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FOOD HABITS OF SITKA BLACK-TAILED DEER IN SOUTHEASTERN ALASKA

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SUMMARY

From January to March 1981, 18 deer were collected from Admiralty and east Chichagof Islands. Rumen and fecal samples from the same deer were analyzed and compared for diet composition. Both techniques provided generally similar results; however, fecal analysis tended to underestimate forbs and ferns and overestimate grasses, mosses, and conifers.

Deer diet composition was determined by fecal analysis for Hawk Inlet and Winning Cove, Admiralty Island, from November 1980 to May 1982. Between-site comparisons and between-year comparisons in seasonal diet composition were made. Deer utilized a variety of forage species throughout the year, but preferred herbaceous forage when available and substantially increased their consumption of conifers, shrubs, and lichens when herbaceous forage was unavailable. Preference for herbaceous forage corresponds to differences in forage quality. When available, *Cornus* and *Rubus* were the most utilized winter species.

Key words: food habits, Sitka black-tailed deer, southeastern Alaska.

CONTENTS

BACKGROUND

Knowledge of seasonal diet preferences and nutritional requirements is important in understanding the habitat requirements of any species. Few quantitative data are available on the plant species composition of diets selected by Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) in Alaska. Klein (1963) identified, through rumen analysis, a number of summer forage species utilized by deer, and Pierce (1981) utilized fecal analysis to describe seasonal food habits of deer from Prince of Wales Island.

Early studies suggested that *Vaccinium* spp. were of major importance in determining winter deer carrying capacity (Olson 1952; Klein 1957; Olson and Klein 1959; Merriam and Batchelor 1963; Merriam 1965, 1967, 1968). More recently, however, evergreen forbs (i.e., *Cornus canadensis, Rubus pedatus, Coptis asplenifolia*) have been identified as important winter forage species for deer (Merriam 1970, 1971, Schoen and Wallmo 1979; Regelin 1979). This report provides additional insight into diet composition and preference of Sitka black-tailed deer.

OBJECTIVES

To evaluate rumen and fecal analysis techniques for diet determination and describe winter diet composition of deer from Admiralty Island.

STUDY AREA

The data reported here were collected from Tenakee Inlet on Chichagof Island, and Hawk Inlet and Winning Cove on northern Admiralty Island, Southeast Alaska. These areas are dominated by old-growth Sitka spruce (*Picea sitchensis*)-western hemlock (*Tsuga heterophylla*) forests and have been described in detail by Schoen et al. (1979).

The winters of 1980-81 and 1981-82 offer an interesting contrast; the former was unusually mild with low snow accumulation and the latter relatively severe. Mean monthly temperatures (°C), January through March, were 3.1, 0.4, and 4.1 during 1981, and -10.1, -5.9, and -0.1 during 1982. Total snow fall during this same period was 49 cm in 1981 and 272 cm in 1982 (from NOAA climatological data).

PROCEDURES

From January through March 1981, deer were collected on Admiralty and northwest Chichagof Islands. Deer were collected with a rifle in the forest or on the beach. Whole rumen-reticulums and 20 fecal pellets were collected from each animal and frozen.

Two 100-200 ml samples were taken from each thawed and mixed rumen-reticulum contents. These samples were washed through 2.0 mm screens, oven-dried, and the plant species separated. Rumen species composition was calculated as percent oven-dry weight. Fecal samples were prepared by mixing and washing through a 0.074 mm screen; 5 slides/sample were prepared according to Sparks and Malechek (1968). Frequency of occurrence of plant species (20 fields/slide) was calculated and converted to percent relative density (Sparks and Malechek 1968).

From November 1980 through April and October 1981, fresh fecal samples were collected monthly in Winning Cove and Hawk Inlet on Admiralty Island (T. Hanley and G. Fisch, unpubl. data). Additional fecal samples were collected in Hawk Inlet from November 1981 through May 1982. Monthly samples consisting of 2 pellets from approximately 20 pellet groups, when available, were frozen and then analyzed as described above.

RESULTS AND DISCUSSION

During the mild winter of 1981, evergreen forbs (*Cornus, Rubus, and Coptis*) were the most abundant forage species in both rumen (50%) and fecal (36%) samples. In comparison, *Vaccinium* made up only 4 and 5% of rumen and fecal samples, respectively, while conifers accounted for 18 and 29%, respectively. Although both techniques produced similar results, fecal analysis tended to underestimate forbs and ferns and overestimate grasses, mosses, and conifers (T. Hanley, D. Spallinger, K. Hanley, and J. Schoen, unpubl. ms.).

Diet composition was determined by fecal analysis for Hawk Inlet and Winning Cove from November 1980 to May 1982 and is presented by species and month (Appendix A, Tables 1-3).

