prezlow,ej; gil/	1968

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ATICA	13--1	3	19	bibi	behv,socl org,wd buff n pk	fuller,wa	1960
PIAIA	74---	87	91	bibi	observ, beha, lone bull bi	fischer,wa	1968
PIAIA	76---	245	262	bibi	bull bison behavior traits	herrig,dm; haug	1969
ZOOLA	43--1	1	40	bibi	social behviour, amer buff	mchugh,t	1958

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	17--4	700	705	ov--	copul beh I. normative stu	bermant,g; clegg/	1969
ANBEA	17--4	706	711	ov--	cop beh II. copu satiation	beamer,w; berman/	1969

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMNAA	56--2	297	324	ovca	ecology of the mount sheep	mccann,lj	1956
CAFNA	77--2	77	94	ovca	behavior of a bighorn herd	blood,da	1963
IGWBA	1----	1	154	ovca	status,life hist,man,idaho	smith,dr	1954
JOMAA	18--2	205	212	ovca	prelim study, yllwstn n pk	mills,hb	1937
JWMAA	31--4	693	706	ovca	populat, desert game range	hansen,cg	1967
JWMAA	34--2	446	450	ovca	mvmnt,behav,smmr rang, wyo	woolf,a; oshea,t/	1970

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
CJZOA	46--5	899	904	ovda	ovca,delayd soc,phys matur	geist,v	1968
JTBIA	72--3	377	384	ovda	sexual selec, ornamn trait	williams,mb	1978
XNFSA	5----	1	238	ovda	the wolves of mt mckinley	murie,a	1944

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

obmo

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

CAFNA 81--1 1 22 oram obsrvtns,kootenay nt pk,bc holroyd,jc 1967

CGFPA 8---- 1 23 oram literature review, ecology hibbs,ld 1966

IGWBA 2---- 1 142 oram life history, manag, idaho brandborg,sm 1955

JOMAA 45--4 551 568 oram rutti behav of the mt goat geist,v 1964

JWMAA 31--1 192 194 oram fight injur, derma shields geist,v 1967

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

ZEJAA 14--3 97 106 caca rel bet behav & repro perf kurt,f 1968

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

ZETIA 43--2 188 213 mure socl behav captiv muntjacs barrette,c 1977

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

ZSAEA 39--2 115 127 cp-- courtship behav, wild goat schaller,gb; laur 1974

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

AAHA 8--35 649 652 dosh breed,seas,competit,mating lindsay,dr; ellsm 1968

ANBEA 13--1 75 78 dosh olfct stim, matng behv,ram lindsay,dr 1965

ANBEA 16--4 410 414 dosh sensry invlvmt matng behr fletcher,ic; lind 1968

ANBEA 17--4 706 711 dosh factors afft copul satiatn beamer,w; berman/ 1969

BEHAA 23--3 249 279 dosh some aspects sexual behavi banks,em 1964

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMZOA	14--1	205	220	ungl	relatnshp social evol, ecol	geist, v	1974
BHBLA	11--2	131	154	----	concept of social dominanc	rowell, te	1974
JTBIA	47--1	223	243	----	asses strat, evol fight beh	parker, ga	1974
MAMLA	36--3	315	341	mamm	role vomeronasal organ, rep	estes, rd	1972
NATUA	246--	15	18	----	logic of animal conflict	maynard smith, jm/	1973

#### OTHER PUBLICATIONS

Bergerud, A. T. 1960. Fall breeding behavior of woodland caribou. Rept. Dept. Mines, Agr., and Resources, Newfoundland. 103 p.

Geist, V. 1964. On the rutting behavior of the mountain goat. Univ. Idaho Bull. 33(22):43-49.



## Male reproductive behavior

List the actions and reactions below. The INDIVIDUAL column is for identification.

[illegible]

[illegible]

## UNIT 1.2: FEMALE REPRODUCTIVE BEHAVIOR

Female ruminants have the very serious ecological responsibility of bearing the young and nursing them until they can be nutritionally weaned. Such direct reproductive responsibilities extend over 85% or more of the year.

Particularly important female reproductive behavior occurs at two times of the year. Breeding occurs in the fall when the female is receptive. At that time, hormone control is very strong and the female is compelled to stand for breeding. Conception is followed by a gestation period of several months (see PART I, CHAPTER 1, UNIT 3.4 and PART III, CHAPTER 6, UNIT 4.1) during which behavior is modified little until parturition approaches.

Parturition is anticipated differently by different species. Caribou travel to historic calving grounds. Female bison go off by themselves and give birth in isolation. White-tailed deer prepare very little for parturition, dropping their fawns wherever they happen to be. Shelter does not seem to be important; I have found birth sites in open fields, exposed in all directions. Michael (1964) reports observations of the births of two fawns in Texas, noting no special preparations, and other deer within 20 yards of one of the does. Dixon (1934) was surprised to find that a mule deer doe went out into an open meadow to give birth to her fawns rather than into a dense thicket. The fawns were well hidden in the dense sedge and marsh grass. The open meadow provided the female with good visibility, permitting her to see danger and move away before it approached too closely.

