WILDLIFE SESSION

HABITAT SELECTION BY FALL MIGRANT SNIPE IN SOUTHEASTERN MISSOURI

W. DEAN RUNDLE[1], School of Forestry, Fisheries, and Wildlife, University of Missouri — Columbia, Gaylord Memorial Laboratory, Puxico, MO 63930

Abstract: Microhabitat variables were measured at 79 locations used by migrant common snipe *(Capella gallinago)*. The maximum water depth used was 27 mm. Snipes demonstrated diurnal rhythms of habitat selection, using wet sites with short vegetation during feeding periods, and dry sites with taller vegetation during nonfeeding periods. Lower vegetation densities were selected in late afternoon. During feeding periods, 67% of snipes were within 15 cm of a soil/water interface, but during midday, 69% were more than 5.0 m from water. Twenty-three plants were associated with snipe microhabitats, but snipes selected microhabitats because of water conditions and vegetation structure, not vegetation composition.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 35:20-26

Recent studies indicate that hunter interest in snipe is increasing (Martin 1979) and that potential for increased harvest exists in many states (Fogarty and Arnold 1977). Snipes are part of a wetland avifauna of nonconsumptive importance, and may prove to be an indicator species of wetland quality. Despite this, the management effort for snipe has been minimal, and recommended habitat manipulation techniques are few (Neely 1959, Johnson 1976, Rundle and Fredrickson 1981). Tuck (1972) qualitatively described many snipe habitats, including Canadian breeding and migration areas, and wintering sites in Louisiana, Georgia, and Florida. Similar information was presented for northern California (White and Harris 1966). In South Carolina, water depths of 2.5 - 5.0 cm, especially when closely interspersed with muddy hummocks, were selected (Neely 1959). Snipes in Colorado preferred sites with water depths of 6.0 cm or less, vegetation 10.0 - 30.0 cm tall, and ground compaction of less than 0.75 kg/cm^2 (Johnson 1976, Johnson and Ryder 1977). Quantitative data on snipe habitat remain sparse, especially for mid-south migration areas.

This study was part of a larger investigation of the ecology and management of rails and shorebirds on man-made seasonally flooded impoundments. Objectives relating to snipe were to identify and measure variables affecting habitat selection, and provide a basis for habitat management decisions. This is a contribution of Gaylord Memorial Laboratory (School of Forestry, Fisheries, and Wildlife, University of Missouri-Columbia and Missouri Department of Conservation cooperating), Accelerated Research Program for Migratory Shore and Upland Game Birds, Contract USDI 14-16-0009-78-038, administered by the Missouri Department of Conservation, National Audubon Society, and Missouri Agricultural Experiment Station, Project 170, Journal Series 8916. I thank J. E. Cely, L. H.

[1] Present address: Hatchie National Wildlife Refuge, Brownsville, TN 38012.

Fredrickson, W. W. Neely, and M. W. Sayre for reviewing the manuscript, J. N. Burroughs for statistical advice, and K. C. Sadler for administrative support. G. L. Clawson and the staff of Mingo National Wildlife Refuge (NWR) provided logistical support.

METHODS

Study Area

Data were collected on Moist Soil Unit (MSU) #3, a 14.5 ha seasonally flooded impoundment of Mingo NWR, located near Puxico, Stoddard County, Missouri. The refuge lies at the northern boundary of the Mississippi Delta, in Mingo Swamp, an ancient abandoned valley of the Mississippi River.

Climate of the area is classified as continental, humid, warm temperate (Krusekopf 1966). Mean January and June temperatures are 0.4 and 24.0 C, respectively (Knauer 1977), and mean annual rainfall (1940 - 69) was 111.84 cm (Fredrickson 1979) at nearby Wappapello, Missouri. Swamp soils are weathered alluvium of the Waverly series. Topsoil is acidic gray silt-loam, to a depth of 12.3 cm, over a gray clay subsoil (Fredrickson et al. 1977).

MSU #3 is part of a 113.3 ha impoundment complex, surrounded by natural lowland hardwood forest. Once a rice field, the unit has been managed for production of natural wetland plants since 1969. From August 1978 to October 1979, management was directed specifically toward migrant shorebirds. Management for post-breeding migrants consisted of disking and flooding in August. Water levels were manipulated to provide maximum interspersion of water and exposed soil and were detailed previously (Rundle and Fredrickson 1981).

