TOPIC 4. REPRODUCTIVE SYSTEM FUNCTIONS

Free-ranging animals exhibit definite reproductive cycles through each year of their lives. First, reproductive maturity is reached, which is dependent on both age and weight. Animals on poor range are expected to weigh les, and reproductive maturity is reached later. After reproductive maturity is reached, the period of breeding is regulated by the effects of light on the hormone balance, and the subsequent gestation and lactation periods are fixed in relation to the time of conception.

Spermatogenesis and ovulation are important functions of individual animals. The extent of differences in sperm and egg production between individual males and females, respectively, is not known because individuals cannot be evaluated under free-ranging conditions. A very high percentage of each sex is likely to be capable of breeding in wild ruminant populations.

After breeding, the male can be primarily concerned with maintenance while the female must meet the demands of gestation, parturition and lactation. These functions occupy about three-fourths of the year or more for the females, and include responsibilities not only for the production of a new individual but also must meet the high metaboliac cost of lactation and provide some measure of protection and behavioral security for the young. Further, the abundance of animals in a population depends on the sucessful completion of reproductive functions over successive annual cycles.

REFERENCES, TOPIC 4

REPRODUCTIVE SYSTEM FUNCTIONS

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS----------	AUTHORS/EDITORS--	YEAR
aubo	meth	loen	321	mamm	ecol of reprod in wild, do	sadleir,rmfs	1969
edbo	caun	nyny	189	ovca	reproduct in mammal, bok 6	austun,cr short,	1976

UNIT 4.1: REPRODUCTIVE CYCLES

Reproduction by wild ruminants does not occur randomly throughout the year, but is part of a biological chronology characteristic of each species and, in some cases, the locations of populations. Males are non-productive for much of the year; sperm are not produced by the inactive testes. Females are non-reproductive for only a short time each year; they are pregnant or lactating most of the time. The timing of the reproductive and non-reproductive periods through the year is quite fixed, with not too much variation between years. This is apparently due to the association between metabolic demands for reproduction and the availability of forage resources on a seasonal basis.

The male reproductive cycle is often represented by the amount of testicular development. White-tailed deer in Texas showed the lowest testicular weights in February-May (Robinson et al. 1965). Pronghorn testes weights (Montana) were at an annual low in January and February (O'Gara et al. 1971). Maximum testes weights and sperm production occur in late summer in pronghorn, resulting in the breeding of pronghorn females earlier than the breeding of deer. Pronghorn have a gestation period of 240 days compared to 200 days for deer, so the earlier breeding results in parturition at about the same time for the two species. The time of breeding is an important consideration in describing the biochronology of a species because breeding commits the females to defined periods of gestation and lactation. The timing of these productive periods is an important consideration in relation to the phenology of the range, especially the last one-fourth of gestation and the first half of lactation because these are such critical periods in the life of both dam and offspring. Later fall breeding combined with a longer gestation period would result in too short a growing period for the young prior to the beginning of their first winter. The importance of the phenology of the range in relation to timing of the arrival of spring was discussed and illustrated in Moen (1978).

Peak breeding of deer in Texas occured in December, about one month later than in New York, which Robinson et al. (1965) consider a normal variation due to latitude effects. Differences in breeding times from north to south are not very large.

LITERATURE CITED

O'Gara, B. W., R. F. May, and G. D. Bear. 1971. The annual testicular cycle and horn casting in the pronghorn (Antilocapra americana). J. Mammal. 52(3) 537-544.

Moen A. N. 1978. Seasonal changes in heart rates, activity, metabolism and forage intake of white-tailed deer. J. Wildl. Manage. 42(4):715-738.

Robinson, R. M., J. W. Thomas, and R. G. Marburger. 1965. The reproductive cycle of male white-tailed deer in central Texas. J. Wildl. Manage. 29(1) 53-59.

REFERENCES, UNIT 4.1

REPRODUCTIVE CYCLES

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS----------	AUTHORS/EDITORS--	YEAR
aubo	coup	itny	670	mamm	patterns mammalian reproduc	asdell,sa	1964

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CAFGA	34--1	25	31	od--	br seas, produc, interstat	chattin,je	1948