Maternal instincts are genetically controlled as a female giving birth for the first time is not dependent on being "taught" how to care for the newborn. Yet there are differences in the kind and amount of maternal care provided by females of different ages and experiences. This has been clearly observed in domestic sheep, for example, and such differences are expected to occur in wild ruminants as well. Maternal care of subsequent offspring likely improves after experiences with the first-born. There seems to be an inherited framework that is subject to individual variation, followed by learning that is based on experiences.

Maternal behavior is difficult to observe in the wild because of limited visibilities, night-time activity periods, and subtle communications between mother and young. The observations of Michael (1964) were made with spotting scope and binoculars from a platform 40 feet high in relatively open country. Female mule deer use their voice--a low bleat--to call their young (Dixon 1934). There are undoubtedly many details to be learned about this important part of behavior.

Female reproductive behavior after parturition is very much related to the development of fawn behavior patterns. White-tail fawns are very quiescent in the first few days, bedding for 95% or more of the time (See CHAPTER 4, UNIT 2.1). The dam visits them periodically during the day to

allow them to nurse, but not "every four hours." Almost ten hours elapsed between feedings of twin mule deer fawns from birth to nine days old (Dixon 1934). The dam spends the rest of her time in the general area, much of the time foraging. About ten minutes were taken by fawns for nursing. The dam nursed her young while lying down in the first three to four days of life, which provided greater safety by being inconspicuous in the tall grass and may have also been necessary for the little fawns to reach the teats. By the time fawns are three months old, they may have to kneel while nursing.

Fawns accompany the dam more and more as they grow older and stronger, foraging more as they become less dependent on milk and more dependent on forage. They are also learning behavioral responses to danger and other relationships with the environment by association with the examples of the mother.

Weaning results in the breaking of the nutritional ties between mother and young, but the fawns may remain with the dam during the first winter, although not necessarily in constant daily contact. Thus a nutritional weaning precedes a social weaning. A more complete break in mother-young relationships of deer comes when parturition occurs again. Adult females are dominant over their young and others, and do not hesitate to drive them away from limited food supplies.

Lactating females must spend a lot of time foraging in order to meet the high metabolic requirements of lactation. This, plus the provision of maternal care for their offspring that results in higher levels of nervousness and environmental awareness than would be the case for barren females, places a high physiological drain on the female. This appears to be very pronounced as minimum weights in the annual cycle are often reached during lactation. After lactation ceases, the females need to forage to meet the costs of growth as they reach their peak weights in late fall or early winter. After that, winter is a time of reduced activity, followed by increases as the last 1/3 to 1/4 of the gestation period is reached, spring arrives and parturition approaches again.

Geist (1971: 105-107) reviews changes in mother-young relationships of several ungulates when the latter are yearlings and the former is about to give birth again. Two groups of species with different kinds of mother-young relationships are discussed. Moose, white-tailed deer, and mule deer exhibit a rather violent mother-young separation as the yearlings are chased away, several times if necessary, as parturition approaches. These yearlings may associate with other animals--adult males, for example--during the summer; red deer (elk), caribou, and mountain sheep do not exhibit such a violent mother-young separation, although yearlings may not be tolerated in close proximity to the newborn. A reasonable hypothesis for these differences is that ungulates which are more social as adults tend to have more gradual and less violent mother-young separations.

The mother-young separation results in another social pattern that appears to be characteristic of ungulates in general. Yearling males tend to wander more after separation, being subordinates in different groups before establishing a home range. Yearling females, however, wander less, likely



becoming residents of part or near their dam's home range. These social hierarchies are dependent on sex, age, and time of year, which are important factors in the roles of individual animals during the reproductive cycles.

#### LITERATURE CITED

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Geist, V. 1971. Mountain Sheep. The University of Chicago Press, Chicago. 383 p.

Michael, E. D. 1964. Birth of white-tailed deer fawns. J. Wildl. Manage. 28(1):171-173.

## REFERENCES, UNIT 1.2

## FEMALE REPRODUCTIVE BEHAVIOR

## BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS-----	AUTHORS/EDITORS--	YEAR
aubo	ucap	beca	567	odhe	a herd of mule deer	linsdale,jm; tomi	1953
aubo	stac	hapa	238	anam	prnghrn antlp & its mngmnt	einarsen,as	1948
aubo	qupr	oton	166	obmo	muskoxen,biol,taxon,canada	tener,js	1965
edbo	jwis	nyny	349	many	maternal care in mammals	rheingold,hl,ed	1963

## SERIALS

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMNAA	77--2	390	417	cerv	soc behav dur repro period	devos,a; brokx,p/	1967
ZOBEA	12--2	219	250	cerv	ethologicl obsrvtns,n amer	geist,v	1966

