Seasonal Food Habits of Black Bears in Great Dismal Swamp, Virginia–North Carolina

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Abstract: Food habits were determined for a black bear (*Ursus americanus*) population in Great Dismal Swamp on the Atlantic Coastal Plain. A total of 535 scats was collected from May 1984 to August 1986. Seasonal shifts in diet composition were similar to previously reported findings for black bear food habits in the southeastern United States. Diets changed from succulent, herbaceous material in the spring to soft mast and corn in the summer. Early fall diets were largely black gum (*Nyssa sylvatica*) (33%) and oak (*Quercus* spp.) (32%) mast. Late fall and winter diets were dominated by fruits of evergreen shrubs and vines. Animal foods comprised 3% of the annual diet. Four scats contained evidence of cannibalism. Management plans for Coastal Plain bear populations should include maintenance and enhancement of stands of mature gum, oaks, pocosins, and forest openings.

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Black bear populations in southeastern wetlands are threatened by habitat destruction and fragmentation. Islands of wetland habitat, such as swamps and pocosins, provide the last remaining refuges for the black bear on the Atlantic Coastal Plain (Monschein 1981, Zeveloff 1983). Food habits data on Coastal Plain black bears are accumulating, particularly in Florida (Harlow 1961; Maehr and Brady 1982, 1984*a*, *b*). However, the data of Landers et al. (1979) remain the only substantial sample of bear foods in the Coastal Plain north of Florida. Traditional corn bait sites there probably altered natural bear feeding ecology, as corn was a major food in all months (Landers et al. 1979). Great Dismal Swamp (GDS), an 850-km^2 forested wetland, contains the last breeding population of black bears in eastern

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Virginia and extreme northeastern North Carolina. Lack of information on this bear population is the major constraint to proper bear management in GDS National Wildlife Refuge (GDSNWR), which occupies the core of the GDS (USFWS 1986). A limited survey of fall and winter food habits of black bears in GDSNWR is the only data available (Daniel 1978). Food habits information provides valuable input to management planning for black bears. As part of a larger study examining ecology of the GDS population (Hellgren 1988), our objective was to describe food habits of black bears in GDS.

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Materials and Methods

Study Area

Work was conducted from April 1984 to August 1986 on the 440 km^2 GDSNWR as well as the 57.5 km^2 North Carolina Dismal Swamp State Park and adjacent privately owned land. The entire study area was 555 km^2. GDS is a forested wetland located on the Virginia-North Carolina border on the mid-Atlantic Coastal Plain. Circular Lake Drummond, about 4 km in diameter, is located centrally within the Swamp. An west-east gradient of about 19 cm/km characterizes the generally flat Swamp (Gammon and Carter 1979). Mean temperatures for January and July are 5.1 and 26.0°C, respectively (Lichtler and Walker 1979). Annual precipitation averages 120 cm, with snow light and irregular (NOAA 1984, 1985).

The vegetation composition of GDS includes several herbaceous plants, evergreen and deciduous shrubs, vines, and deciduous and evergreen, broad-leaved and needle-leaved tree species (Gammon and Carter 1979). Virtually all the timber on the entire GDS was cut beginning in the late 1700s. Besides timber harvest, the vegetative community has been disturbed by fire, ditching, drainage, and road-building. Approximately 250 km of sand or peat roads cover the study area. Roads generally have been built with spoil from ditch construction and consequently are adjacent to ditches.

Plant terminology follows Radford et al. (1968). The major forest cover type is the red maple (*Acer rubrum*)-black gum association. Other major tree species are loblolly pine (*Pinus taeda*), pond pine (*P. serotina*), and sweetgum (*Liquidambar styraciflua*). Remnant stands of bald cypress (*Taxodium distichum*)-water tupelo (*Nyssa aquatica*) and Atlantic white cedar (*Chamaecyparis thyoides*) also exist

(Gammon and Carter 1979). Dense inkberry (*Ilex glabra*)-dominated shrub communities, or pocosins, cover part of the study area southeast of Lake Drummond. Mesic stands containing oak-beech (*Fagus*) associations occur as islands within GDS and also along the western periphery.