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AJVRA	39--6	1053	1056	odvi	antl, long bone mass, andr	brown,rd; cowan,/	1978
BIREB	16--3	340	343	odvi	repro ster, fema seas chan	plotka,ed; seal,/	1977
BIREB	17--1	78	83	odvi	repr, proges, estrog, preg	plotka,ed; seal,/	1977
CJZOA	44--1	59	62	odvi	breeding seasons, manitoba	ransom,ab	1966
CJZOA	56--1	121	127	odvi	seas var LH,FSH, tes, male	mirarchi,re; how/	1978
ENDOA	94--4	1034	1040	odvi	annual testos rhyth, adult	mcmillin,jm; sea/	1974
JANSA	31--1	225	225	odvi	sperm reserves of w-t deer	lambiase,jt,jr; a	1970
JANSA	40--1	185	186	odvi	andr lev, antl cy, bree se	mirarchi,re; sca/	1975
JANSA	42--1	271	272	odvi	seas var, gonad char, male	mirarchi,re; sca/	1976
JOMAA	32--4	411	421	odvi	analys reproduc pat, s tex	iilege,d	1951
JOMAA	40--1	108	113	odvi	breed record, capt, alabam	haugen,ao	1959
JOMAA	47--2	266	280	odvi	endocrine glands,seas chan	hoffman,ra; robin	1966
JOMAA	53--4	760	773	odvi	ovar comp, repr phys,venez	brokx,pa	1972
JRPFA	47--1	161	163	odvi	chan estro, estradi, pregn	harder,jd; woolfl	1976
JWMAA	10--3	249	263	odvi	breeding season, new york	cheatum,el; morto	1946
JWMAA	14--3	290	295	odvi	breed rec, upper pen, mich	haugen,ao; davenp	1950
JWMAA	28--1	171	173	odvi	birth of white-tai d fawns	michael,ed	1964
JWMAA	29--1	53	59	odvi	reproduc cycle, male texas	robinson,rm; tho/	1965
JWMAA	29--1	74	79	odvi	reproducti studies, penned	verme,lj	1965

odvi continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	30--4	843	845	odvi	regional diff, fawning tim	weber,aj	1966
JWMAA	31--1	114	123	odvi	reprodtive biolo, manitoba	ransom,ab	1967
JWMAA	33--3	708	711	odvi	fertility, male w-t fawns	follmann,eh; klim	1969
JWMAA	33--4	881	887	odvi	repro pattern, nutri plane	verme,lj	1969
JWMAA	36--3	868	875	odvi	reproductive physiol, male	lambiase,jt,jr; /	1972
JWMAA	38--2	183	196	odvi	eff diethylstilbes, reprod	harder,jd; peterl	1974
JWMAA	40--2	373	374	odvi	initia, preg, lactating de	scanlon,pf; murp/	1976
JWMAA	40--4	792	795	odvi	noneff, mechan birth contr	matschke,gh	1976
JWMAA	41--1	87	91	odvi	diethylstilbestr, contrace	matschke,gh	1977
JWMAA	41--1	92	99	odvi	ann chang, sperm prod org	mirarchi,re; sca/	1977
JWMAA	41--2	178	183	odvi	androg levels, antl develo	mirarchi,re; sca/	1977
JWMAA	41--2	194	196	odvi	antifertil act, syn proges	matschke,gh	1977
JWMAA	41--4	715	719	odvi	fact aff peak fawning, vir	mcginnes,bs; down	1977
NFGJA	16--2	261	261	odvi	twin fawns born 2 days apa	hesselton,wt; van	1969
NFGJA	20--1	40	47	odvi	breedi, parturit dates, ny	jackson,lw; hesse	1973
PCGFA	9----	128	131	odvi	birth dates of alabama dee	lueth,fx	1955
PCGFA	20---	123	130	odvi	breeding seas in louisiana	roberson,jh,jr; d	1966
PCGFA	20---	130	139	odvi	delin of rut, breedin seas	payne,rl; provos/	1966
PCFGA	29---	646	651	odvi	oral accep, eff, diethylst	matschke,gh	1975
PCGFA	32---	335	338	odvi	fawning dates, manag impli	butts,gl; harmel/	1978
POASA	56---	24	25	odvi	breeding season, e oklahom	dunbar,mr	1976
TJSCA	26...	417	420	odvi	breeding season in s texas	harwell,wf; barro	1975
TNWSD	27---	19	38	odvi	photoperiodism, breeding	mcdowell,rd	1970
VJSCA	24--3	112	112	odvi	spermatozoan reserves in d	lenker,dk; scanlo	1973
VJSCA	26--2	59	59	odvi	plas androg lev,repro char	mirarchi,re; sca/	1975
VJSCA	26--2	60	60	odvi	seas. age dif, male org wt	russell,md; wess/	1975
VJSCA	27--2	46	46	odvi	plas progest lev, estr cyc	kirkpatrick,rl; /	1976
WLSBA	3---4	152	156	odvi	hormon implan, contr repro	bell,rl; peterle,	1975

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
APARD	1976-	208	215	odhe	environ eff on reproductio	sadleir,rmfs	1976
CAFGA	43--1	91	96	odhe	breedin seas, herds, calif	bischcoff,ai	1957
CJZOA	54-10	1617	1636	odhe	horm reg, repro, antl cycl	west,no; nordan,h	1976
CJZOA	54-10	1637	1656	odhe	eff methallibure,hormon tr	west,no; nordan,h	1976

odhe continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JOMAA	54--1	302	303	odhe	reproductio, b-t deer fawn	thomas,dc; smith,	1973
JRPFA	44--2	261	272	odhe	reprod pattern, female b-t	thomas,dc; cowan,	1975
JWIDA	7---1	67	69	odhe	bilateral testicular degen	murphy,bd; clugst	1971
JWIDA	11--1	101	106	odhe	testicular atrophy, calif	demartini,jc; con	1975
JWMAA	14--4	457	469	odhe	bree seas, prod, faw, utah	robinette,wl; gas	1950
JWMAA	40--4	795	796	odhe	preg fawn, quintupl mule d	nellis,ch; prent/	1976