Data Collection

Censuses, along 13 transect lines, marked at uniform 40 m intervals, were conducted at least twice weekly from 9 August - 6 December 1978, and 1 August - 8 October 1979. A slow zig-zag pattern was walked, and a trained dog was often used to detect all snipes on the area. Forty-two censuses were conducted and each hourly interval between 0600 and 2000 CDT was sampled at least twice. On randomly selected censuses, snipe flush sites were marked for measurement of microhabitat variables. Only sites where the exact locations of birds could be determined, often with the aid of fresh tracks of droppings, were marked. Time of observation, and soil substrate moisture (described as flooded, saturated, damp or dry) were recorded at each site. Water depth to the nearest mm and distance to the nearest interface between water and exposed soil, to the nearest cm, were measured with a steel tape. Interface distances greater than 5.0 m were not measured, but were recorded as more than 500 cm.

Vertical vegetation density and horizontal vegetation density at 5, 10, 20, 30, 50, 70, 100, and 150 cm above the substrate were measured with a point intercept sampler similar to that described by Cody (1968). Attitude of the sampler was determined by pointing one horizontal arm toward the sun. Vertical vegetation density was the mean number of leaf or stem intercepts of 4 vertical drops of a metal rod, at 90 degree angles, 25.0 cm from the flush site. Horizontal densities were determined by 4 passes of a thin metal rod, through the vegetation, parallel to the substrate at each height. The passes were at 90 degree angles to each other, and covered a distance of 0.5 m. Vegetation intercepts within 15.0 cm of the sampler were not recorded to avoid possible biases caused by vegetation disturbance from sampler placement. When uneven ground prevented a full 0.5 m pass, a value of 10 was assigned to the mound intercept. Horizontal densities were calculated as stem/leaf intercepts/m. Vegetation height was defined as the height above which horizontal densities fell below 2/m. All plant species occurring in a 0.5 m radius of each flush site were identified. Observations on general habitat use and movements between habitat types were also recorded.

The Kruskal - Wallis and Chi-square tests (Seigel 1956) were used to test for differences in microhabitat variables among different time periods. The Wilcoxon matched-pairs test (Seigel 1956) was applied to plant occurrence data from feeding and nonfeeding periods.

RESULTS

Snipes were present on the study area from mid-August to early December. Microhabitat variables were measured at 58 flush sites in 1978, and 21 in 1979. Sixteen snipes (20.3%) were flushed from flooded locations.Water depths ranged from 0.1 - 2.7 cm ($\bar{X}$ = 0.9, SD = 0.8 cm). Mean vegeation height was 9.9 cm (SD = 10.2 cm). Vertical vegetation density averaged 0.8 ± 0.6 intercepts/drop. Horizontal densities at 5, 10, and 20 cm above the substrate were 10.4 ± 7.5, 3.8 ± 3.8, and 0.6 ± 0.8 intercepts/m, respectively. No vegetation intercepts occurred over 70 cm above the substrate; percentages of sites with intercepts at 30, 50, and 70 cm heights were 18, 6, 3, respectively. Forty-two (53%) flush sites were within 5.0 m of a soil/water interface, and no snipes were flushed more than 27 cm from exposed soil.

Frequent observations revealed that snipes made morning and evening feeding flights at MSU #3, and selected different microhabitats during 3 diurnal time periods (Table 1). Feeding habitats were used before 1000 h and after 1600 h CDT. Periods 1000 - 1100 h and 1500 - 1600 h were transition periods when snipes used both feeding and nonfeeding microhabitats (Fig. 1).

Snipes selected wetter sites ($X^2 = 28.6$, $P < 0.001$) before 1100 h and after 1600 h than during the midday, nonfeeding period. Only 12 of 47 sites analyzed for the feeding and transition periods were more than 15.0 cm from a soil/water interface. During midday, only 7 of 32 sites were within 5.0 m of water. Vegetation at feeding and transition period sites was shorter ($X^2 = 7.4$, $P < 0.025$) than at midday sites. During the evening feeding period, snipes used microhabitats with lower horizontal vegetation densities at 5 cm (Kruskal - Wallis test, $P < 0.03$) and 10 cm ($P < 0.01$). There was no difference in the vertical vegetation density (Kruskal - Wallis test, $P > 0.10$). Because of the large number of zero values, statistical analyses of horizontal vegetation densities above 10 cm were not conducted.

