Distribution, biology and harvest of Common Snipe (Capella gallinago delicata) in Montana
by Graham Stuart Taylor

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE
in Fish and Wildlife Management
Montana State University

Abstract:
Distribution, migration chronology, breeding biology and harvest of Common Snipe (Capella gallinago delicata) were studied during 1976 and 1977 in Montana. Seven census sites, including one intensive study site, were maintained: Jackson and Divide in southwest Montana, Helm- ville and Choteau in the westcentral portion of the state, Malta and Medicine Lake in the northeast and Belgrade, which doubled as an intensive study site, in southcentral Montana. Spring arrival dates varied from 11 April to 11 May at Belgrade and Medicine Lake, respectively.

Fall migration observed at the Belgrade area peaked the last two weeks of October in both years. Breeding pair densities (pairs per 100 hectare of habitat) for each census site, based on winnowing censuses were 14 pairs at Jackson, 17 at Divide, 14 at Helmville, 21 at Choteau, 50 at Malta, 8 at Medicine Lake and 34 at Belgrade. Breeding habitat surveyed ranged in size from 269 hectares at Jackson to 26 at Malta.

Based on information from 20 nests, peak hatch occurred the last week of May and the first two weeks in June at Belgrade. Ninety-five percent of twenty-one nests were successful while individual egg success was equally high at 93 percent. Clutch size averaged 4 eggs. Vegeta-tional analysis of nest sites showed a strong preference by nesting snipe for stands of Carex spp. with residual vegetation. Wintering birds were noted on the Belgrade area. Eighty-four snipe were banded in spring and early summer. Two snipe banded as adults on their breeding grounds were retrapped on those same breeding grounds the subsequent year. Montana harvest data for 1976 indicates 450 hunters bagged 1350 snipe in 1125 days afield. Eighty-four percent of the harvest and eighty percent of the hunting pressure occurred in the Pacific flyway portion of the state. Harvest information parallels the distribution of breeding habitat and relative breeding densities of snipe within the state. This habitat centers around the moist intermountain valleys of western and west-central Montana and is supplemented by the presence of many flood irrigation projects.

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DISTRIBUTION, BIOLOGY AND HARVEST OF COMMON SNIPE (*CAPELLA GALLINAGO DELICATA*) IN MONTANA

by

GRAHAM STUART TAYLOR

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Fish and Wildlife Management

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March, 1978

ACKNOWLEDGMENTS

The author wishes to express his most sincere appreciation to the following people for their contributions to this study: Dr. Robert L. Eng, Montana State University, for project planning, technical supervision and guidance in preparation of this manuscript; Mr. Dale Witt, Montana Department of Fish and Game for project planning; Dr. Richard J. Mackie and Dr. Robert E. Moore, Montana State University, for critically reviewing the manuscript; Mr. Jay Bellinger, refuge manager, Medicine Lake National Wildlife Refuge and Mr. Jack Foster, refuge manager, Bowdoin National Wildlife Refuge for advice and personal interest in the study; regional personnel of the Montana Department of Fish and Game for assistance in determining breeding distribution; the many individual landowners for their cooperation; my family and friends for their support; and my wife, Maria, for her prayers, patience and good humor for the duration of this project.

This study was funded by the Accelerated Research Program for Migratory Shore and Upland Game Birds through Contract No. 14-16-0008-2065 between the U. S. Department of the Interior, Fish and Wildlife Service and the Montana Department of Fish and Game.