A mixture of woodlots, agricultural areas, and urban areas surround the study area. The west edge of the study area is bordered by a mosaic of peanut, soybean, and corn fields mixed with small woodlots. The north edge is bordered by the cities of Suffolk and Portsmouth and a 6-lane highway (U.S. 58-460). Approximately 4,000 ha of Swamp occurs north of the highway and south of the James River. To the east, the study area is bordered by Dismal Swamp Canal and U.S. Highway 17. Little swampland occurs east of Dismal Swamp Canal, as agricultural and residential development has cleared most of the forest. The south edge of the study area is bordered by Highway 158 and agricultural fields. South of the highway is a large tract of privately-held swamp, which in turn is bordered to the south by U.S. Highway 17 and Albemarle Sound.

Food Habits

Bear food habits were determined through analysis of 535 scats collected incidentally to bear trapping and radiotracking. Scats found in groups, such as around daybeds, were considered 1 independent scat. Scats were placed in labelled plastic bags and frozen for later analysis. In the laboratory, samples were thawed and washed through a series of sieves to separate equal-sized particles. Contents were identified to species or lowest taxa possible. Frequency of occurrence and an ocular estimate of percent volume of individual food items were determined for scats.

Samples were summed across years because of small samples within years. Each food item was assigned an index value based on percent volume in each scat: 0 = 0%, 1 = >1%, 2 = 1–5%, 3 = 6–25%, 4 = 26–50%, 5 = 51–75%, 6 = 76 95%, and 7 = >95%. Relative amounts (aggregate percent, Martin et al. 1946) of each food item in annual and seasonal diets were determined by assigning each index value the percent corresponding to the midpoint of its particular interval. Aggregate percent values for each food item then were summed, multiplied by 100, and divided by the sum of all percent values of all food items. Daubenmire (1968) discussed the precision and use of unequal-sized classes to estimate ground coverage with large numbers of sample plots, an analogous situation to using index classes in this study. Simulation studies indicated that this technique had a positive bias of $3.9 \pm 1.1\%$($N = 75$; 4 runs) and thus provides adequate precision. Our seasonal sample sizes ranged from 64 to 140 (excluding winter). Seasons were determined by changes in plant phenology and shifts in bear food habits: spring - 1 April to June 15; early summer - 16 June to 31 July; late summer - 1 August to 15 September; early fall - 16 September to 15 November; late fall - 16 November to 15 January; winter - 16 January to 31 March.

Results and Discussion

The seasonal pattern of diet composition paralleled shifts observed in previous studies of black bear food habits in both wetland and upland habitats in the southeastern United States (Hardy 1974, Landers et al. 1979, Beeman and Pelton 1980, Eagle and Pelton 1983, Maehr and Brady 1984*a*, Smith 1985, Garner 1986) (Fig. 1). Spring diets were dominated (72%) by succulent new growth of woody plants, primarily stems and leaves of greenbriar (*Smilax* spp.) and sweetbay (*Magnolia virginiana*) (Table 1). This is the first report of intensive use of sweetbay by black bears. Grasses, particularly switchcane (*Arundinaria gigantea*), and ferns also were important (Table 1). These results parallel those seen in other southeastern wetland populations (Hardy 1974, Landers et al. 1979, Maehr and Brady 1984*a*). Debris (e.g., soil, wood slivers) made up 7% volume in spring scats. Hardy (1974) and Smith (1985) also reported a high frequency of bark and wood slivers in spring scats. Hardy (1974) suggested that these items were ingested accidentally while extracting insects from logs and stumps. The occurrence of wood slivers and insects in the same scats indicated that this was occurring in GDS. However, during April and May in our study, we found numerous Atlantic white cedar trees which had been debarked and scratched up to heights of 2 m. This sign was structurally and temporally distinct from bear marking behavior. Although we could never positively identify white cedar slivers in scats, it is possible that bears were feeding on new sapwood in the spring, as documented by Poelker and Hartwell (1973) in western Washington.