Twenty-three plant species occurred at snip use-sites. Species with over 10% occurrence were: blunt spikerush (*Eleocharis obtusa*) (57%); trumpetcreeper (*Campsis radicans*) (57%); buttonweed (*Diodia virginiana*) (37%); creeping marshpurslane (*Ludwigia repens*) (34%); sedges (*Carex* spp.) (30%); bugleweed (*Lycopus americana*) (27%); rice cutgrass (*Leersia oryzoides*) (24%); common rush (*Juncus effusis*) (22%); cocklebur (*Xanthium* sp.) (22%); and barnyardgrass (*Echinochloa* spp.) (19%). Trumpetcreeper usually occurred as individual stems, whereas the other dominants

Table 1. Microhabitat variables of common snipe use-sites by diurnal period.

Period	Occurrence							$\bar{X} \pm SD$		
	Substrate		Vegetation height (cm)		Interface distance (cm)					
	F/S[a]	D/D[b]	≤10	>10	<15	15-500	>500	D_v[c]	D_{h_5}[d]	$D_{h_{10}}$
Dawn - 1100h (N=25)	22	3	21	4	17	7	1	0.8±0.5	11.4±6.8	4.3±2.8
1100 - 1600h (N=32)	9	23	20	12	5	5	22	1.1±0.6	12.1±7.8	4.9±4.4
1600h - dusk (N=22)	19	3	21	1	14	4	4	0.6±0.4	6.9±6.8	1.7±3.2

[a] Flooded or saturated.
[b] Damp or dry.
[c] D_v = Vertical vegetation density; units are stem/leaf intercepts/drop.
[d] D_h = Horizontal vegetation density; units are stem/leaf intercepts/m; subscript numbers indicate cm above substrate.