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	26--1	179	183	odvi	reprod behav, captive deer	warren,rj; vogel/	1978
AMZOA	10--4	480	481	odvi	partur, matr, neonat beha	townsend,tw; bail	1970
ECOLA	53--2	262	270	odvi	activ patt, fawns, s texas	jackson,rm; whit/	1972
JOMAA	35--1	129	130	odvi	rutting behavior of the wh	pruitt,wo,jr	1954
JOMAA	38--3	420	421	odvi	partur, early react, fawns	haugen,ao; speake	1957
JOMAA	56--2	347	362	odvi	partur, matr, neonat beha	townsend,tw; bail	1975
JWMAA	27--3	422	427	odvi	nocturnl mvmnt, actv rhyth	montgomery,gg	1963
JWMAA	28--1	171	173	odvi	birth of w-tail deer fawns	michael,ed	1964
JWMAA	34--2	407	419	odvi	social organization, w-t d	hawkins,re; klms	1970
JWMAA	36--3	897	906	odvi	dam-newb fawn beh,cap,mort	white,m; knowlto/	1972
JWMAA	39--4	679	683	odvi	actv pattns during estrus	ozoga,jj; verme,l	1975
NFGJA	2---2	239	241	odvi	some obs on breeding behav	severinghaus,cw	1955
PCGFA	18---	140	152	odvi	telem, movem, behav, flori	jeter,lk; marchin	1964
TISAA	62--2	117	119	odvi	day location, beds, fawns	kjos,cg; montgome	1969
VJSCA	24--3	112	112	odvi	breedi behav, captv female	abler,wa; buckla/	1973
VJSCA	26--2	60	60	odvi	aspcts, reprod beh, captiv	vogelsang,rw; wa/	1975

ODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
CAFGA	20--3	181	282	odhe	life history, california	dixon,js	1934
CAFGA	26--2	139	166	odhe	calif deer,rcky mt mule de	mclean,dd	1940
JOMAA	38--1	116	120	odhe	gesta per, breed, fawn beh	golley,fb	1957
JOMAA	38--2	247	253	odhe	observatns, behavr, penned	browman,lg; hudso	1957
JOMAA	39--1	155	155	odhe	failure to wean offspring	hanson,wr	1958
JOMAA	42--4	522	526	odhe	aggressive behavior in dee	cowan,imc; geist,	1961
JOMAA	56--2	520	522	odhe	beh assoc parturitn, captv	halford,dk; alldr	1975
JOMAA	59--3	463	476	odhe	soc behav, breed syst, des	kucera,te	1978
JWMAA	18--4	537	538	odhe	use deer call, locat fawns	diem,kl	1954
JWMAA	29--3	629	631	odhe	behav assoc with parturiti	milller,fl	1965
JWMAA	41--1	150	151	odhe	birth, first day behavior	truett,jc	1977
NATUA	229--	55	56	odhe	olfctry imprnt,precoc mamm	muller-schwarze,/	1971
ZETIA	28--5	527	533	odhe	maternal behav, fawn death	milller,fl	1971

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	27--2	536	544	ceel	mothr-offspring assoc,rhum	guinness,fe; hal/	1979
BEHAA	16--1	84	92	ceel	charact of estrus, captive	morrison,ja	1960
BEHAA	55--3	287	300	ceel	behavior at calving time	clutton-brock,th/	1975
JAECA	47--3	817	832	ceel	factors aff calf mortality	guinness,fe; clu/	1978
JRPFA	27--3	427	438	ceel	reprod cycle, female red d	guinness,f; linc/	1971
JRPFA	S19--	271	285	ceel	reproductive performance	mittchell,b	1973
JRPFA	37--1	87	90	ceel	partur, matrnl behav, capt	arman,p	1974
JRPFA	54--2	325	334	ceel	factors affecting fertilit	guinness,fe; alb/	1978
JWMAA	9---4	295	319	ceel	roosvlt elk, olympic penin	schwartz,je,II; /	1945
JZOOA	185-1	105	114	ceel	calving times in red deer	guinness,fe; gib/	1978
XARRA	240--	1	4	ceel	herbucid, elk calvng behav	ward,al	1973
XNFSA	4----	1	206	ceel	ecol, coyote, yllwstn n pk	murie,a	1940
ZETIA	24--1	80	114	ceel	behavior of during the rut	struhsaker,tt	1967
ZOOLA	41--8	65	71	ceel	pattnrs,hrd beh,free-rngng	altmann,m	1956

