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pine voles, *Microtus pinetorum*. Behav. Ecol. Sociobiol., 13:183–187.

HRDY, S. 1974. Male-male competition and infanticide among the langurs (*Presbytis entellus*) of Abu, Rajasthan. Folia Primat., 22:19–58.

LABOV, J. B. 1980. Factors influencing infanticidal behavior in wild house mice (*Mus musculus*). Behav. Ecol. Sociobiol., 6:297–303.

MALLORY, F. F., AND R. J. BROOKS. 1978. Infanticide and other reproductive strategies in the collared lemming, *Dicrostonyx groenlandicus*. Nature, 273:144–146.

MILLIGAN, S. R., H. M. CHARLTON, AND E. VERSI. 1979. Evidence for a coitally controlled "mnemonic" involved in luteal function in the vole (*Microtus agrestis*). J. Reprod. Fert., 57:227–233.

SCHADLER, M. H. 1981. Postimplantation abortion in pine voles (*Microtus pinetorum*) induced by strange males and pheromones of strange males. Biol. Reprod., 25:295–297.

———. 1982. Strange males block pregnancy in lactating pine voles, *Microtus pinetorum*, and reduce survival and growth of nursing young. Pp. 132–138, *in* Proceedings of the Sixth Eastern Pine and Meadow Vole Symposium. Harpers Ferry, WV, March 1982, 147pp.

———. 1983. Male siblings inhibit reproductive activity in female pine voles, *Microtus pinetorum*. Biol. Reprod., 28:1137–1139.

SCHADLER, M. H., AND G. M. BUTTERSTEIN. 1979. Reproduction in the pine vole, *Microtus pinetorum*. J. Mamm., 60:841–844.

SCHWAGMEYER, P. L. 1979. The Bruce effect: an evaluation of male/female advantages. Amer. Nat., 114:932–938.

VOM SAAL, F. S., AND L. S. HOWARD. 1982. The regulation of infanticide and parental behavior: implications for reproductive success in male mice. Science, 215:1270–1271.

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OVERLAP IN WINTER DIETS OF SYMPATRIC MOOSE AND WHITE-TAILED DEER IN MAINE

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Food habits of moose (*Alces alces*) (Belovsky, 1981; Joyal, 1976; Oldenmeyer, 1974; Peek et al., 1976; Peterson, 1955) and white-tailed deer (*Odocoileus virginianus*) (Banasiak, 1961; Crawford, 1982; Huot, 1974) are well-documented. However, these species tend not to concentrate in the same areas during winter (Irwin, 1975; Telfer, 1970, 1972); thus, information on their diets in zones of overlap are sparse. The purpose of this study was to quantify the winter diets of sympatric populations of moose and white-tailed deer.

Research was conducted in Baxter State Park, Piscataquis Co., Maine (45°50'N, 68°54'W) at an elevation of 244 m in a 6 km^2 area along Roaring Brook Road in the southern portion of the park. Vegetation was a softwood-hardwood mix; balsam fir (*Abies balsamea*) is the dominant species. Aspen (*Populus* spp.) and beech (*Fagus grandifolia*) were more common at higher elevations. Other abundant species included moosewood (*Viburnum alnifolium*), striped and mountain maple (*Acer pensylvanicum* and *A. spicatum*), white spruce (*Picea glauca*), and white pine (*Pinus strobus*).

Moose and white-tailed deer feces were collected from January–March 1984 in an area where both herbivores occurred. Thirty fecal groups each for moose and deer were frozen and stored separately until ready for laboratory preparation. Feces were then oven dried at 50°C for 24 h and ground with an all-purpose mill. Particle size was standardized by sifting fragments through a 40-mesh (0.5 mm) screen and then rinsing sifted feces through a nylon stocking with tap water. The residue was simmered in hot water with detergent for 1 h. Samples were rinsed through a stocking again and placed in 5% sodium hypochlorite for 24 h. Samples were rinsed with tapwater and stored in 70% methanol prior to mounting; fecal fragments from each pellet group were spread evenly over one slide and mounted in glycerin jelly. On each slide six microscope fields, 5 cm in length, were examined at 100×. Plant fragments were identified by comparison with a reference collection. A mean of 187 plant fragments (SD = 80) were identified for each of 60 slides. Percent relative frequency was determined from the number of fragments for a particular species relative to the total number of fragments identified.