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ABSTRACT

Distribution, migration chronology, breeding biology and harvest of Common Snipe (Capella gallinago delicata) were studied during 1976 and 1977 in Montana. Seven census sites, including one intensive study site, were maintained: Jackson and Divide in southwest Montana, Helmville and Choteau in the westcentral portion of the state, Malta and Medicine Lake in the northeast and Belgrade, which doubled as an intensive study site, in southcentral Montana. Spring arrival dates varied from 11 April to 11 May at Belgrade and Medicine Lake, respectively. Fall migration observed at the Belgrade area peaked the last two weeks of October in both years. Breeding pair densities (pairs per 100 hectare of habitat) for each census site, based on winnowing censuses were 14 pairs at Jackson, 17 at Divide, 14 at Helmville, 21 at Choteau, 50 at Malta, 8 at Medicine Lake and 34 at Belgrade. Breeding habitat surveyed ranged in size from 269 hectares at Jackson to 26 at Malta. Based on information from 20 nests, peak hatch occurred the last week of May and the first two weeks in June at Belgrade. Ninety-five percent of twenty-one nests were successful while individual egg success was equally high at 93 percent. Clutch size averaged 4 eggs. Vegetational analysis of nest sites showed a strong preference by nesting snipe for stands of Carex spp. with residual vegetation. Wintering birds were noted on the Belgrade area. Eighty-four snipe were banded in spring and early summer. Two snipe banded as adults on their breeding grounds were retrapped on those same breeding grounds the subsequent year. Montana harvest data for 1976 indicates 450 hunters bagged 1350 snipe in 1125 days afield. Eighty-four percent of the harvest and eighty percent of the hunting pressure occurred in the Pacific flyway portion of the state. Harvest information parallels the distribution of breeding habitat and relative breeding densities of snipe within the state. This habitat centers around the moist intermountain valleys of western and westcentral Montana and is supplemented by the presence of many flood irrigation projects.

INTRODUCTION

Since little research has been conducted on Common Snipe (Capella gallinago delicata) in Montana, the Accelerated Research Program for Migratory Shore and Upland Game Birds of the U. S. Fish and Wildlife Service, in cooperation with the Montana Department of Fish and Game initiated a snipe study in the spring of 1976. The National Program Planning Group for Migratory Shore and Upland Game Birds (U. S. F. W. S.) has determined basic research needs for the Common Snipe. Among those needs are research on population analysis (banding programs), harvest information and habitat inventory (Sanderson 1977).

Snipe hunting seasons have existed in Montana since 1968 and 1976 for the Pacific and Central flyway portions of the state, respectively. Due to the diverse and abundant nature of game bird species in the state, along with excellent hunter opportunity, bird hunting pressure is light (an average of 3 birds harvested per square mile, (Wallestad 1975)). Consequently, the snipe is given a low priority by most bird hunters, resulting in a low harvest.

Objectives of this study were: 1) to determine the distribution and densities of breeding snipe in Montana; 2) to document spring and fall migration chronology; 3) to document various aspects of the breeding biology of snipe; and 4) to estimate harvest and hunting pressure within the state.

Field data were collected full time during the summer of 1976 and the spring, summer and fall of 1977 and part-time during the spring and fall of 1976.

DESCRIPTION OF STUDY AREAS

Selection of study areas, accomplished during the summer of 1976, was based upon three general criteria: 1) presence of a breeding population of snipe as evidenced by spring and summer winnowing display; 2) location providing representative coverage of statewide snipe breeding densities; and 3) accessibility and proximity to roads satisfactory as census routes. In western Canada, Robbins (1954) was forced to abort efforts to census large portions of snipe habitat because of poor access to major portions of breeding range. Study sites selected in Montana are as follows (Figure 1):

1) Belgrade (Gallatin Valley)
2) Jackson (Big Hole Valley)
3) Divide (Divide Creek)
4) Helmville (Blackfoot Valley)
5) Choteau (Muddy Creek)
6) Malta (Bowdoin National Wildlife Refuge)
7) Medicine Lake (Medicine Lake National Wildlife Refuge)

Belgrade Study Area

Two sites serving separate functions were maintained within the confines of the Belgrade study area: a census area and an intensive study area. The Belgrade area is seven kilometers north and northwest of Belgrade, Gallatin County, Montana (Appendix, Figure 14). The census

FIGURE 1. Location of snipe study areas in Montana.

area, 19.5 square kilometers, is delimited by local highway 346 on the east and north boundaries. A western boundary is shaped by the West Gallatin River. The southern boundary is formed by an unnamed county road. Within this census area lies the intensive study site (Figure 2), encompassing approximately 1.3 square kilometers. All other areas served as census sites only.

The Gallatin Valley, in which the Belgrade study area lies, is characterized as a high intermountain valley with the valley floor a gently sloping plain. Mean elevation of the site is 1359 meters above sea level. Typical of the Belgrade study area, much of the valley contains existing and remnant stream beds. Most of the area lies within the prescribed 100 year floodplain of the East and West Gallatin Rivers (U.S.D.A./S.C.S 1972). Soils on the area are mostly poorly drained silt loams and considered to be in the swampy phase. Irrigation is held partly responsible for a high water table contributing to the soil conditions described (DeYoung 1931).