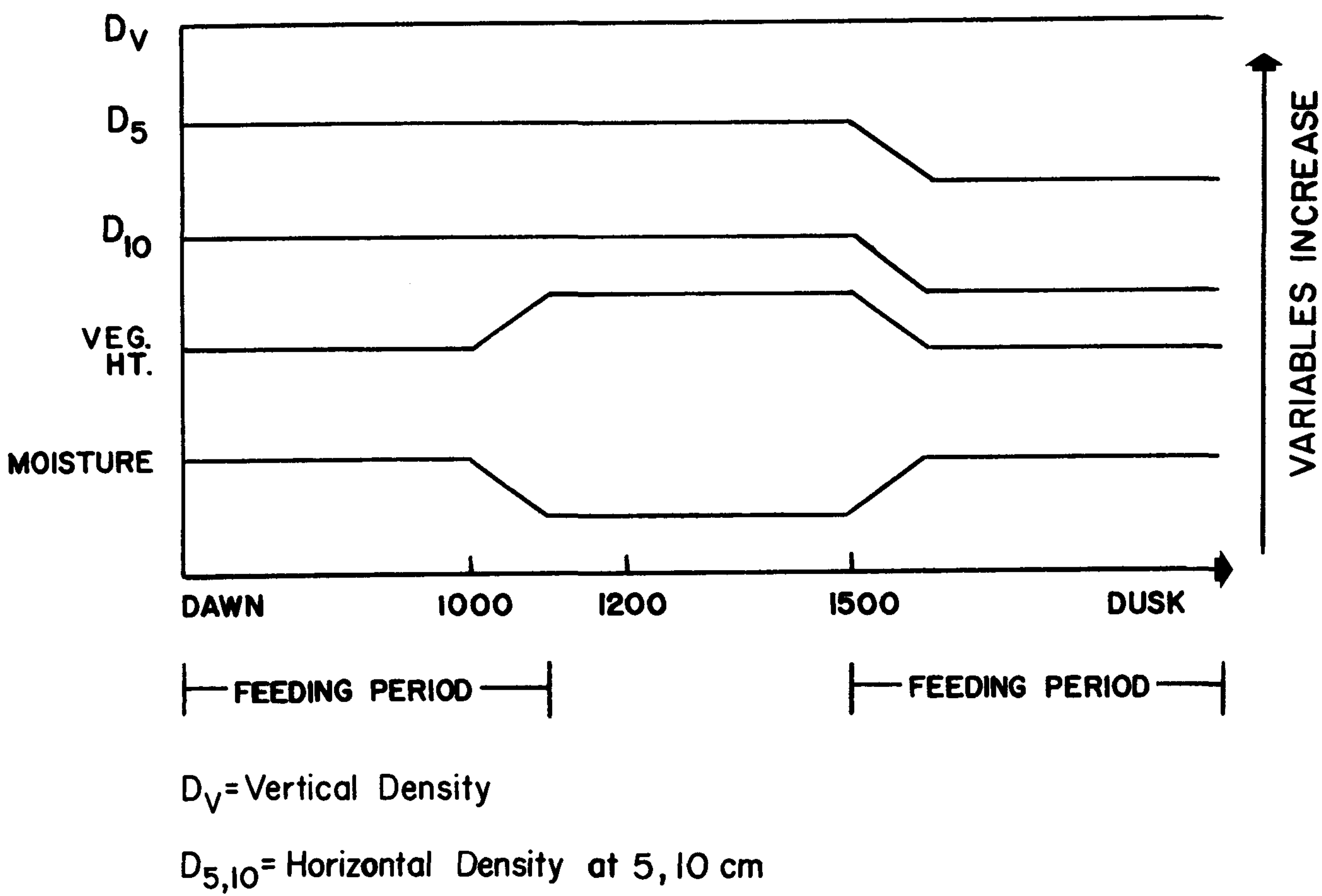

Fig. 1. Daily variation in microhabitat variables selected by fall migrant snipes.

occurred in pure and mixed stands. Although several species occurred more frequently in feeding or nonfeeding microhabitats, there was no statistical difference in the overall occurrence of plants associated with those sites (Wilcoxon test, $P > 0.05$).

DISCUSSION

The maximum water depth (27 mm) was considerably less than the maximum preferred depths of 5 - 6 cm previously suggested (Neely 1959, Johnson 1976). This disparity may be the result of prior investigators sampling the overall habitat, rather than precisely identified use-sites. Such shallow water is difficult to maintain in the mid-south because of high evaporation rates and low rainfall during post-breeding migration (Rundle and Fredrickson 1981). Managers should be cognizant of this problem when planning flooding schemes and water manipulations for snipes.

Close interspersion of water and exposed soil in the form of hummocks was reported as desirable when managing for snipes (Neely 1959, Johnson and Ryder 1977). My results corroborate this for feeding habitats where most snipes were found within a few cm of a soil/water interface. Because no snipes were flushed from sites more than 27 cm from exposed soil, management for large uniform water areas, even of a preferred depth, should be discouraged. Disking makes ground uneven, and probable creates more interspersion than other suggested practices such as mowing (Johnson 1976), burning (Lynch 1941, Blakey 1947), and would tend to improve soil impaction rates (Johnson and Ryder 1977). Hence, Neely's (1959) preference for disking is supported as a most effective management technique.

Diurnal rhythms of foraging activity by snipes have been reported. Morning and evening feeding flights are well documented (Tuck 1972), and Owens (1967) reported wintering snipes in Louisiana concentrated their feeding in early morning and late afternoon. Present data show that diurnal rhythms in habitat selection accompany the behavioral shifts. Feeding habitats, characterized by high soil moisture and short vegetation, are those generally described in the literature. Selection of dryer sites with taller, denser vegetation when not feeding, has important implications for wetland managers desiring to concentrate snipes for consumptive and nonconsumptive purposes. Management should provide a variety of habitat conditions that meet species requirements for rest, maintenance and protection, as well as food.