Soft mast became the dietary staple in early summer. Blackberry (*Rubus* spp.) and black cherry (*Prunus serotina*), associated with roadsides and disturbed areas,

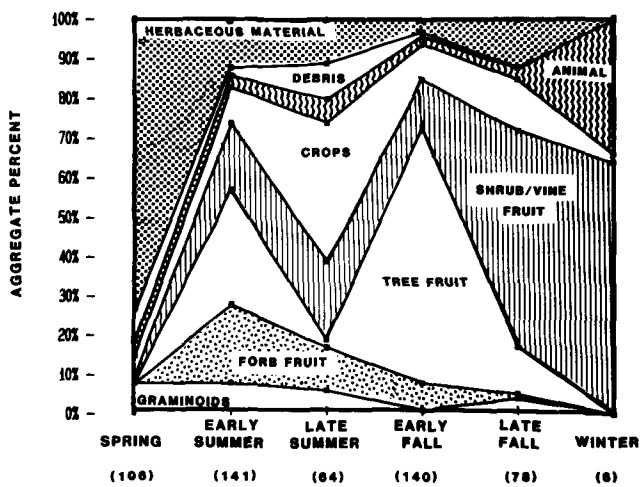

Figure 1. Seasonal variation in major components of black bear diets in Great Dismal Swamp during 1984–1986.

Table 1. Percent frequency and aggregate percentage of items identified in 535 black bear scats collected within Great Dismal Swamp, Virginia–North Carolina, 1984–1986.

	Spring ($N=106$)		Early summer ($N=141$)		Late summer ($N=64$)		Early fall ($N=140$)		Late fall ($N=78$)		Winter ($N=6$)		Entire year ($N=535$)	
Food item	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %
Graminae	21[a]	8	22	8	25	6	15	1	15	4			19	5
Forbs														
Aralia spinosa (f)[b]							16	4	3	1			5	1
Phytolacca americana (f)					17	9	7	2	13	T[c]			6	2
Rubus spp. (f)			29	18									8	5
Others			10	T	8	1	2	T					1	T
Ferns	19	2	17	2	11	1	11	1					12	1
Moss			1	T	2	T							T	T
Algae			1	T			1	1					T	T
Tree fruit														
Nyssa sylvatica			1	T	22	2	61	33	6	3			20	9
Prunus serotina			37	29	2	T							10	8
Quercus spp.							34	32	10	9			10	10
Others	5	T			4	T	5	T	1	T			1	T
Shrub fruit														
Ilex coriacea					20	7	5	1					4	1
Ilex glabra							2	1	41	30			7	5
Ilex verticillata							2	1	21	11			4	2
Vaccinium spp.	7	2	26	16									8	5
Others			1	T			2	1	11	T	17	T	2	T
Vine fruit														
Lonicera japonica									3	1			T	T
Smilax spp.	8	T	1	T	5	T	11	1	40	13	66	63	12	3
Vitis spp.			4	1	27	13	16	8					8	4

Table 1. Continued

Food item	Spring ($N = 106$)		Early summer ($N = 141$)		Late summer ($N = 64$)		Early fall ($N = 140$)		Late fall ($N = 78$)		Winter ($N = 6$)		Entire year ($N = 535$)	
	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %	% Freq.	Agg. %
Crops														
Corn (f)	2	1	9	8	37	29	9	6	8	5	17	2	11	8
Corn (h)			3	1	23	6	5	1					5	1
Peanuts					1	T	2	2	9	8			2	2
Others	5	4	3	1	23	6	5	1					6	2
Tree, shrub and vine herbaceous matter														
Magnolia virginiana[d]	43	31	6	2					3	T			11	7
Smilax spp.	38	21	14	5	9	5	4	1	21	7	50	1	17	7
Others	3	T	19	T	17	T	11	T	37	2			17	T
Animal matter														
Hymenoptera	43	2	41	1	48	5	5	T			17	T	27	1
Coleoptera	11	T	15	T	31	1	20	T	4	T			16	T
Odocoileus virginanus	2	1	6	T	3	T	2	1	12	3			5	1
Ursus americanus[e]	6	T	9	1	19	T	4	T	3	T	33	35	8	T
Unknown	2	T					1	T					1	T
Others	3	T	5	1	4	T	4	1	4	T			4	T
Debris (bark, leaf, soil, etc.)	44	8	33	2	57	9	12	T	13	T	17	T	30	3
Unidentified vegetation	39	20	26	5	11	4	11	T	20	3	17	T	22	6