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
BEHAA	16---	84	92	ceel	charact of estrous, captiv	morrison,ja	1960
JOENA	53-PR	48	49	ceel	thyr calci, seas repro cha	phillippo,m; lin/	1972
JOMAA	36--1	145	145	ceel	fetus in yearling cow elk	saunders,jk jr	1955
JOMAA	47--2	332	334	ceel	fetus resorption in elk	haugen,ao	1966
JOMAA	51--4	812	813	ceel	precoci antl dev, sex matu	moran,rj	1970
JRPFA	25--1	41	54	ceel	puberty, seas breedin male	lincoln,ga	1971
JRPFA	27--3	427	438	ceel	female reprodu cycl, scotl	guiness,f; linco/	1971
JWMAA	16--3	313	315	ceel	age at sex maturity, male	conoway,cf	1952
JWMAA	17--2	223	223	ceel	pregnant yearling cow elk	coffin,al; reming	1953
JWMAA	23--1	27	34	ceel	breed seas, known-age embr	morrison,ja tra/	1959
JWMAA	32--2	368	376	ceel	exper studies, contr repro	greer,kr; hawkin/	1968
JZOOA	163-1	105	123	ceel	seas reprodu changes, stag	lincoln,ga	1971
JZOOA	172-3	363	367	ceel	timing, reproduc, latitude	fletcher,tj	1974
JZOOA	185-1	105	114	ceel	calving times, red d, scot	guiness,fe; gibs/	1978
MAMLA	35--2	204	219	ceel	ruru, season, births, n z	caughley,g	1971
NAWTA	21---	545	554	ceel	postconcept ovulation, elk	halazon,gc; buech	1956
NATUA	248--	616	618	ceel	restor lib, cast stag, est	fletcher,tj; shor	1974
ZEJAA	1---1	69	75	ceel	caca, dada [time of birth]	rieck,w	1955
ZEJAA	21--4	238	242	ceel	1 sided testicle shrinkage	wurster,k; hofma/	1975

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AVSPA	14--1	81	91	alal	morph, ultrastr, spermatoz	andersen,k	1973
JOMAA	37--2	300	300	alal	late breeding, moose, alce	moisan,g	1956
JWMAA	26--4	360	365	alal	in gravelly, snowcrest mou	peek,jm	1962
VILTA	6---3	1	299	alal	reproductio, moose, sweden	markgren,g	1969

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CAFNA	90--4	449	463	rata	annual antler cycle, newfo	bergerud,at	1976
CJZOA	50--1	43	46	rata	reprodu, female reind, car	mcewan,eh; whiteh	1972
CJZOA	53--9	1213	1221	rata	repro seas, carib, newfoun	bergerud,at	1975
CJZOA	56--8	1684	1696	rata	morphol, b-g caribou ovary	dauphine,tc,jr	1978
JWMAA	35--1	175	177	rata	antl shedd, parturi, reind	espmark,y	1971
JWMAA	38--1	54	66	rata	synchronous mating, b gr c	dauphine,tc,jr; m	1974
NCANA	97--1	61	66	rata	calving dates, carib, queb	desmeules,p; sim	1970
PASCC	22---	17	17	rata	repro patter, reind, carib	mcewan,eh; whiteh	1971
ZOLZA	46-12	1837	1841	rata	[reproduc, wild, taimyr p]	michurin,ln	1968

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
WMBAA	16---	17	23	bibi	biol, manage, national par	fuller,wa	1962

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CJZOA	46--5	899	944	ovca	social, physical maturatio	geist,v	1968
SWNAA	22---	153		ovca	minimum breeding age, utah	mccutchen,he	1977

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
FUNAA	24...	96	100	obmo	early matur, fecund, norwa	alendal,e	1971

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	19--4	417	429	oram	two-year study, crazy moun	lentfer,jw	1955

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JRPFA	21--1	1	8	dada	reproductive cycle, male	chapman,di; chapm	1970

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ATRLA	1----	333	376	bibo	reproduc of european bison	jaczewski,z	1958
ATRLA	12---	333	334	bibo	breeding, zool garden, pol	landowski,j; woli	1967
ATRLA	12---	407	444	bibo	reprod biol, reserve, free	krasinski,z; racz	1967
ZSAEA	33--4	193	214	many	[developm antlers, reprod]	lau,d	1968

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JOMAA	52--3	537	544	anam	ann test cycle, horn casti	ogara,bw; moy,rf/	1971

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JRPFA	12--2	337	351	caca	sexual cycle seas breed ma	short,rv; mann,t	1966

Testes development as percent of body weight
in male white-tailed (odvi) through the annual cycle

The reproductive data in Robinson et al. (1965) on male deer collected through the year are ideal for representation as a sine wave through the annual cycle. The circle diagram shown in the Figure 2 in the published paper illustrates a pattern throughout the year that can be easily converted to a symmetric sine wave, with the maximum occurring in November and the minimum in May. Thus only a primary phase correction (see CHAPTER 1) is necessary.