Microhistological examination of plant epidermis recovered from herbivore feces has been used widely

TABLE 1.—*Percent relative frequency of plant species in winter diets of sympatric moose and white-tailed deer in Baxter State Park, Piscataquis Co., Maine, during January-March 1984 determined from 30 fecal groups for each ungulate.*

Plant species	Moose			White-tailed deer		
	$\bar{X}$	SE	Range	$\bar{X}$	SE	Range
Abies balsamea	70.5	1.7	51.6–88.4	14.6	2.3	0.0–43.1
Acer negundo	0.3	0.2	0.0–2.9	1.7	0.3	0.0–5.8
Crategeous sp.	9.3	1.3	0.0–23.9	17.3	3.3	1.0–67.7
Fagus grandifolia	11.4	1.2	0.0–26.8	17.9	0.8	0.0–21.7
Hamamelis virginiana	0.0	0.0	0.0	0.6	0.3	0.0–7.0
Juniperus communis	0.0	0.0	0.0	0.2	0.2	0.0–4.5
Larix laricina	0.0	0.0	0.0	3.5	0.8	0.0–17.1
Ostrya virginiana	0.0	0.0	0.0	0.1	0.1	0.0–2.5
Picea glauca	2.2	0.5	0.0–11.8	34.6	2.6	9.7–63.9
Pinus strobus	0.0	0.0	0.0	2.2	0.4	0.0–9.4
Populus balsamifera	0.0	0.0	0.0	0.3	0.1	0.0–1.9
Populus grandidentata	2.4	1.2	0.0–24.0	0.0	0.0	0.0
Populus tremuloides	0.1	<0.1	0.0–0.7	0.0	0.0	0.0
Rhus radicans	3.0	0.6	0.0–15.7	6.6	0.9	1.3–25.1
Rubus idaeus	0.0	0.0	0.0	0.1	<0.1	0.0–1.6
Thusa occidentalis	0.1	0.1	0.0–1.6	0.0	0.0	0.0
Tsuga canadensis	0.1	0.1	0.0–1.5	0.0	0.0	0.0
Viburnum alnifolium	<0.1	<0.1	0.0–0.8	0.0	0.0	0.0

in studies of food habits (Holechek et al., 1982). Anthony and Smith (1974) noted that 15 samples were sufficient to describe seasonal food habits of deer. Problems in analysis have arisen with this technique in comparing forage classes with differential digestibilities (Fitzgerald and Waddington, 1979; Gill et al., 1983; McInnis et al., 1983); this source of bias was minimized in our study because winter diets of moose and white-tailed deer were composed largely of browse species with similar digestibilities (Mautz et al., 1976). A two-sample Z-test for proportions (Remington and Schork, 1970) was used to test for differences in the food habits of moose and white-tailed deer.

Moose ingested 11 species and white-tailed deer 13 species of browse during winter; 7 species of trees and shrubs were common to the diets of both herbivores (Table 1). Sorenson's similarity coefficient (Greig-Smith, 1964) of 50.0% indicated some overlap in winter diets of these mammals. However, this procedure considered only the number of species consumed and did not evaluate differences in the frequency with which species were eaten. Thus, Schoener's (1968) overlap value also was calculated and indicated a 41.2% similarity in diets.

Moose consumed 72.9% conifers and white-tailed deer 55.1%, but this difference was not significant ($Z = 1.46$, $P > 0.14$). Pair-comparisons of all food items in the diets of moose and white-tailed deer (Table 1) showed significant differences only in the greater use of balsam fir by moose ($Z = 5.32$, $P < 0.001$) and the greater consumption of white spruce ($Z = 3.72$, $P < 0.001$) by white-tailed deer.

Differences in requirements for winter cover contributed to variation in diets of moose and white-tailed deer in boreal forests. Deer wintering areas often include cedar swamps, white spruce forests, and stands of large hemlocks (Crawford, 1982; Rounds, 1981), whereas moose tend to favor areas with abundant balsam fir (Kearney and Gilbert, 1976; Rounds, 1981).

Nudds (1980) argued that availability of forage species in deer wintering areas may be more important in determining diet selection than the nutritional content of the food. Apparently low availability of white cedar and eastern hemlock in the local areas of herbivore overlap may explain the absence of these foods in the diet of white-tailed deer (Table 1); these species are important winter forages for deer in other regions of Maine (Banasiak, 1961; Crawford, 1982).

Peterson (1955) suggested that competiton for winter browse between moose and white-tailed deer should be intense because allopatric populations of these ungulates consumed similar forages. Balsam fir is important winter forage for moose (Joyal, 1976; Peterson, 1955; Prescott, 1974; Rounds, 1981) but is considered a starvation diet for white-tailed deer (Banasiak, 1961; Peterson, 1955). Although some dietary overlap occurred, significant differences in the use of balsam fir and white spruce during winter occurred for sympatric populations of these herbivores in Maine.