Selection of sites with lower horizontal vegetation densities during evening alone is difficult to interpret. Snipes are nocturnal migrants (Tuck 1972), and the need to assimilate nutrients for migrational flight may outweigh potentials for increased predation risks in late afternoon foraging. The importance of nocturnal behavior and habitat selection is unclear. On a basis of gizzard volumes, Owens (1967) suggested that nocturnal foraging was insignificant in Louisiana, but observations of individually marked snipes in Georgia (Tuck 1972) showed substantial nocturnal foraging. Because snipes are adapted for tactile foraging (Tuck 1972, Rundle 1980), the latter finding is more plausible. Clearly, there is a need for further research on nocturnal activities of snipes.

Snipes have been reported to select habitat based on preference for particular plant species (Watson and O'Hare 1979). Such preferences were not observed in the present study. Plants most frequently associated with feeding and nonfeeding sites were those characteristic of wet and dry sites, respectively. Johnson (1976) documented plant species occurrence in snipe habitats, but suggested no preference for particular plant species or communities. The combined evidence indicates that snipes select habitat on the basis of soil and water conditions and vegetation structure, not plant species composition.

LITERATURE CITED

Blakey, H. L. 1947. The role of brush control in habitat improvement on the Arkansas National Wildlife Refuge. Trans. North Am. Wildl. Conf. 12:179-184.

Cody, M. L. 1968. On the methods of resource division in grassland bird communities. Am. Nat. 102:107-147.

Erickson, A. V. 1941. A study of Wilson's snipe. Wilson Bull. 53:62.

Fogarty, M. J., and K. A. Arnold. 1977. Common snipe. Pages 189-209. *in* G. C. Sanderson, ed. Management of migratory shore and upland game birds in North America. Int. Assoc. Fish and Game Agencies, Washington, D. C. 358pp.

Fredrickson, L. H. 1979. Floral and faunal changes in lowland hardwood forests in Missouri resulting from channelization, drainage, and impoundment. U. S. Dept. Inter. FWS/OBS-79/91. 130pp.

__________,T. S. Baskett, G. K. Brakhage, and V. C. Cravens. 1977. Evaluating cultivation near duck blinds to reduce lead poisoning hazard. J. Wildl. Manage. 41:624-631.

Johnson, B. R. 1976. Investigations of common snipe in Colorado. Colo. Div. Wildl. Game, P-R Rep., Proj. W-88-R-21. 41pp.

__________, and R. A. Ryder. 1977. Breeding densities and migration periods of common snipe in Colorado. Wilson Bull. 89:116-121.

Knauer, D. F. 1977. Moist soil plant production on Mingo National Wildlife Refuge. M. S. Thesis. Univ. of Missouri, Columbia. 189pp.

Krusekopf. H. H. 1966. Delta soils of southeast Missouri. Univ. Missouri Agric. Exp. Sta., Columbia. 38pp.

Lynch, J. J. 1941. The place of burning in management of the gulf coast wildlife refuges. J. Wildl. Manage. 5:454-457.

Martin, E. M. 1979. Hunting and harvest trends for migratory game birds other than waterfowl: 1964-1976. U. S. Fish and Wildl. Serv. Spec. Sci. Rep. - Wildl. No. 218. 37pp.

Neely, W. W. 1959. Snipe field management in the southeastern states. Proc. Ann. Conf. S. E. Assoc. Game and Fish Comm. 13:288-291.

Owens, J. 1967. Food habits of the common snipe *(Capella gallinago)* in portions of south central Louisiana. M. S. Thesis. Louisiana State Univ., Baton Rouge. 107pp.

Rundle, W. D. 1980. Management, habitat selection and feeding ecology of migrant rails and shorebirds. M. S. Thesis. Univ. of Missouri, Columbia. 228pp.

__________, and L. H. Fredrickson. 1981. Managing seasonally flooded impoundments for migrant rails and shorebirds. Wildl. Soc. Bull. 9:80-87.

Siegel, S. 1956. Nonparametric statistics for the behavioral sciences. McGraw Hill Book Co., New York. 312pp.

Tuck, L. M. 1972. The snipes: a study of the genus *Capella.* Can. Wildl. Serv. Monogr. Ser. No. 5. 428pp.

Watson, A., and P. J. O'Hare. 1979. Bird and mammal numbers on untreated and experimentally treated Irish bog. Oikos 33:97-105.

White, M., and S. W. Harris. 1966. Winter occurrence, foods, and habitat use of snipe in northwestern California. J. Wildl. Manage. 30:23-34.