[a]Percentage values are rounded to the nearest whole number.
[b]f = fruit, h = herbaceous material (stems, leaves).
[c]Indicates trace amount (<0.5 %).
[d]Spring aggregate percent estimates for *Magnolia virginiana* and *Smilax* spp. are minimum estimates. If identifiable leaf parts were found, these were included in frequency data. However, if scat contents were too finely ground to estimate individual species volumes, contents were considered unidentifiable ground vegetation.
[e]Four scats contained evidence of cannibalism (claws, bone, tissue). The remainder were associated with grooming activities.

and blueberry (*Vaccinium* spp.) were the major fruits eaten (Table 1). Vegetative plant parts decreased in dietary importance as fruits ripened. As presence of the above 3 fruits waned in late summer, other soft mast, such as pokeberry (*Phytolacca americana*), wild grape (*Vitis* spp.), and large gallberry (*Ilex coriacea*), became available (Table 1). A wide variety of soft mast consumed during summer has been reported for other southeastern populations (Hardy 1974, Landers et al. 1979, Maehr and Brady 1984*a*, Smith 1985). In southeastern North Carolina, large gallberry was 48% and 64% of the diet, volumetrically, during August and September, respectively (Landers et al. 1979). Use of this fruit in GDS may have been underestimated. Eight radio-collared females used an *Ilex*-dominated pocosin in August 1985 (Hellgren 1988) and were believed to be feeding on large gallberry. Very few scats were collected from this area because of dense vegetation. Use of agricultural crops was heaviest during late summer, as corn fruit, leaves, and stalks comprised 35% of the late summer diet (Table 1, Fig. 1). Landers et al. (1979) noted similar bear use of corn fields in coastal North Carolina during summer.

Disturbed areas, particularly road margins, proved to be important bear feeding areas during summer. For example, 4 major bear foods—fruits of black cherry, blackberry, pokeberry, and devil's walking stick (*Aralia spinosa*) (Table 1)—are found almost exclusively in disturbed area of GDS. Since public vehicular access to GDSNWR is prohibited except under special permit, bears have undisturbed use of roads as travel and feeding corridors. Over 100 observations of bears on roads were made in the study area by study personnel in 2 years. In addition, 34 of 47 visual observations of radio-collared females were made during the summer months, when roadside soft mast was ripe.

Black gum and oak mast made up 65% of the early fall diet (Table 1, Fig. 1). Bear feeding sign indicated that swamp chestnut oak (*Q. michauxii*), a white oak species, was preferred. The importance of these 2 mast types as fall food for several southeastern wetland populations has been well-documented (Harlow 1961, Hardy 1974, Landers et al. 1979, Maehr and Brady 1982, 1984*a*, *b*, Smith 1985). Black gum constituted only 5% of the fall bear diet in GDS north of Lake Drummond in a previous study (Daniel 1978). Daniel (1978) found wild grape, persimmon (*Diospyros virginiana*), and paw-paw (*Asimina triloba*) to be primary fall foods. However, black gum is very abundant in GDS, forming with red maple the most prevalent community type in the study area (Levy and Walker 1979). The paucity of black gum seeds in Daniel's (1978) scat sample may have resulted from his small sample ($N = 42$) and sampling area or to gum mast failure in his sampling area. Grapes, devil's walking-stick, pokeberry and corn also were eaten during early fall (Table 1).