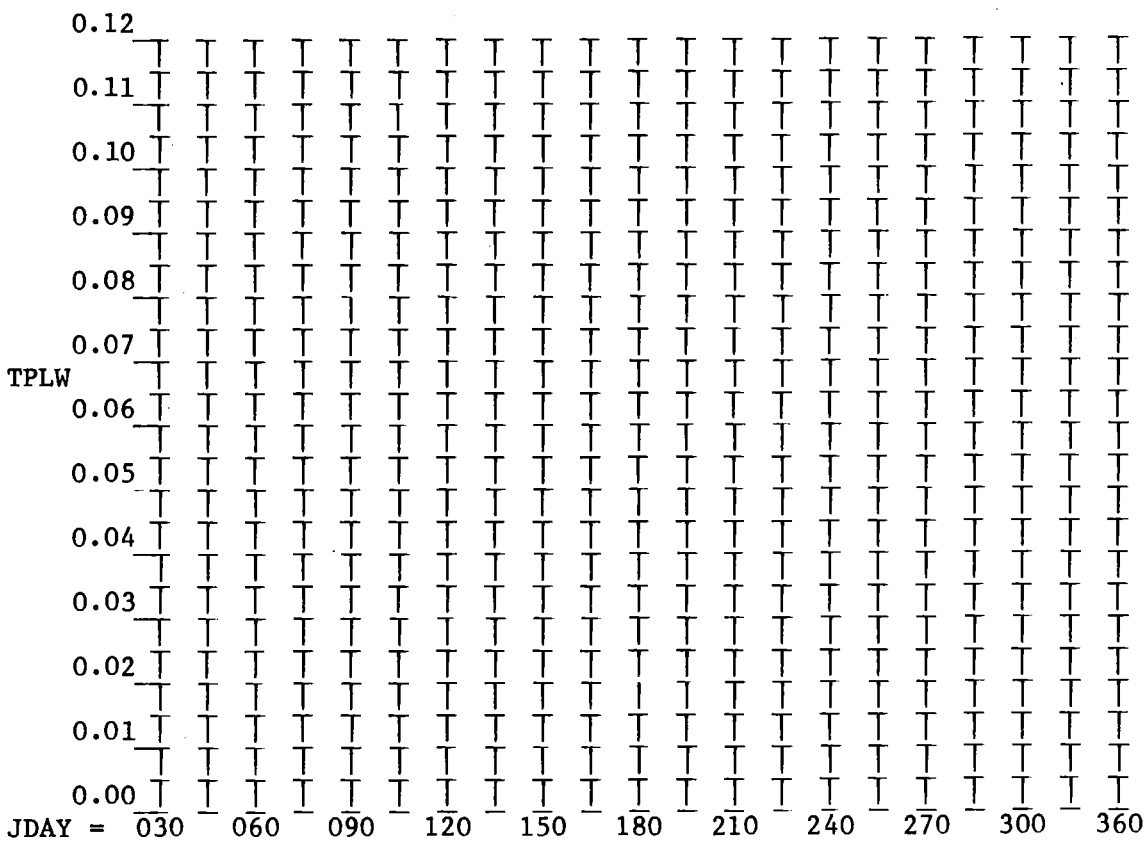
Complete the following table using data given by Robinson and adding the columns indicated by the underscore. The first line is an example.

Deer Number	Date Collected	Age (years)	JDAY	Total Weight (pounds)	LWKG	Testes Weight (gms)	Testes Percent of total Weight
N-4	9-22-62	3.5	264	88	40	31.5	0.078
N-97	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—

Rewrite the procedures described in CHAPTER 1 for deriving sine wave equations with a primary phase correction, and derive an equation for testes weight as a percent of live weight (TPLW). Plot the results on the graph on the next page.

The primary phase correction is:

The equation is:



LITERATURE CITED

Robinson, R. M., J. W. Thomas, and R. G. Marburger. 1965. The reproductive cycle of male white-tailed deer in central Texas. J. Wildl. Manage. 29(1):53-59.

UNIT 4.2: SPERMATOGENESIS AND OVULATION

Testes are compact organs with specialized cells for the production of spermatozoa. Testicular weights, epididymal weights, testicular spermatozoa numbers, and epididymal spermatozoa numbers were all highly caculated with plasma endrogen levels in white-tailed deer (Mirachi et al. 1976). These reproductive characteristics of the male, are apparently related to the light regime, and coincide with the reproductive condition of the female, of course.

