TOPIC 5. EXCRETORY SYSTEM FUNCTIONS

Excretion of unused forage components and waste products of metabolism is an important function since regularity is necessary to avoid build-up of potentially toxic substances.

Urine and feces are the two main kinds of materials excreted from the body of wild ruminants. Gas production also occurs, and waste materials are sloughed off the skin and hair. These waste products should be considered when evaluating the metabolic costs of maintenance; they are discussed in later chapters.

Urine and feces are discharged directly from the excretory system in measurable quantities that can be related to water and forage intake. The difference between ingestion and excretion represents some level of metabolic efficiency. There are many details to consider when evaluating efficiencies, however, since the components of excretory products come from both ingestion and metabolic sources.

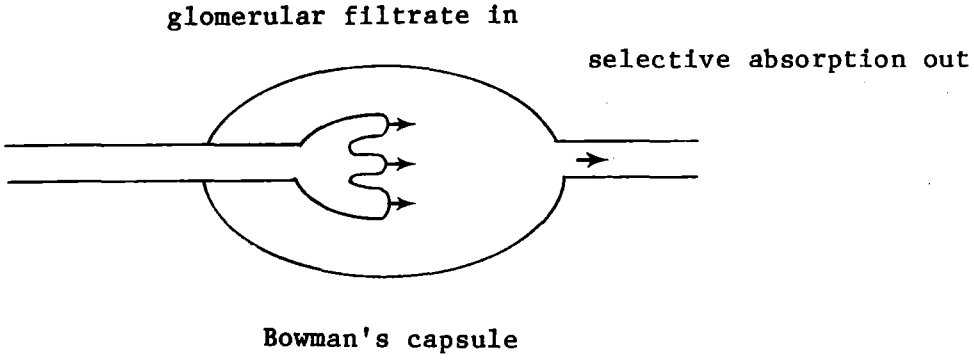
Few research studies have been completed in the excretory functions of wild ruminants. The basic functions behind urine and feces excretion are discussed in UNITS 5.1 and 5.2. Some of the more practical uses of fecal excretion characteristics is in estimating populations, but this is discussed in CHAPTER 19.

UNIT 5.1: URINARY FUNCTIONS

Water and salt balances are maintained as a result of the actions of the kidneys in regulating the amount and concentration of the urine. It is the only organ capable of regulating the movements of water and salts between the environmental medium and the fluid compartments of the body (McCauley 1971:158). Water loss also occurs in the feces, but this is quite constant, and through the skin. Neither of these two pathways are capable of regulating water balance, however, fecal water losses are fairly constant, and the losses through the skin vary in relation to thermal energy balance rather than water balance. Thus dehydration occurs when temperatures are excessive and water losses through the skin high.

The functional unit in the kidney is the nephron. It is richly supplied with blood, and differences in blood pressure within the glomerulus result in fluid, called glomerular filtrate, collecting in the cavity of Bowman's capsule. Reabsorption by active transport then occurs, resulting in the reclaiming of useful materials such as sugars and amino acids, and waste products are allowed to pass into the rumen. These and other details of renal function are described in McCauley (1971:153-168).

A schematic drawing of kidney function is shown below.



Note that urea may be reabsorbed rather than eliminated by the ruminant, resulting in the conservation of nitrogen as an aid in protein metabolism when the range is low in protein.

The recycling of urea is an example of resource conservation by free-ranging animals, illustrating how the resource economy may be maintained over time, thereby maintaining a higher level of productivity than would be the case if resource transactions were made on a short-term basis only.

LITERATURE CITED

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

REFERENCES, UNIT 5.1

URINARY FUNCTIONS

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JANSA	38--1	186	191	odvi	nitrogen metabolis, whit-t	robbins,ct; prio/	1974
JWMAA	39--2	346	354	odvi	blood prot, gestatio, suck	harstook,ew; whe/	1975
JWMAA	39--4	692	698	odvi	ener, prot, blood urea nit	kirkpatrick,rl; /	1975
JWMAA	42--4	776	790	odvi	diet prot, energ fawn meta	verme,lj; ozoga,j	1978
JWMAA	43--2	454	460	odvi	season, nutri, serum nitro	bahnak,br; holla/	1979

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JAVMA	155-7	1085	1085	odhe	urine-collect device, male	richmond,m; pill/	1969

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
NZJSA	13--4	663	668	ceel	kidney wt, kidne fat index	batcheler,cl; cl/	1970