Deer diet composition by forage class and season was determined in 1980-81 for Hawk Inlet and Winning Cove (Table 1). Conifers, forbs, and shrubs, in that order, were most utilized in fall.

Snow accumulation during December reduced forb availability and utilization during that month (Appendix A). *Cornus* and *Rubus* were the species most heavily utilized except during December when *Tsuga* accounted for about 50% of the diet (Appendix A). Lichens, mosses, and ferns accounted for about 15% of the diet and were utilized nearly equally. Fall diets were generally similar between Hawk Inlet and Winning Cove.

The greatest between-site differences occurred in the winter diet. At Hawk Inlet, forbs (primarily *Cornus* and *Rubus*) made up 44% of the diet, conifers (*Tsuga*) 16%, and shrubs (primarily *Vaccinium*) 6%. Unknown forbs and shrubs made up an additional 20%. Use of other forage classes was similar to fall. At Winning Cove, in constrast, conifers (primarily *Tsuga*) dominated the diet (49%), while forbs represented only 18% of the winter diet. Use of other forage classes at Winning Cove was similar to Hawk Inlet. Diet composition was compared with indices of forage availability at both sites (T. Hanley and G. Fisch, unpubl. data). This comparison indicated the biomass of forbs and shrubs at their Winning Cove site was only about half that of the Hawk Inlet site and that perhaps the higher use of conifers reflected relative availability.

During spring, forbs ranked first in diet composition at both Hawk Inlet (39%) and Winning Cove (26%). The evergreen forbs *Cornus* and *Rubus* continued to dominate this forage class. Use of shrubs increased in spring at both Hawk Inlet (30%) and Winning Cove (10%). *Vaccinium* and *Oplopanax* were the shrubs most utilized. At Winning Cove, unknown forbs and shrubs made up 39% of the diet.

Summer diet composition was determined only for Hawk Inlet. Forbs represented 56% of the diet. During July, August, and September, *Lysichiton*, *Rubus*, and *Cornus* made up 46% of the summer diet (Appendix A). Shrubs were of lower importance, representing 21% of the summer diet. Of the shrubs, *Alnus* received the greatest use during this period, followed by *Oplopanax*, *Menziesia*, and *Vaccinium* (Appendix A).

The data presented here on summer diets were derived from fecal pellets collected from low-elevation forested habitat. This probably represents diet composition of resident deer. During summer, a major component of the population migrates to higher elevation forest, subalpine, and alpine habitats (Schoen et al. 1981, 1982) and their diets likely differ in individual species composition from the diets reported here. Forbs are likely a major component of the summer diet of migratory deer. Our observation of deer use of subalpine ranges as well as gross evaluation of summer rumen contents of subalpine deer suggest that *Fauria* is a major forage species. Klein (1965, 1979) has indicated the importance of herbaceous plants during summer, especially *Caltha* and *Fauria*.

The diet composition of Hawk Inlet deer from November through May was compared between 2 winters of contrasting snow conditions (Table 2). During November and December both years, the diet was generally similar, although conifers and shrubs were more heavily utilized than forbs in 1980, while the reverse occurred in 1981. This selection use reflected accumulated snow during December 1980 and generally snow-free conditions throughout November and December 1981.

Comparison of late winter 1981 and 1982 is most revealing. During the snow-free conditions of February and March 1981, forbs made up 44% of the diet, while conifers and shrubs combined accounted for 22%. The following winter with substantial snow accumulation, forbs represented only 1% of the January and March diet composition, while conifers made up 56% of the diet, followed by shrubs at 26%. Use of lichens increased from 3 to 12%; use of ferns decreased from 4 to 0%. As availability of the herb layer evergreen forbs and ferns was reduced, deer increased their use of conifers, shrubs, and lichens. Under the comparatively heavy snow conditions of 1982, *Tsuga* (54%) and *Vaccinium* (25%) made up the bulk of the winter diet (Appendix A).

The preceding data were derived from fecal material collected at elevations below 300 m. On 4 March 1982, a sample of fecal pellets was collected between 300 and 450 m elevation and analyzed separately (Appendix A). The composition of this sample was dominated by lichens (43%), followed by *Tsuga* (29%), and *Vaccinium* (21%). The snow depth at this elevation was greater than 75 cm (J. Schoen and M. Kirchhoff, unpubl. data), and most forage plants except conifers, some tall shrubs, and lichens were buried under snow.

During spring, the same general between-year pattern observed in the winter diet continued, although use of forbs and ferns began to increase as snow melted.

These data indicate a strong selection for herb layer forage when it is available, and increasing utilization of shrubs, conifers, and lichens with increasing snow. Utilizing these same data relative to forage availability, T. Hanley and G. Fisch (unpubl. data) found that deer prefer herbs, shrubs, and conifers in that order. This preference reflects the nutritional value of these forage classes (Hanley and McKendrick, in press).