When spermatogenesis occurs, the spermatozoa arise from specialized sex cells called spermatogonia. They are released and move by way of the epididymis and vas deferens to the ejaculatory duct, from which they are expelled at the time of mating. Spermatogenesis occurs almost exclusively during the period of lowest body temperature (McCauley 1971:395). The testes of wild ruminants are suspended in the scrotum, which has a lower temperature than the abdominal cavity.

Ovulation occurs as undeveloped sex cells, or ova, mature and are released from the ovary, enter the fallopian tube and move through it to the uterus. If sperm are present, the ovum may be fertilized and then implanted in the uterine wall where it develops.

The female enters a period of estrus, or "heat," when ovulation occurs and she is ready to receive the male. Estrus occurs again in 3-4 weeks if conception has not occurred. The frequency of unsuccessful matings during the first estrus is not known for wild ruminants because of their secretiveness and daily behavior patterns. The general impression one gets from reproductive data on wild ruminants is that they reproduce very successfully and consistently when range conditions are favorable and herd health is good.

LITERATURE CITED

McCauley, W. J. 1971. Vertebrate physiology. W. B. Saunders Co., Philadelphia. 422 pp.

Mirachi, R. E., P. F. Scanlon, and R. L. Kirkpatrick. 1976. Seasonal variation in gonadal characteristics of male white-tailed deer. J. Anim. Sci. 42(1):271-272.

REFERENCES, UNIT 4.2

SPERMATOGENESIS AND OVULATION

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS----------	AUTHORS/EDITORS--	YEAR
aubo	coup	itny	670	mamm	patterns mammalian reprodu	asdell,sa	1964

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AJANA	132-2	189	205	odvi	ultrastr corpus lute, preg	sinha,aa seal,u/	1971
BIREB	17--1	78	83	odvi	repr, proges, estrog, preg	plotka ed; seal,/	1977
CIRIB	6---2	1053	1056	odvi	collec semen, electro ejac	bierschwal,cj; m/	1968
COVEA	39--3	282	291	odvi	corpora lutęa, ovul incide	cheatum,el	1949
JANSA	31--1	225	225	odvi	sperm reserves of w-t deer	lambiase,jt,jr; a	1970
JANSA	42--1	271	272	odvi	seas var, gonad char, male	mirarchi,re; sca/	1976
JAVMA	157-5	627	632	odvi	char semen coll, elec ejac	bierschwal,cj; m/	1970
JOMAA	32--3	267	280	odvi	notes on fecunidty, maine	palmer,rs	1951
JOMAA	40--1	108	113	odvi	breed record, capt, alabam	haugen,ao	1959
JOMAA	48--2	321	321	odvi	polyovulation in wt-tailed	hesselton,wt	1967
JOMAA	53--4	760	773	odvi	ovar comp, repr phys,venez	brokx,pa	1972
JWMAA	12--1	78	86	odvi	produc, yield, george rsrv	o'roke,ec; hamers	1948
JWMAA	15--2	73	80	odvi	produc, mortalit, coralled	severinghaus,cw	1951
JWMAA	29--1	74	79	odvi	reproducti studies, penned	verme,lj	1965
JWMAA	29--3	487	492	odvi	corpora lutea variation of	trauger,dl; hauge	1965
JWMAA	31--1	114	123	odvi	reprodtive biolo, manitoba	ransom,ab	1967
JWMAA	33--3	708	711	odvi	fertility, male w-t fawns	follmann,eh; klim	1969
JWMAA	33--4	881	887	odvi	repro pattern, nutri plane	verme,lj	1969
JWMAA	35--2	369	374	odvi	accessory corp lute, ovari	mansell,wd	1971
JWMAA	36--3	868	875	odvi	reproductive physiol, male	lambiase,jt,jr; /	1972
JWMAA	38--2	183	196	odvi	eff diethylstilbestrol rep	harder,jd; peterl	1974
JWMAA	41--1	92	99	odvi	ann chang, sperm prod, org	mirarchi,re; sca/	1977
JWMAA	41--2	87	91	odvi	microencapsulatd diethylst	matschke,gh	1977
JWMAA	41--2	194	196	odvi	antifertil act, syn proges	matschke,gh	1977
JWMAA	41--4	731	735	odvi	ferti control, steroi impl	matschke,gh	1977
NFGJA	11--1	13	27	odvi	product, growth, adirondac	severinghaus,cw;	1964

odvi continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
PCFGA	29---	646	651	odvi	oral accep, eff, diethylst	matschke,gh	1975
VJSCA	24--3	112	112	odvi	ovula, pregnan, lactat dee	scanlon,pf; murp/	1973
VJSCA	24--3	112	112	odvi	spermatozoan reserves in d	lenker,dk; scanlo	1973
VJSCA	27--2	46	46	odvi	plas progest lev, estr cyc	kirkpatrick,rl; /	1976
WLSBA	3---4	152	156	odvi	hormon implan, contr repro	bell,rl; peterle,	1975