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	6---	3	155	159	alal social integration of calf	altmann,m	1958
ANKIA	60--	3	79	80	alal life with mother	altmann,m	1957
BEHAA	20--	3	377	416	alal behavior, n amer moose, bc geist,v		1963
CAFNA	87--	3	321	321	alal associati of calf and bull	lynch,gm; labonte	1973
CAFNA	90--	4	475	476	alal beh, calf, norfolk is, ont	croskery,p	1976
IUNRA	24...		690	....	alal social organization	geist,v,ed; houst	1974
JOMAA	40--	3	420	424	alal group dynam, rut seas wyom	altmann,m	1959
JWMAA	13--	3	313	313	alal obser of courting behavior	thompson,wr	1949
JWMAA	35--	1	63	71	alal radiotelemet, ne minnesota	van ballenberghe/	1971
MUZPA	25---		1	44	alal moose of isle royale	murie,a	1934
NCANA	101--		307	323	alal a review of rutting behavr	lent,pc	1974
NCANA	101--		325	369	alal mother infant relationship	stringham,sf	1974
NCANA	101--		371	377	alal chng behv w/ age, domestic	knorre,ep	1974
TLPBA	14--	1	76	104	alal time-energ budget of a moo	belovsky,ge; jord	1978
ZOOLA	41-14		105	118	alal ecol,behav,pop dynam,wyomi	denniston,rhII	1956

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMZOA	10--	4	481	481	rata vocalization, behavior	erickson,ca	1970
ANBEA	13---		259	264	rata rutng behav, brn grnd pop	lent,pc	1965
ATICA	19--	2	111	113	rata functn brow tine, caribou	pruitt,wo	1966
BEHAA	54--	1	50	59	rata individua char, calls, cal	espmark,y	1975
BPURD	1----		387	397	rata intrasp commun, mother-cal	ericson,ca	1975
BPURD	1----		398	408	rata acoustic communicat, revl	lent,pc	1975
BPURD	1----		423	435	rata socializat, calving ground	milller,fl; ander/	1975
BVJOA	125-1		48	50	rata estrous behav in reindeer	barden,p	1969
CAFNA	81--	1	63	66	rata funct anat, tail, behavior	lewin,v; stelfox,	1967
CAFNA	87--	1	21	25	rata beh, mort, stress, maternl	milller,fl; brough	1973
CAFNA	87--	4	357	369	rata movmnt, rut behavr, quebec	bergerud,at	1973
JOMAA	49--	4	778	778	rata plactl remnts rumen matern	milller,fl; parker	1968

rata continued on the next page

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
JWMAA	24--3	250	258		rata behav bar-gr cari, calv gr de vos,a		1960
JWMAA	27--3	422	427		rata comp sim, activ patter, en bunnell,fl; whit/		
JWMAA	31--1	150	159		rata results, tagging, manitoba miller,dr; robert		1967
JWMAA	35--1	175	177		rata antler shedding, parturitn espmark,y		1971
UABPA	3----	1	44		rata behavior, barre gr caribou pruit,wo,jr		1960
WMBAA	12---	1	148		rata continued barren-grnd stud kelsall,jp		1957
WMBAA	15---	1	145		rata co-op studies barrn-ground kelsall,jp		1960
XNFSA	5----	1	238		rata the wolves of mt mckinley murie,a		1944
ZETIA	23--6	701	756		rata calvng & rel behav, bar gr lent,pc		1966
ZETIA	29--1	42	81		rata mother-young, ontogeny, be espmark,y		1971

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
CAFGA	30--4	221	241		anam prngrnd antlp, california mclean,dd		1944
CGFPA	3----	1	28		anam literature review,behavior prenzlow,ej		1965
CGFPA	17---	1	16		anam some behavior patterns of prenzlow,ej; gil/		1968
JOMAA	47--4	708	709		anam observation of parturition howard,vw,jr		1966
JWMAA	6---4	281	286		anam gath, transpl, care, young nichol,aa		1942
JWMAA	37--3	343	352		anam mortality, fawns, wst utah beale,dm; smith,a		1973
XNFSA	4----	1	206		anam ecol, coyote, yllwstn n pk murie,a		1940

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
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CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMNAA	56--2	297	324		ovca ecology of the mount sheep mccann,lj		1956
CAFNA	77--2	77	94		ovca behavior of a bighorn herd blood,da		1963
IGWBA	1----	1	154		ovca status,life hist,man,idaho smith,dr		1954
JOMAA	18--2	205	212		ovca prelim study, yllwstn n pk mills,hb		1937
JOMAA	44--1	116	118		ovca growth, behav, captiv lamb forrester,dj; hof		1963

ovca continued on the next page

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JOMAA	44--3	433	433	ovca	observa of lambing, desert	simmons,nm; levy/	1963
JOMAA	50--1	128	128	ovca	defensive behav in females	hornocker,mg	1969
JWMAA	34--2	446	450	ovca	mvmnt, behav,smmr rang,wyo	woolf,a; oshea,t/	1970
XNFSA	4----	1	206	ovca	ecol, coyote, yllwstn n pk	murie,a	1940

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
XNFSA	5----	1	238	ovda	the wolves of mt mckinley	murie,a	1944

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
					obmo		

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
CAFNA	81--1	1	22	oram	obsrvtns,kootenay nt pk,bc	holroyd,jc	1967
CGFPA	8----	1	23	oram	literature review, ecology	hibbs,ld	1966
IGWBA	2----	1	142	oram	life history, manag, idaho	brandborg,sm	1955