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Literature Cited

ANTHONY, R. G., AND N. S. SMITH. 1974. Comparison of rumen and fecal analysis to describe deer diets. J. Wildl. Mgmt., 38:535–540.

BANASIAK, C. F. 1961. Deer in Maine. Bull. Maine Dept. Inland Fish. and Wildl. Game, 6:1–159.

BELOVSKY, G. E. 1981. Food plant selection by a generalist herbivore: the moose. Ecology, 62:1020–1030.

CRAWFORD, H. S. 1982. Seasonal food selection and digestibility by tame white-tailed deer in central Maine. J. Wildl. Mgmt., 46:974–982.

FITZGERALD, A. E., AND D. C. WADDINGTON. 1979. Comparison of two methods of fecal analysis of herbivore diet. J. Wildl. Mgmt. 43:468–473.

GILL, R. B., L. H. CARPENTER, R. M. BARTMANN, D. L. BAKER, AND G. G. SCHOONVELD. 1983. Fecal analysis to estimate mule deer diets. J. Wildl. Mgmt., 47:902–915.

GREIG-SMITH, P. 1964. Quantitative plant ecology. Butterworths, London, 265 pp.

HUOT, J. 1974. Winter habitat of white-tailed deer at Thirty-one Mile Lake, Quebec. Canadian Field-Nat., 88:293–301.

HOLECHEK, J. L., B. GROSS, AND R. D. PIEPER. 1982. Botanical composition determination of range herbivore diets: a review. J. Range Mgmt., 35: 309–315.

IRWIN, L. L. 1975. Deer-moose relationships in a burn in North-Eastern Minnesota. J. Wild. Mgmt., 39:653–662.

JOYAL, R. 1976. Winter foods of moose in La Verendrye Park, Quebec: an evaluation of two browse survey methods. Canadian J. Zool. 54:1764–1770.

KEARNEY, S. R., AND F. F. GILBERT. 1976. Habitat use by white-tailed deer and moose on sympatric range. J. Wildl. Mgmt., 40:645–657.

MCINNIS, M. L., M. VAVRA, AND W. C. KRUEGER. 1983. A comparison of four methods used to determine the diets of large herbivores. J. Range Mgmt., 36:302–306.

MAUTZ, W. M., H. SILVER, J. B. HOLTER, H. H. HAYES, AND W. E. URBAN, JR. 1976. Digestibility and related nutritional data for seven northern deer browse species. J. Wildl. Mgmt., 40:630–638.

NUDDS, T. D. 1980. Forage "preference": theoretical considerations of diet selection by deer. J. Wildl. Mgmt., 44:735–740.

OLDENMEYER, J. L. 1974. Nutritive value of moose forage. Nat. Canadian, 101:217–226.

PEEK, J. M., D. L. URICH, AND R. J. MACKIE. 1976. Moose habitat selection and relationships to forest management in northeastern Minnesota. Wildl. Monogr., 48:1–65.

PETERSON, R. L. 1955. North American moose. Univ. Toronto Press, Toronto, 280 pp.

PRESCOTT, W. H. 1974. Interrelationships of moose and deer of the genus *Odocoileus*. Nat. Canadian, 101:493–504.

REMINGTON, R. D., AND M. A. SCHORK. 1970. Statistics with applications to the biological and health sciences. Prentice-Hall, Englewood Cliffs, New Jersey, 418 pp.

ROUNDS, R. C. 1981. First approximation of habitat selectivity of ungulates on extensive winter ranges. J. Wildl. Mgmt., 45:187–196.

SCHOENER, T. W. 1968. The anolis lizards of Bimini: resource partitioning in a complex fauna. Ecology, 49:704–726.

TELFER, E. S. 1970. Winter habitat selection by moose and white-tailed deer. J. Wildl. Mgmt., 34: 553–559.

———. 1972. Association measures applied to moose and white-tailed deer distributions. J. Mamm., 53:196–197.

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SCANNING BEHAVIOR OF HARBOR SEALS ON HAUL-OUT SITES

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Harbor seals (*Phoca vitulina concolor*) in the Bay of Fundy haul out onto isolated rocks or beaches near low tide (Terhune and Almon, 1983). Near Saint John, New Brunswick, these groups were as large as 56 during 1982, but single animals were most common (14.9%, $n = 457$) and the frequency of observation