The evergreen forbs *Cornus* and *Rubus* dominated the herbaceous component of deer diets. The nutritional quality of these species is relatively high compared to other winter forage species (Schoen and Wallmo 1979; Hanley and McKendrick, in press). Alaback (1982) found the abundance of *Cornus* and *Rubus* to be nearly comparable in old growth and clearcuts, while they were greatly reduced in even-aged 2nd growth. During periods of light-to-moderate snow accumulation, however, the availability of these species is much greater in old growth which, because of canopy interception, accumulates less snow on the forest floor.

During winter 1982, we received a Sitka black-tailed deer (male, fawn) in near-starvation condition. The deer was rehabilitated and habituated to human handling over a period of 6 weeks. This provided us an opportunity to observe at close range winter-spring foraging of an unrestrained Sitka black-tail. In an old-growth forest with patchy snow cover <30 cm in depth, this deer primarily utilized *Tsuga*, *Cornus*, *Rubus*, *Vaccinium*, arboreal lichens, and *Lysichiton*. Arboreal lichens (*Usnea* and/or *Alectoria*) were especially preferred and were sought out wherever they occurred on shrubs or the forest floor. Next in preference were the evergreen forbs *Cornus* and *Rubus*. Later in spring as new shoots of *Lysichiton* became available, it became the species most preferred.

On Prince of Wales Island in winter, percent diet composition of deer included *Chamaecyparis* and/or *Thuja*, *Vaccinium*, *Tsuga*, *Cornus*, ferns, and lichens in that order (Pierce 1981). Pierce (1981) found that cedar and *Vaccinium* were utilized more throughout the year than our data indicated. *Thuja* does not occur as far north as Admiralty Island and *Chamaecyparis* was not common at either of the Admiralty study sites. *Chamaecyparis* was common on Chichagof Island, however, and composed a significant component of the diet in that area. Extensive winter deer utilization of conifers, primarily cedars and hemlocks, has been reported from Washington, British Columbia, and Alaska (Brown 1961, Cowan 1945, Gates 1968, Jones 1975, Rochelle 1980, Klein 1979, Pierce 1981).

The increase in lichen utilization during periods of extensive snow accumulation corresponds with data on winter deer diets from Vancouver Island, British Columbia (Cowan 1945, Jones 1975, Rochelle 1980). The abundance of arboreal lichens (primarily *Alectoria*) has been considered an important aspect in determining critical winter deer range on Vancouver Island (Bunnel 1979, Hebert 1979). Lichen litterfall was nearly equal to quantities of available rooted vegetation in some old-growth stands on Vancouver Island and made up a significant portion of the winter diet of deer (Rochelle 1980). Lichens were determined by Rochelle (1980) to be the most digestible winter deer forage and appeared to have an enhancement effect on other components of mixed deer diets. Arboreal lichens are most abundant in old-growth forests, scarce in even-aged second growth, and virtually absent in clearcuts.

Within old-growth habitats, where most winter deer use occurs, winter use is most closely related to the understory species *Cornus*, *Rubus*, and *Vaccinium* which are typically associated with well-drained hemlock stands (Schoen et al. 1981, 1982). During winters with average-to-moderate snow accumulation, herbaceous forage is probably more available in these mid- to high-volume hemlock stands. In contrast, snow depth is greater in low-volume stands (Bloom 1978, Schoen and Kirchhoff 1982) and spruce stands (Schoen and Kirchhoff 1982), and availability of herbaceous vegetation is presumably reduced. During late spring and summer,

however, deer use of old-growth habitat shifts toward more open canopy, lower volume stands and high spruce stands with *Oplopanax* understories. This movement is reflected in changing diet composition in spring.

During summer and early fall, forage resources are generally unlimited. Deer are widely distributed but prefer subalpine and alpine habitats where herbaceous forage is abundant. Winter and early spring are the most restrictive periods for deer, with snow generally limiting them to low-elevation, old-growth forest habitats. Forage in clearcuts is often buried under deep snow and unavailable at this time, and even-aged 2nd growth is essentially devoid of herbaceous evergreen forage or deciduous shrubs. Within old-growth habitats, variety is an important quality of deer range, providing an opportunity for deer to exploit the highest quality forage available throughout a variety of seasonal and climatic conditions.

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Table 1. Between-site comparison of seasonal deer diet (% fecal composition) by forage class for Hawk Inlet and Winning Cove, 1980-81.