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
VILTA	6---6	461	540	caca	moth-young rela, behav dev	espmark,y	1969
ZEJAA	14--3	97	106	caca	rel bet behav & repro perf	kurt,f	1968
ZSAEA	30--1	65	128	caca	[birth, adu fema-juv rela]	bubenik,ab	1965

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ZETIA	43--2	188	213	mure	socl behav captiv muntjacs	barrette,c	1977

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ZSAEA	39--2	115	127	cp--	courtship behav, wild goat	schaller,gb; laur	1974

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
JRMGA	19--4	200	204	doca	use of mountain slope	cook,cw	1966

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ZETIA	23--5	588	592	dogo	matern imprint, role chemi	klopf,ph; gambl	1966

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	12--1	34	37	dosh	obs suckling habit twin lam	ewbank,r	1964
ANBEA	14--1	120	125	dosh	critical per, lamb attachm	smith,fv; van-to/	1966
ANBEA	14--4	419	424	dosh	mat behav ewe,eff mat effi	lindsay,dr	1966
ANBEA	15--2	251	258	dosh	nurse,suckling beh,ewes,lam	ewbank,r	1967
ANBEA	16--4	410	414	dosh	sensory involmnt matng beh	fletcher,ic; lind	1968
ANBEA	16--4	415	417	dosh	snsry recogn lambs by dams	lindsay,dr; fletc	1968
ANBEA	19--1	75	79	dosh	acc orphan lamb, tranq ewe	neathery,mw	1971
BEHAA	23--3	249	279	dosh	some aspects sexual behavi	banks,em	1964
ECOLA	37--2	228	239	dosh	dogo, analysis, socializatn	collias,ne	1956
JANSA	21--4	870	874	dosh	mating behavior of the ewe	hulet,cv; blackw/	1962
PAANA	3----	105	114	dosh	maternal behav, merino ewe	alexander,g	1960

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMZOA	14--1	205	220	ungl	relatnshp socal evol, ecol	geist,v	1974
MAMLA	36--3	315	341	mamm	role vomeronasl org, repro	estes,rd	1972
SCIEA	175--	82	84	----	prenatal stress, male beha	ward,jl	1972

#### OTHER PUBLICATIONS

Bergerud, A. T. 1960. Fall breeding behavior of woodland caribou. Rept. Dept. Mines, Agr., and Resources, Newfoundland. 103 p.





## Female reproductive behavior

List the actions and reactions below. The INDIVIDUAL column is for identification.

[illegible]

[illegible]

### UNIT 1.3: SOCIAL HIERARCHIES

Social hierarchies result from the abilities of animals in a group to recognize, exert, and maintain positions of dominance over other animals. The leader, or dominant animal, is recognized as such by subordinate animals. The position of dominance, however, is earned and must be maintained. We humans have difficulties recognizing the subtle cues which are perceived by individuals in a social group. Many of them are visual, but they may be accompanied by scent cues or auditory cues which we do not perceive.

Social hierarchies are established by aggressive assertions. These assertions seldom result in physical fights in most species. In most cases, non-contact assertions of dominance are made, especially after the dominant position has been established. Non-contact assertions of dominance have many similarities between species, with particular details that are characteristic of the species.

Wild sheep are perhaps the most physical of the wild ruminants. Bighorns, as the most active, are the most extreme example of both non-contact and contact assertions. They separate into functional groups, segregating by behavioral type rather than by sex as those acting like sexually immature sheep stay in female bands and those acting like males in male groups (Geist 1971). Horn size is of great importance in a band of sheep, "the largest-horned ram in a band automatically becomes the leader of the band since small rams follow him" (Geist 1971: 131).

What behavioral interactions are employed to establish social hierarchies in a band of sheep? Geist (1971) lists the following acts, which I have classified as non-contact and contact and summarized from Geist's description.

Butt	Contact	A physical butting with horns to move a subordinate aside, involving a downward blow with the head and the horns thrown forward and down.
Clash	Contact	Specialized, sophisticated form of the butt including two animals clashing head-on, with horn contact.
Front kick	Contact	Kick with extended front leg, performed mainly by dominant rams on all subordinate sheep.
Push	Contact	A push with the chest may accompany a front kick.
Horning	Non-contact	The horns are rotated or scrubbed with pressure on bushes, shrubs, and small trees.

Head-shake	Non-contact	Head-shaking is done by small sheep after being disturbed by a large sheep.
Horn-threat	Non-contact	An intention movement to butt, shown by dominants chasing any subordinates, or by subordinates toward approaching dominants.
Horn display: Low stretch	Non-contact	Very common display threat by dominant to subordinate; head low.
Horn display: Present	Non-contact	As above, but head held high.
Nuzzling	Contact	Subordinates nuzzle head of dominant.
Licking	Contact	Subordinates lick head of dominant while nuzzling.
Rubbing	Contact	Subordinate rubs face on face of dominant.
Threats	Non-contact	Social behavior that involves withdrawal from dangerous stimuli.
Threat-jump	Non-contact	An intention to clash.
Direct stare	Non-contact	Appears to be an aggressive posture.
Twist	Non-contact	An intensified low-stretch, with the head rotated, rapid flicks of tongue, and a harsh, loud growl.
Neck fight	Contact	Rams put chins and throats over the withers of opponent; no pushing or wrestling followed.