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
APARD	1976-	208	215	odhe	environ eff on reproductio	sadleir,rmfs	1976
CAFGA	44--3	253	259	odhe	productiv, herds californi	bischoff,ai	1958
JOMAA	54--1	302	303	odhe	reproductio, b-t deer fawn	thomas,dc; smith,	1973
JWIDA	7---1	67	69	odhe	bilateral testicular degen	murphy,bd; clugst	1971
JWIDA	11--1	101	106	odhe	testicular atrophy, calif	demartini,jc; con	1975
JWMAA	19--1	115	136	odhe	fertility, utah mule deer	robinette,wl; ga/	1955
JWMAA	19--4	503	503	odhe	rocky mount, high repr rte	jensen,w; robinet	1955
JWMAA	21--1	62	65	odhe	ovarian anal, reprod perfo	golley,fb	1957
MRLTA	50--1	12	12	odhe	record, multiple ovulation	fowle,ke	1969
NAWTA	9----	156	161	odhe	productivity, central utah	robinette,wl; ols	1944
NAWTA	15---	589	596	odhe	productiv, mule d, colorad	tolman,cd	1950
THGNB	3---3	101	106	odhe	early pubert, female b-t d	mueller,cc; sadle	1975

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
BEHAA	16	84	92	ceel	charact of estrus, captive	morrison,ja	1960
CIRIB	8---4	994	997	ceel	freezi red d semen, polan	jaczewski,z; mor/	1976
JOMAA	47--1	152	153	ceel	occ of acces corpora lutea	douglas,mjw	1966
JRPFA	25--1	41	54	ceel	puberty, seas breedin male	lincoln,ga	1971
JRPFA	27--3	427	438	ceel	female reprodu cycl, scotl	guiness,f; linco/	1971
JWMAA	17--2	177	184	ceel	reproduction, yellowstone	kittans,wh	1953
JWMAA	24--3	297	307	ceel	ovarian char, breed histor	morrison,ja	1960
JWMAA	32--2	368	376	ceel	exper studies, contr repro	greer,kr; hawkin/	1968

ceel continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JZOOA	163-1	105	123	ceel	seas reprodu changes, stag	lincoln,ga	1971
NAWTA	20---	560	567	ceel	increas natal, lowered pop	buechner,hk; swan	1955
NAWTA	21---	545	554	ceel	postconcept ovulation, elk	halazon,gc; buech	1956
ZEJAA	4---3	105	130	ceel	[reproductive phenomena]	valentincic,si	1958
ZEJAA	21--4	238	242	ceel	1 sided testicle shrinkage	wurster,k; hofma/	1975

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AVSPA	14--1	81	91	alal	morph, ultrastr, spermatoz	andersen,k	1973
JWMAA	22--3	261	268	alal	reproductn in a population	edwards,ry; ritce	1958
JWMAA	23--4	381	401	alal	reprod & produc, newfoundl	pimlott,dh	1959
VILTA	6---3	1	299	alal	reproductio, moose, sweden	markgren,g	1969

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CJZOA	56--8	1684	1696	rata	morphol, b-g caribou ovary	dauphine,tc,jr	1978
JOMAA	52--2	479	479	rata	twinning in caribou	mcewan,eh	1971
JOMAA	54--3	781	781	rata	twinning in reindeer, nwt	nowosad,rf	1973
JWMAA	38--1	54	66	rata	synchronous mating, b gr c	dauphine,tc,jr; m	1974
JZOOA	164-4	419	424	rata	collec, exam, reinde semen	dott,hm; utsi,mnp	1971
JZOOA	170-4	505	508	rata	artific insemina, reindeer	dott,hm; utsi,mnp	1973
PASCC	22---	17	17	rata	repro patter, reind, carib	mcewan,eh; whiteh	1971

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	9---2	155	156	ovca	non-breeding in bighorn sh	pulling, avs	1945
JWMAA	30--1	207	209	ovca	twinning in bighorn sheep	spalding,dj	1966

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
FUNAA	24...	96	100	obmo	early matur, fecund, norwa	alendal,e	1971

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	19--4	417	429	oram	two-year study, crazy moun	lentfer,jw	1955

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
ATRLA	1....	333	376	bibo	reproduc of european bison	jaczewski,z	1958
ATRLA	12---	407	444	bibo	reprod biol, reserve, free	krasinski,z· racz	1967

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
AMNTA	114-1	101	116	ungu	maternal reproductv effort	robbins,ct; robbi	1979

UNIT 4.3 GESTATION AND PARTURITION

Gestation occurs when the fertilized ovum, called a zygote, is implanted on the endometrium of the uterus. The zygote develops, becoming an embryo, and extraembryonic tissues develop to become the placenta. The placental membranes function in the exchange of nutrients, gases, and wastes between the fetal and maternal circulatory systems.