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
BIJOA	155-3	549	566	alal	ceel, chymotrypsin, pancre	lindsay,rm; steve	1976

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	39--2	379	386	rata	kidney wt fluct, fat index	dauphine,tc,jr	1975

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

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

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

ANREA 169-2 343 343 ovca observ kidney, desert bigh horst,r; langwort 1971

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

JANSA 35--6 1271 1274 dosh eff wat restric nutrnt dig asplund,jm; pfand 1972

UNIT 5.2: FECAL FUNCTIONS

The feces of ruminants contain water, undigested forage residues, cells that have been abraded from the gastrointestinal tract, bacteria, products of rumen fermentation, and other products of physiological processes such as bile acids, pigments, mucin, and inorganic salts. Large amounts of feces are defecated by ruminants because so much of the forage ingested is not digested. The more lignified the forage material is, the less it can be digested. Fecal samples may be used as a technique for estimating dietary composition by identifying fragments.

The water content of ruminant feces varies seasonally. Succulent spring forage is high in water content, and feces have little or no form. At other times, especially in the winter, the feces are quite dry and, in many species, formed into small pellets which are defected as pellet groups.

The excretion of rather dry pellet groups, composed largely of indigestible forage, has been used by biologists as a field method for estimating populations. If a known member of pellet groups are defecated per animal each day, then the number of pellet groups divided by the number defecated per day is an estimate of the number of animal-days of use. Such estimates may not be very precise due to sampling errors in counting pellet groups in the field and variations in the number of pellet groups defecated per day. This technique is discussed further in CHAPTER 19.

REFERENCES, UNIT 5.2

FECAL FUNCTIONS

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	33--3	506	510	od	qual ident forage remnants	zyznar,e; urness,	1969

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JRMGA	30--1	61	63	odvi	chrom oxid indic fecal out	ruggiero,lf; whel	1977
JRMGA	32--2	93	97	odvi	infl brush control on diet	quinton,da; hore/	1979
JWMAA	26--1	50	55	odvi	rain, count of pellet grou	wallmo,oc; jacks/	1962
VJSCA	23--3	116	116	odvi	dosh chrmicoxide fecal out	sanders,ot skee/	1972

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JRMGA	30--2	116	118	odhe	food, wld hors, doca, colo	hansen,rm; clark/	1977

odhe continued on the next page

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	28--3	435	444	odhe	defecation rates of mule d	smith,ad	1964
JWMAA	31--1	190	191	odhe	anam, id fecal gr, pH anal	howard,vw,jr	1967
JWMAA	32--4	961	962	odhe	fecal ph values, dom sheep	nagy,jg; gilbert,	1968
JWMAA	43--2	563	564	odhe	number pellets per defecat	strong,ll; freddy	1979
JWMAA	32--4	961	962	odhe	fecal ph values, dom sheep	nagy jg; gilbert,	1968
SWNAA	13--2	159	166	odhe	food plants, habitat, okla	clark,tw	1968

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	29--2	406	407	ceel	determinat defecation rate	neff,dj; wallmo,/	1965
JWMAA	41--1	76	80	ceel	foods of ungulates, colora	hansen,rm; clark,	1977

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	40--2	374	375	alal	dail wint pell gr, bed, al	franzmann,aw; ar/	1976
NCANA	95--5	1153	1157	alal	[numb pellet-gro each day]	desmeules,p	1968

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
GRBNA	38--2	222	224	anam	sim bet prong, odhe fec pe	johnson,mk; maccr	1978
JRMGA	32--4	275	279	anam	fec, rum, util meths, diet	smith,ad; shandru	1979
JRMGA	32--5	365	368	anam	livest, foods, dese steppe	johnson,mk	1979
JWMAA	40--3	469	478	anam	diets, forag avail, colora	schwartz,cc; nagy	1976

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	42--3	581	590	bibi	diet, sl rvr herd, nw terr	reynolds,hw; han/	1978

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	37--3	363	366	ovca	food hab, plant frag, fece	todd,jw; hansen,r	1973
JWMAA	39--1	108	111	ovca	food of, southern colorado	todd,jw	1975

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
CWOPA	35--1	1	19	obmo	rata, diets, canadi arctic	parker,gr	1978

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

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JZOOA	185--	270	273	dosh	caca, comparison wint diet	henry,bam	1978

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS	AUTHORS	YEAR
JWMAA	43--3	796	798	ungu	fecal ph compar, 3 species	peek,jm; keay,ja	1979