The effects of aggressive assertions may not be direct physical harm, but indirect by depriving subordinates of necessary resources. Adult deer will drive even their own young away in order to get at food themselves (Severinghaus 1974). As a result, the smaller deer, more closely coupled to the range resources, will suffer and die. Larger deer can hardly be "taught" to be more considerate; such behavioral characteristics have developed naturally and must be recognized and accepted.

Seasonal changes in social hierarchies occur as a result of changes in hormone levels, weights, weather conditions, food resources, and other factors. Social standings are not as subject to inviolate laws as physical characteristics are, and are subject to change out of necessity if current conditions warrant it. A subordinate animal, for example, may adjust its timing and location to feed without being harrassed by a dominant. The

smaller, subordinate animal cannot add one cm to its maximum reach for forage, however, so it will always have access to less total forage than the larger, dominant animal.

Changes in social hierarchies are often tied to the reproductive cycles of males and females. Male groups of white-tailed deer formed in Minnesota and Iowa after the breeding season but before the antlers were shed (Zagata and Moen 1974). Social hierarchies were not evident within the groups. My guess is that the largest male would be the dominant animal in the group, both before and after the antlers were shed, but that the position of dominance would become less important to the animals as winter progressed. Bull moose also formed groups in the winter, which tended to break up during the calving season (Geist 1971). Males of several species become much more solitary during the summer.

#### LITERATURE CITED

- Geist, V. 1971. Mountain Sheep. The University of Chicago Press, Chicago. 383 p.
- Severinghaus, C. W. 1974. Deer populations - a wildlife roller coaster. The Conservationist 29(5): 36-38.
- Zagata, M. D. and A. N. Moen. 1974. Antler shedding by white-tailed deer in the midwest. J. Mammal. 55(3): 656-659.

# REFERENCES, UNIT 1.3

## SOCIAL HIERARCHIES

### BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS-----	AUTHORS/EDITORS--	YEAR
aubo	olbd	loen	653	----	anim dispers,rel to soc be	wynne-edwards,vc	1962
aubo	plpc	nyny	183	----	aggressn,dom, indiv spacng	krames,l,ed	1978
aubo	ucap	beca	567	odhe	a herd of mule deer	linsdale,jm; tomi	1953
aubo	stac	hapa	238	anam	prngrhn antlp & its mngmnt	einarsen,as	1948
aubo	stac	hapa	225	anam	hunting pronghorn antelope	popowski,b	1959
aubo	qupr	oton	166	obmo	muskoxen,biol,taxon,canada	tener,js	1965

### SERIALS

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
NATUA	220--	813	814	cerv	horn-like str,rank,grd,wea	geist,v	1968
PZSLA	128-4	608	612	cerv	social habits british deer	delap,p	1957
ZOBEA	12--2	219	250	cerv	etholog ovbsrvtns, no amer	geist,v	1966

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
WLSBA	3---2	82	83	od--	deer sociobiology	peterle,tj	1975

CODEN	VO-NU	BEPa	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
JOMAA	43--4	462	469	odvi	soc dom,phys cond,pen fwms	robinson,wl	1962
JOMAA	46--2	314	327	odvi	hrd soc bhv,hypogndl males	thomas,jw; robins	1965
JWMAA	33--1	196	203	odvi	mvts,translocatd,grp accpt	hawkins,re; montg	1969
JWMAA	34--2	407	419	odvi	prelim study, social organ	hawkins,re; klima	1970
JWMAA	36--3	861	868	odvi	aggres beh, wintr cuttings	ozoga,jj	1972
JWMAA	40--3	429	441	odvi	migratn, role wolf predatn	hoskinson,rl; mec	1976
JWMAA	40--3	454	463	odvi	group size, composit, flor	hardin,jw; silvy/	1976
RWLBA	6---2	153	326	odvi	w-t deer of the adirondcks	townsend,mt; smit	1933
SWNAA	13--4	411	420	odvi	aggressive behavior, w-t d	michael,ed	1968
WLMOA	53---	1	55	odvi	soc behav, relatn to habit	hirth,dh	1977
WLSBA	4---4	181	182	odvi	sociobiology, secnd thghts	smith,ca	1976