Fetal development is relatively slow in the first one-third, increases some in the second one-third, and increases rapidly in the final one-third of pregnancy; growth rates were discussed in CHAPTER 1.

Parturition in wild ruminants seems to be a rather routine event that is accomplished rather quickly, based on the few observations of parturition reported in the literature. Most wild ruminants tend to give birth at times and places that make observation difficult.

Breeding as a result of natural selection does not result in the physical mismatches that can occur through selective breeding of domestic ruminants. A large-breed ram and a small-breed ewe, for example, may result in difficulties during parturition due to fetal size. Difficulties at birth are probably quite infrequent in natural populations, although actual rates of mortality during parturition are unknown.

REFERENCES, UNIT 4.3

GESTATION AND PARTURITION

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JOANA	94--1	1	33	cerv	aspects of placentation	hamilton,wj; har/	1960

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AJANA	126-2	201	241	odvi	morphogen, fetal membranes	sinha,aa; seal,u/	1969
AJANA	127-4	369	395	odvi	ultrastr amnion, amni plaq	sinha,aa; seal,u/	1970
AJANA	132-2	189	205	odvi	ultrastr corpus lute, preg	sinha,aa; seal,u/	1971
BIREB	17--1	78	83	odvi	repr, proges, estrog, preg	plotka,ed; seal,/	1977
CNJNA	54--2	259	259	odvi	doca, cotyled attach, uter	scanlon,pf	1974

odvi continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JRPFA	47--1	161	163	odvi	chan estro, estradi, pregn	harder,jd; woolfl	1976
JWIDA	9---4	356	358	odvi	multipl anomali, w-t fetus	wobeser,g; runge,	1973
JWIDA	11--4	497	501	odvi	congen anom, neonat, alber	barrett,mw; chalm	1975
JWMAA	26--4	409	411	odvi	x-ray in determi pregnancy	verme,lk; fay,ld/	1962
JWMAA	27--1	142	143	odvi	technique for preser uteri	haugen,ao	1963
JWMAA	28--1	171	173	odvi	birth of white-tai d fawns	michael,ed	1964
JWMAA	29--1	53	59	odvi	reproduc cycle, male texas	robinson,rm; tho/	1965
JWMAA	29--3	487	492	odvi	corpora lutea variation of	trauger,dl; hauge	1965
JWMAA	30--2	414	417	odvi	sexing embryo by chromatin	segelquist,ca	1966
JWMAA	31--1	114	123	odvi	reprodtive biolo, manitoba	ransom,ag	1967
JWMAA	33--4	881	887	odvi	repro pattern, nutri plane	verme,lj	1969
JWMAA	37--3	423	424	odvi	support dev, field laparot	scanlon,pf; lenke	1973
JWMAA	39--4	684	691	odvi	uterin comp, growth, pregn	robbins,ct; moen,	1975
JWMAA	40--2	373	374	odvi	initia, preg, lactating de	scanlon,pf; murp/	1976
NFGJA	16--2	261	261	odvi	twin fawns born 2 days apa	hesselton,wt; van	1969
NFGJA	18--1	42	51	odvi	reprod anomali, female, ny	hesselton,wt; jac	1971
OJSCA	78-AP	14	14	odvi	possibl superfeta, spontan	lamvermeyer,bl; m	1978
PIAIA	71---	241	247	odvi	struc, cervic regi, uterus	morris,je	1964
VJSCA	23--3	116	116	odvi	a laparotomy technique w-t	scanlon,pf; lenke	1972
VJSCA	23--3	116	116	odvi	aspects of early pregnancy	scanlon,pf; murp/	1972
VJSCA	24--3	112	112	odvi	ovula, pregnan, lactat dee	scanlon,pf; murp/	1973

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
ACATA	84--1	118	128	odhe	anam, morpho, cervix uteri	kanagawa,h; hafez	1973
ANREA	122--	335	340	odhe	quadruplets in mule deer	sears,hs browman	1955
CJZOA	48--1	123	132	odhe	odvi, develo, fetal period	ommundsen,p; cowa	1970
JOMAA	38--1	116	120	odhe	gesta per, breed, fawn beh	golley,fb	1957
JWMAA	37--3	312	326	odhe	effect nutr chan on captiv	robinette,wl; ba/	1973
JWMAA	40--4	795	796	odhe	preg fawn, quintupl mule d	nellis,ch; prent/	1976

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CJZOA	47--6	1418	1419	ceel	sexual dimorphi in fetuses	retfalvi,l	1969
JOMAA	36--1	145	145	ceel	fetus in yearling cow elk	saunders,jk jr	1955
JOMAA	47--2	332	334	ceel	fetus resorption in elk	haugen,ao	1966
JWMAA	17--2	177	184	ceel	reproduction, yellowstone	kittans,wh	1953
JWMAA	17--2	223	223	ceel	pregnant yearling cow elk	coffin,al; reming	1953
JWMAA	23--1	27	34	ceel	breed seas, known-age embr	morrison,ja; tra/	1959
JWMAA	31--1	145	149	ceel	determ preg, rectal palpat	greer,kr; hawkins	1967
JWMAA	40--2	330	335	ceel	nutri, hesta, succes repro	thorne,et dean/	1976