Late fall and winter diets were dominated by shrub and vine mast, primarily *Ilex* spp. and greenbriar fruits (55% and 63%, respectively; Table 1, Fig. 1). Inkberry was consumed in the above-mentioned pocosin, which was used by 7 radio-collared females from November 1985 to January 1986 (Hellgren 1988). Black gum and oak mast still were eaten where found. Crops comprised 13% of the late fall diet, as bears fed on peanuts (laying in fields postharvest) and corn.

Animal matter was a small but consistent part of the diet, forming about 3% of the annual diet (Table 1, Fig. 1). Colonial hymenopterans, especially ants (Formicidae), and coleopterans were eaten with high frequency during spring and summer. Extensive spring sign of bears foraging for insects in decaying stumps and logs corroborated the abundance of insects in scats. Large amounts of soil were found commonly in scats containing ants. Similar results have been seen in other studies of wetland populations (Hardy 1974, Landers et al. 1979, Maehr and Brady 1984*a*, Smith 1985). During fall, scavenging of hunter-killed deer (*Odocoileus virginianus*) became important (Table 1). Smith (1985) reported a similar result. Other vertebrates identified in bear scats were trace amounts of eastern cottontail (*Sylvilagus floridanus*), opossum (*Didelphis virginianus*), and black bear. Black bear hairs were found in 41 scats and probably represented primarily grooming activities. However, 4 scats contained evidence of cannibalism (claws, bone, tissue). Three of these scats, collected in April, June, and July, contained cub parts. The fourth scat contained parts of a radio-collared adult female that had been cannibalized. No fish remains were found in any scats.

Management Implications

As discussed by Landers et al. (1979) and shown by the annual diet reported in this study, a variety of habitats are needed to fulfill bear food needs throughout the year. Management plans for Coastal Plain bear populations should include guidelines to maintain and enhance stands of mature gum and oaks, pocosins, and forest openings (e.g., roadside margins, burns). Provision of a number of alternate natural foods (e.g., blackberry, blueberry, grape, black cherry, devil's walking stick, pokeberry, large gallberry) may minimize bear use of agricultural fields during failures of major fruit-producing species.

Maintenance of mature, mast-producing stands by preventing the conversion of hardwood forests to short rotation pine plantations is a critical need for black bears in the Atlantic Coastal Plain (Landers et al. 1979). Surface water manipulation to produce site conditions conducive to gum-cypress swamps may enhance these hydric communities. It also may retard successional trends to more mesic forest types, such as red maple.

This study showed the importance of pocosin species in black bear food habits in GDSNWR and probably other Coastal Plain black bear populations. Christensen et al. (1981) stated that pocosin vegetation tends to perpetuate itself by its own character. However, with human alteration of pocosins and adjacent areas (Richardson et al. 1981) and fire suppression, this may not be true. For example, in GDSNWR, invasion and shading-out of pocosins by red maple is occurring as the Swamp becomes drier (Lichtler and Walker 1979). Although it is clear that fire historically has been a part in pocosins communities and many pocosin species are adapted to fire, the effects of fire in pocosins are poorly understood (Christensen et al. 1981). Species diversity and pocosin species germination are highest following relatively deep peat burns (Christensen et al. 1981). Research on the response of

pocosins to fire is needed to provide management recommendations to prevent further loss of and to enhance pocosin habitat.

Active management is necessary to maintain productive pocosins for black bears. As mentioned above, the response of pocosins to fire is not clearly understood. We feel that experimental prescribed burns in pocosin habitats to enhance seed regeneration of pocosin species are needed. Small burns of 20 ha or less are suggested during times of high water tables. Such burns are easier to control and prevent too much peat removal (Monschein 1981). Monschein (1981) recommends winter burns in pocosins for a variety of reasons, but black bear denning chronology, particularly of adult females (Dec–Apr: Smith 1985, Hellgren 1988), needs to be considered when planning the timing of burns.