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
BIBED	3---	4	319	330	odhe sparring by, during rutting	wachtel,ma; beko/	1978
CAFGA	26--	2	139	166	odhe calif deer, rocky mt mule d	mclean,dd	1940
CAFNA	85--	4	295	301	odhe mutual grooming, nw oregon	millier,fl	1971
CGFPA	7----	1	26		odhe literature review,behavior	dorrance,mj	1966
JOMAA	31--	4	426	429	odhe rel moon phas,occur salt lk	buss,io; harbert,	1950
JOMAA	37--	2	143	164	odhe behavior, ref to pop ecol	dasman,rf; taber	1956
JOMAA	38--	2	247	253	odhe observtns behavior, penned	browman,lg; hudso	1957
JOMAA	42--	4	522	526	odhe aggressive behavior in deer	cowan,imct; geist	1961
JOMAA	59--	3	463	476	odhe soc behav,breed sys,desert	kucera,te	1978
JWMAA	37--	3	288	300	odhe odvi, intrsp behav,disprsn	kraemer,a	1973

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ANBEA	27--	1	211	225	ceel adaptive aspects, fighting	clutton-brock,th/	1979
ATRLA	19-32		509	514	ceel role of antlrs, hrd hierar	topinski,p	1974
BEHAA	4---	2	116	143	ceel soc behav,jackson hole area	altmann,m	1952
BEHAA	69--	3	145	170	ceel roarng, evol honest advrti	clutton-brock,th/	1979
BEHAA	74--	3	294	309	ceel social rank & food access	appleby,mc	1980
CAFNA	94--	2	148	153	ceel aggregation behavior,manit	rounds,rc	1980
FVHFA	16---	1	80		ceel aggres, reprod behav,red d	buetzler,w	1974
HOBEA	3---	4	375	396	ceel testost, social sexual beh	lincoln,ga; guin/	1972
JOMAA	56--	1	102	118	ceel soc orgnztn, hom ran,rsvlt	franklin,wl; mos/	1975
JWMAA	31--	2	293	299	ceel chrctr natrl licks, montan	knight,rr mudge,m	1967
JWMAA	33--	3	465	481	ceel pop ecol residnt,jksn hole	martinka,cj	1969
LUTAA	5---	1	1	8	ceel [social life of red deer]	eygenraam,ja	1963
RSZOA	72-24		434	440	ceel [kin rel, herd form,red d]	schloeth,r	1966
ZOOLA	41--	8	65	71	ceel pattns, herd behavior,wyo	altmann,m	1956
ZOOLA	45--	1	35	39	ceel alal, juvenile, socl dynam	altmann,m	1960

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	6-3/4	155	159	alal	social integratn,moos calf	altmann,m	1958
BEHAA	20--3	377	416	alal	moos behav, british columb	geist,v	1963
CAFNA	92--3	223	227	alal	grouping charact, manitoba rounds,	rc	1978
JOMAA	39--1	128	139	alal	summr obsrvtns, behv,ontar	de vos,a	1958
JOMAA	40--3	420	424	alal	group dynam,rutt seas, wyo	altmann,m	1959
JOMAA	55--1	126	137	alal	aggregatn,alaska,minn,mont	peek,jm; leresch/	1974
MUZPA	25---	1	44	alal	moose of isle royale	murie,a	1934
ZOOLA	41-14	105	118	alal	ecol,behav,pop dynam, wyom	denniston,rh,II	1956
ZOOLA	43--1	35	39	alal	role, juvenile, socl dynam	altmann,m	1960

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AIATA	4----	1	52	rata	relat, peary, barr-gr cari	manning,th	1960
ANBEA	12--4	420	426	rata	dom-subord rel, semi-domes	espmark,y	1964
BPURD	1----	436	461	rata	antlrs, social life bar gr	bubenik,ab	1975
CAFNA	87--4	357	369	rata	movemnt, rut behav, quebec	bergerud,at	1973
JWMAA	35--1	175	177	rata	antler shedding, parturitn	espmark,y	1971
ZETIA	23--6	710	756	rata	calvng & rel behav, bar gr	lent,pc	1966

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
AMNTA	43--2	257	354	anam	lif hstry,ecol,rng use,tex	buechner,hk	1950
BEHAA	48--3	215	267	anam	soc behav relat to ecology	jarman,pj	1974
BMAEA	516--	1	63	anam	rng use, food hab, montana	cole,gf	1956
CGFPA	3----	1	28	anam	literature review,behavior	prenzlow,ej	1965
CGFPA	17---	1	16	anam	some behavior patterns of	prenzlow,ej; gil/	1968
IZYBA	13---	217	220	anam	behav develop, hand reared	muller-schwarze,/	1973
JWMAA	31--4	843	844	anam	orphaned pronghrns survive	bromley,pt; ogara	1967
WLMOA	38---	1	96	anam	social behavior & ecology	kitchen,dw	1974
WLMOA	42---	6	111	anam	behavr, socializatn, fawns	autenrieth,re; f/	1975



CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ATICA	13--1	2	19	bibi	beha, socl orgnzatn, canad	fuller,wa	1960
ZETIA	30--4	416	419	bibi	rel, dominance, play behav	lumia,ar	1972
ZOOLA	43--1	1	40	bibi	soc behav of ameri buffalo	mchugh,t	1958