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	26--4	360	365	alal	in gravelly, snowcrest mou	peek,jm	1962

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CAFNA	90--4	498	499	rata	twin fetuses, woodland car	shoesmith,mw	1976
JOMAA	49--4	778	778	rata	placental remnants, rumens	miller,fl; parker	1968
JWMAA	25--2	205	205	rata	sex determination of calve	bergerud,at	1961
JWMAA	28--3	477	480	rata	field meth, parturiti rate	bergerud,at	1964

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	30--1	207	209	ovca	twinning in bighorn sheep	spalding,dj	1966
JWMAA	43--4	970	973	ovca	deter pregncy, progestin,	ramsay,ma; sadlei	1979

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
FUNAA	24...	101	103	obmo	gestation period of muskox	alendal,e	1971

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	19--4	417	429	oram	two-year study, crazy moun	lentfer,jw	1955

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CBCPA	43A--	673	679	mamm	gestation period, body wt	kihlstrom,je	1972

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
AMNTA	114-1	101	116	ungu	matern repro effort, fetal	robbins,ct; robbi	1979

UNIT 4.4: LACTATION

The production of milk is a distinguishing feature of mammals. It is a very necessary process as the neonates are not able to either forage or digest forage; milk is the sole supply of nutrients immediately after birth. Further, colostrum, the first milk produced after parturition is highly nutritious and contains more dry matter, more protein, and more vitamins than milk produced a few days after parturition and through the rest of the lactation period. The colostrum of ruminants also contain antibodies essential for the young until they develop an active immunity to diseases. The low resistance due to a lack of antibodies at birth in ruminants is due to the lack of placental transmission from mother to fetus. The effects of these important mother-young relationships in the first few days of life may be realized in population dynamics as changing environmental conditions affect the successful establishment of both the nutritional and social relationships.

The amount of milk produced usually increases for a few weeks after parturition and then slowly decreases. The increase coincides with the increased demand for nutrients by the rapidly growing young before the rumen is developed well enough to be fully functional.

Milk is released in response to the nursing activities of the young. They may suckle several times a day, with a decline in the frequency of nursing in the last two-thirds of lactation. This decline coincides with increasing dependence on forage and decreasing milk production. Milk production ceases when the young no longer stimulate the dam by nursing, usually 3-5 months after parturition in wild ruminants.

REFERENCES, UNIT 4.4

LACTATION

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS----------	AUTHORS/EDITORS--	YEAR
aubo	isup	amia	291	doca	secretion of milk, 4th ed.	esped,w; smith,vr	1952
edbo	saco	phpa	584		handbook of biologica data	spector,ws,ed.	1956
aubo	coup	itny	670	mamm	patterns mammalian reprodu	asdell,sa	1964
edbo	acpr	nyny	516	mamm	mammary gland, dev & maint	larson,bl; smith,	1974
edbo	acpr	nyny	458	mamm	biosyn & secr milk;disease	larson,bl; smith,	1974
edbo	acpr	nyny	425	mamm	nutrit and biochem of milk	larson,bl; smith,	1974

REFERENCES, UNIT 4.4

LACTATION

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	39--2	355	360	odvi	milk consumpt, weight gain	robbins,ct; moen,	1975

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JWMAA	44--2	472	478	odhe	milk yield, black-tailed d	sadleir,rmfs	1980

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
JRPFA	37--1	67	84	ceel	comp, yield, milk, red dee	arman,p; kay,rnb/	1974
JWMAA	40--2	330	335	ceel	nutri, gesta, succes repro	thorne,et; dean,/	1976
SZSLA	41---	297	312	ceel	physiol effe lacta on moth	hanwell,a; peake	1977

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
ALLKA	55	23	28	alal	struc rib,thorax indic mil	anghi,c	1968
JWIDA	12--2	202	207	alal	milk, hair, element relati	franzmann,aw; fl/	1976
PNSUA	27--2	129	138	alal	compar nut in preg, lactat	payne,pr; wheele/	1968
VILTA	6---3	1	299	alal	reproductio, moose, sweden	markgren,g	1969

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS----------	AUTHORS----------	YEAR
CJZOA	49--4	443	447	rata	measu, milk intake, calves	mcewan,eh; whiteh	1971
CJZOA	54--1	55	64	rata	glucos metab, lactat reind	white,rg; luick,j	1976
SZSLA	41---	297	312	rata	physiol effe lacta on moth	hanwell,a; peake	1977

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

anam

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

JOANA 94--1 1 33 cerv aspects of placentation hamilton,wj; har/ 1960

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

bibi

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

ovca

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

ovda

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

obmo

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

oram

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

EVOLA 31--1 177 199 mamm signif lacta, evol of mamm pond,cm 1977