Forage class	Hawk Inlet				Winning Cove		
	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Conifer	28	16	9	5	36	49	9
Shrub	18	6	30	21	6	5	10
Forb	27	44	39	56	32	18	26
Unknown forb-shrub	8	20	11	9	8	8	39
Lichen	5	3	2	1	5	3	2
Moss	6	6	3	4	4	5	4
Fern	6	4	1	2	6	4	6
Grasses	1	0	2	3	4	2	2
Fucus	1	2	2	1	0	3	1

Table 2. Between-year comparison of deer diet (% fecal composition) by forage class for Hawk Inlet during fall, winter, and spring 1980-81 and 1981-82.

	Fall		Winter		Spring	
	(Nov.-Dec.)		(Feb.-Mar.)	(Jan.-Mar.)	(Apr.-May)	
Forage class	1980	1981	1981	1982	1981	1982
Conifer	34	22	16	56	10	22
Shrub	22	12	6	26	34	23
Forb	23	32	44	1	34	11
Unknown forb-shrub	5	12	20	0	10	11
Lichen	4	6	3	12	2	14
Moss	6	6	6	4	4	16
Fern	4	8	4	0	2	4
Grasses	2	1	2	2	2	1
Fucus	2	2	2	1	2	2
Other	0	1	0	1	0	0

APPENDIX A. Table 1. Monthly diet (% fecal composition) of deer by forage species, Hawk Inlet, 1980-81.

Forage species	Nov.	Dec.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
Tsuga sp.	17	48	15	17	17	3	7	3	3	7	16
Picea sitchensis		2								1	
Alnus sp.	1		1				2	4	13	11	6
Vaccinium sp.-stem	4	39	7	4	29	9	5				2
Vaccinium sp.-leaf	1		1			2	1	1	2	1	
Menziesia ferruginea						2	1	3	3	2	
Oplopanax horridum						26	14	10	5	8	1
Lysichiton americanum	2		3	3	4		2	11	26	9	5
Cornus canadensis	19	1	30	17	8	37	29	10	15	12	9
Rubus pedatus	22	1	19	13	9	6	14	22	13	19	11
Coptis asplenifolia								2			1
Tiarella trifoliata	1		2	2	1			8	5	1	9
Osmorhiza purpurea						4	2	9		3	1
Other forbs								2	2		
Unidentified forbs/ shrubs	9	1	10	31	13	7	12	7	2	17	15
Lichens	3	6	3	3	5		2		2	2	5
Ferns	8		2	4	3		4	3	1	1	10
Grasses/grasslike herbs	2	1				3	2	3	3	2	1
Mosses	11	1	7	4	7	1	2	1	4	6	5
Fucus sp.	3		2	2	3	1	1	1	1	1	1

APPENDIX A. Table 2. Monthly diet (% fecal composition) of deer by forage species, Winning Cove, 1980-81.

Forage species	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Tsuga sp.	4	63	58	45	40	8
Picea sitchensis	1	3	2		1	1
Alnus sp.	1	1			1	1
Vaccinium sp.-stem		7	6	2	3	9
Vaccinium sp.-leaf	1			1		
Menziesia ferruginea	1			1		
Oplopanax horridum	1				1	
Lysichiton americanum	1			1	1	
Cornus canadensis	22	2	4	10	19	2
Rubus pedatus	32	1	1	4	7	22
Tiarella trifoliata	7			5	2	2
Unidentified forbs/ shrubs	14	2	9	13	11	39
Lichens	2	8	5	2	2	2
Ferns	10	1		10	3	6
Grasses/grasslike herbs		7	2		3	2
Mosses	3	4	5	5	5	4
Fucus sp.		1	5	1	2	1
Other		1				

APPENDIX A. Table 3. Monthly diet (% fecal composition) of deer by forage species, Hawk Inlet, 1981-82.

Forage species	Nov.	Dec.	Jan.	Mar. <300 m	Mar. >300 m	Apr.	May
Tsuga sp.	23	19	54	54	29	30	13
Picea sitchensis	1		2	2		2	
Alnus sp.	2	1	1			2	
Vaccinium sp.-stem	3	14	22	28	21	19	14
Vaccinium sp.-leaf							1
Menziesia ferruginea			1				
Oplopanax horridum	2						
Other shrubs	1		1				
Lysichiton americanum	4	2				1	2
Cornus canadensis	10	12				2	6
Rubus pedatus	13	12	1	1		2	7
Coptis aspleniifolia	1						
Tiarella trifoliata	6	3					
Osmorhiza purpurea	1						
Other forbs	1						2
Unidentified forbs/ shrubs	12	11				7	15
Lichens	5	8	13	10	43	17	10
Ferns	7	8					9
Grasses/grasslike herbs	2		2	1		1	
Mosses	7	5	4	4	5	14	18
Fucus sp.	1	2	1	1	1	2	1
Other		2	1				