Historically, natural disturbances such as fire and windthrow have been responsible for opening continuous forest canopies and increasing production of fruiting shrubs. Periodic burning is considered a characteristic of Coastal Plain pocosins and Carolina bays (Sharitz and Gibbons 1982), as well as pond pine-canebrake habitats (Hughes 1966). Fires also have occurred in large southeastern swamps, such as Okefenokee (Cypert 1972), and are considered responsible for major swamp features, such as Okefenokee's prairies (Cypert 1972) and GDS's Lake Drummond (Whitehead and Oaks 1979). However, modern wildfire suppression has resulted in a loss of these openings, and openings due to windthrow in mature or old-growth forests are uncommon because of timber harvest of mature age classes.

Active habitat management is necessary to provide forest openings that supply bear foods. Prescribed burns and small (5–10 ha) clearcuts or drum-chopped areas, such as planned for GDSNWR (USFWS 1986), are necessary to replace the above natural processes. In addition, management of 10-m roadside strips for blackberries and other roadside plants by 3–4 year rotation mowing would produce a large amount of productive habitat. The attractiveness of roads to bears has been noted in several protected and unharvested populations (Carr and Pelton 1984, Smith 1985, Garner 1986). In harvested populations with unrestricted public road use, managers would need to consider the effects of roadside management on bear vulnerability. If out-of-season poaching is not a problem, it may be beneficial to manage for fruits that ripen during summer, but not for fall fruits that ripen concomitant with the hunting season. Management is not recommended for margins of heavily traveled roads. Similar management activities are suggested for other large Coastal Plain tracts of public land containing bear populations, such as Croatan National Forest and Alligator River National Wildlife Refuge.

Literature Cited

Beeman, L. E. and M. R. Pelton. 1980. Seasonal foods and feeding ecology of black bears in the Smoky Mountains. Int. Conf. Bear Res. and Manage. 4:141–148.

Carr, P. C. and M. R. Pelton. 1984. Proximity of adult female black bears to limited access roads. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 38:70–77.

Christensen, N. L., R. B. Burchell, A. Liggett, and E. L. Simms. 1981. The structure and

development of pocosin vegetation. Pages 43–61 *in* C. J. Richardson, ed. Pocosin wetlands, an integrated analysis of Coastal Plain freshwater bogs in North Carolina. Hutchinson Ross Publ., Stroudsburg, Pa.

Cypert, E. 1972. Plant succession on burned areas in Okefenokee Swamp following the fires of 1954 and 1955. Tall Timbers Fire Ecol. Conf. 12:199–217.

Daniel, F. L. 1978. The fall and winter food habits of the black bear (*Ursus americanus*) in the Great Dismal Swamp of Virginia. M.S. Thesis, Old Dominion Univ., Norfolk, Va. 30pp.

Daubenmire, R. F. 1968. Plant communities: a textbook of plant synecology. Harper and Row, New York. 300pp.

Eagle, T. C. and M. R. Pelton. 1983. Seasonal nutrition of black bears in the Great Smoky Mountains National Park. Int. Conf. Bear Res. and Manage. 5:94–101.

Gammon, P. T. and V. Carter. 1979. Vegetation mapping with seasonal color infrared photographs. Photogramm. Eng. Remote Sens. 45:87–97.

Garner, N. P. 1986. Seasonal movements, habitat selection, and food habits of black bears (*Ursus americanus*) in Shenandoah National Park, Virginia. M.S. Thesis, Va. Polytech. Inst. and State Univ., Blacksburg. 104pp.

Hardy, D. M. 1974. Habitat requirements of the black bear in Dare County, North Carolina. M.S. Thesis, Va. Polytech. Inst. and State Univ., Blacksburg. 121pp.

Harlow, R. F. 1961. Characteristics and status of Florida black bear. Trans. North Am. Wildl. Nat. Resour. Conf. 26:481–495.