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
AMNAA	56--2	297	324	ovca	ecology of the mount sheep	mccann,lj	1956
CAFGA	52--2	68	84	ovca	winter obse, sierra nevada	mccullough,dr; sc	1966
CAFNA	77--2	77	94	ovca	behavior of a bighorn herd	blood,da	1963
CJZOA	46--5	899	904	ovca	ovda,delayd soc,phys matur	geist,v	1968
CJZOA	51--9	987	993	ovca	oram, eff snow, soc behavr	petocz,rg	1973
CJZOA	55-11	1802	1810	ovca	rams,max repr fitns,segreg	geist,v; petocz,r	1977
IGWBA	1----	1	154	ovca	status,life hist,man,idaho	smith,dr	1954
JOMAA	50--1	128	128	ovca	defensive behavior, female	hornocker,mg	1969
ZSAEA	36--6	342	350	ovca	anal, mech brooming horns	shackleton,dm; hu	1971
ZETIA	25--2	199	215	ovca	extrnl appr,soc behv,struc	geist,v	1968

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
CJZOA	46--5	899	904	ovda	ovda delayd soc,phys matur	geist,v	1968
ZETIA	25--2	199	215	ovda	extrnl appr,soc behv,struc	geist,v	1968

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ANBEA	24--4	756	758	obmo	ruttnng fight mortality,nwt	wilkinson,pf; sh/	1977

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
CGFPA	8----	1	23	oram	literature review, ecology	hibbs,ld	1966
IGWBA	2----	1	142	oram	life history, manag, idaho	brandborg,sm	1955

oram continued on the next page

CODEN	VO-NU	BEPa	ENPA	ANIM KEY WORDS-----	AUTHORS-----	YEAR
JWMAA	19--4	417	429	oram 2 yr study crazy mts, mont	lentfer,jw	1955
JWMAA	31--1	192	194	oram fightng injur, derm shield	geist,v	1967
MAMLA	39--2	241	249	oram agonistic behavior, duiker	ralls,k	1975

CODEN	VO-NU	BEPa	ENPA	ANIM KEY WORDS-----	AUTHORS-----	YEAR
NATUA	209--	1041	1042	dada uncertainty, leadrshp-rank	gilbert,bk; hailm	1966
ZETIA	25--7	867	876	dada devel socl behav, fallow d	gilbert,bk	1968

CODEN	VO-NU	BEPa	ENPA	ANIM KEY WORDS-----	AUTHORS-----	YEAR
ANBEA	11--4	529	533	doca soc postn, movement orders	beilharz,rg; mylr	1963
ANIPA	9---1	1	5	doca behav dairy bulls in group	dalton,dc; pears/	1967

CODEN	VO-NU	BEPa	ENPA	ANIM KEY WORDS-----	AUTHORS-----	YEAR
JCPPA	40...	255	264	dogo lack corr,leadrshp-dom,hrd	stewart,jc; scott	1947

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
APANE	4---	2	125	140	dosh ef rearng cond,aggres, dom zlto,ca;	wilson,/	1978
ANBEA	11--	4	507	513	dosh behav of indiv relatd grou	hunter,rf; milner	1963
ANIPA	5---	2	183	194	dosh eff meth rearing soc behav	hunter,rf; davis,	1963
ECOLA	37--	2	228	239	dosh dogo, anal, socialization	collias,ne	1956
SZSLA	18---		179	210	dosh soc grpng,home range,feral	grubb,p; jewell,p	1966

CODEN	VO-NU	BEP	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
AMZOA	14--	1	205	220	ungl relatn social evol, ecolog	geist,v	1974
ANBEA	24--	2	261	274	mamm soc systms: struct & funct	crook,jh; ellis,/	1976
ANKIA	64--	2	41	44	---- "teen-age" problms,	wildern altmann,m	1961
ARECB	8----		193	207	ungl soc adap, ecol, gall birds	geist,v	1977
BEHAA	49--	4	227	267	---- obsrv study beh, samp meth	altmann,m	1974
BHBLA	11--	2	131	154	---- concept of social dominanc	rowell,te	1974
JTBIA	47--	1	223	243	---- asses strat, evol fight beh	parker,ga	1974
NATUA	220--		813	814	---- horn-lik str,rank,gurd,wea	geist,v	1968
NATUA	246--		15	18	---- logic of animal conflict	maynard smith,jm/	1973
NATUA	250--		354	354	---- on fighting strategies	geist,v	1974
NAWTA	21---		538	544	biga patterns of social behavio	altmann,m	1956
PHZOA	17--	1	83	123	vert aggressive behav, vertebra	collias,ne	1944
QRESA	1....		283	315	ungl soci evol,dispersl, pleist	geist,v	1971
SCAMA	205-6		112	122	---- fighting behavr of animals	eibl-eibesfeldt,i	1961
SZSLA	18---		85	107	mamm concept of home range	jewell,pa	1966

#### OTHER PUBLICATIONS

Dane, B. 1967. Social behavior of the mountain goat. Bulletin of the Ecological Society of America 48(3): 134.