Hellgren, E. C. 1988. Ecology and physiology of a black bear (*Ursus americanus*) population in Great Dismal Swamp and reproductive physiology in the captive female black bear. Ph.D. Diss., Va. Polytech. Inst. and State Univ., Blacksburg. 231pp.

Hughes, R. H. 1966. Fire ecology of canebrakes. Tall Timbers Fire Ecol. Conf. 12:149–158.

Landers, J. L., R. J. Hamilton, A. S. Johnson, and R. L. Marchinton. 1979. Foods and habitat of black bears in southeastern North Carolina. J. Wildl. Manage. 43:143–153.

Levy, G. F. and S. W. Walker. 1979. Forest dynamics in the Dismal Swamp of Virginia. Pages 101–126 *in* P. W. Kirk, ed. The Great Dismal Swamp. Univ. Press of Va., Charlottesville.

Lichtler, W. F. and P. N. Walker. 1979. Hydrology of the Dismal Swamp. Pages 140–168 *in* P. W. Kirk, ed. The Great Dismal Swamp. Univ. Press of Va., Charlottesville.

Maehr, D. S. and J. R. Brady. 1982. Fall food habits of black bears in Baker and Columbia Counties, Florida. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:565–570.

——— and ———. 1984*a*. Food habits of Florida black bears. J. Wildl. Manage. 48:230–235.

——— and ———. 1984*b*. Comparison of food habits in two North Florida black bear populations. Fla. Sci. 47:171–175.

Martin, A. C., R. H. Gensch, and C. P. Brown. 1946. Alternative methods in upland gamebird food analysis. J. Wildl. Manage. 10:8–12.

Monschein, T. D. 1981. Values of pocosins to game and fish species in North Carolina. Pages 155–170 *in* C. J. Richardson, ed. Pocosin wetlands, an integrated analysis of Coastal Plain freshwater bogs in North Carolina. Hutchinson Ross Publ., Stroudsburg, Pa.

NOAA. 1984. Climatological data Virginia. U.S. Dep. Commerce, Natl. Oceanic and Atmos. Admin., Asheville, N.C. 28pp.

NOAA. 1985. Climatological data Virginia. U.S. Dep. Commerce, Natl. Oceanic and Atmos. Admin., Asheville, N.C. 20pp.

Poelker, R. J. and H. D. Hartwell. 1973. Black bear of Washington. Wash. State Game Dep. Biol. Bul. No. 14, Olympia. 180pp.

Radford, A. E., H. E. Ahles, and C. Ritchie Bell. 1968. Manual of vascular plants of the Carolinas. Univ. N.C. Press, Chapel Hill. 1183pp.

Richardson, C. J., R. Evans, and D. Carr. 1981. Pocosins: an ecosystem in transition. Pages 3–19 *in* C. J. Richardson, ed. Pocosin wetlands, an integrated analysis of Coastal Plain freshwater bogs in North Carolina. Hutchinson Ross Publ., Stroudsburg, Pa.

Sharitz, R. R. and J. W. Gibbons. 1982. The ecology of southeastern shrub bogs (pocosins) and Carolina bays: a community profile. U.S. Dep. Int., Fish and Wildl. Serv., FWS/OBS-82/04, Washington, D.C. 93pp.

Smith, T. R. 1985. Ecology of black bears in a bottomland hardwood forest in Arkansas. Ph.D. Diss., Univ. Tenn., Knoxville. 209pp.

USFWS. 1986. Draft environmental impact statement for the Great Dismal Swamp National Wildlife Refuge Master Plan. U.S. Dep. Int., Fish and Wildl. Serv., Region 5, Newton Corner, Mass. 230pp.

Whitehead, D. R. and R. Q. Oaks, Jr. 1979. Developmental history of the Dismal Swamp. Pages 25–43 *in* P. W. Kirk, ed. The Great Dismal Swamp. Univ. Press of Va., Charlottesville.

Zeveloff, S. I. 1983. Island biogeographic considerations for pocosin wildlife conservation. J. Elisha Mitchell Sci. Soc. 99:69–77.