Climate of the area is continental in character and subject to wide extremes of seasonal and daily temperatures. The final killing frost normally occurs the latter part of May, thus beginning a frost free season of 115 days (Caprio 1965). Mean annual precipitation, most of which falls during the growing season, totals 35 to 40 centimeters. Mean annual temperature at Belgrade, Montana is 6.1 degrees C (Southard 1973).

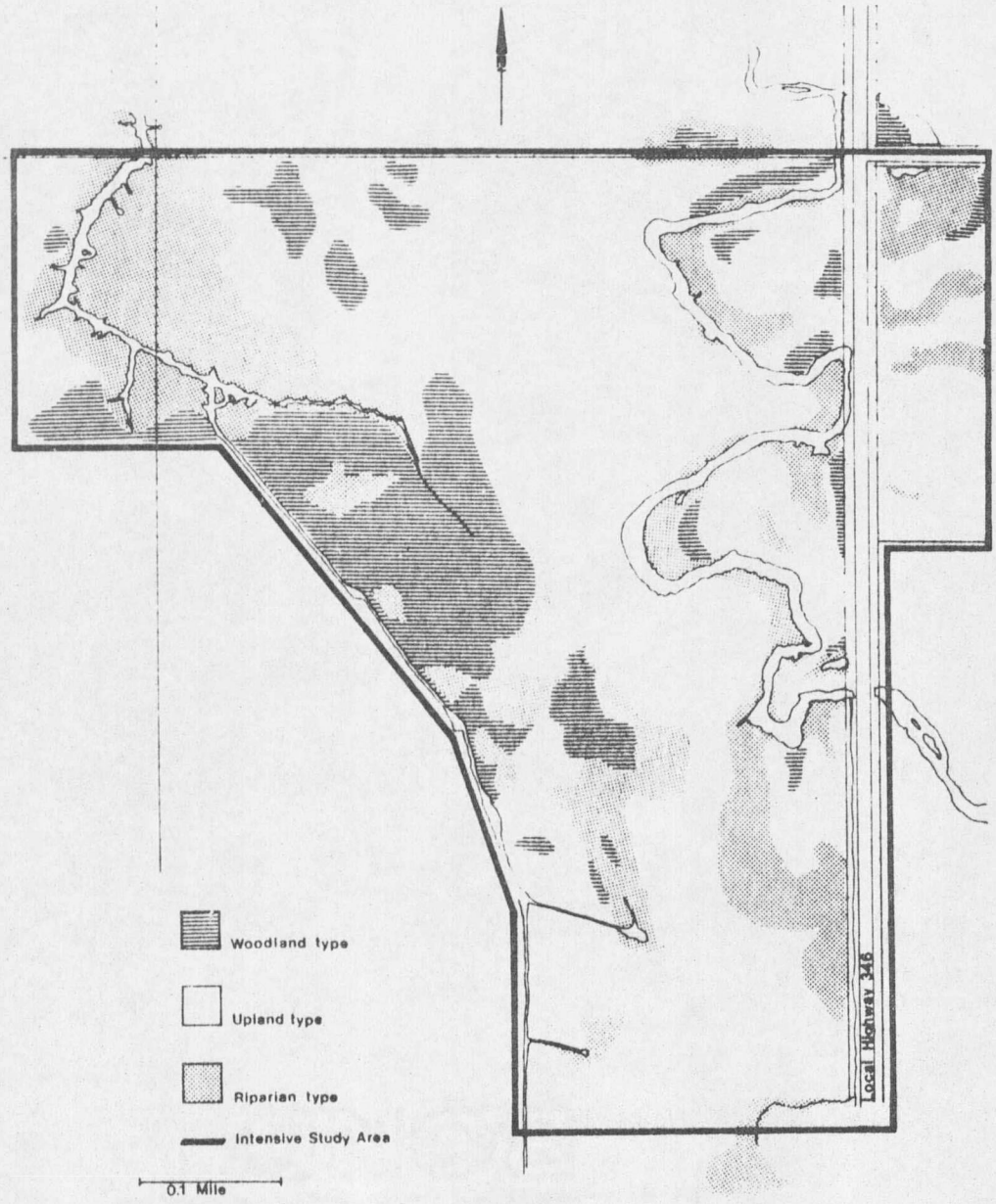

FIGURE 2. The Belgrade intensive study area.

Based on the objectives of this study, an exact and detailed delineation of vegetational types on the Belgrade area is not warranted. Three general vegetational types are described. These types include woodland, upland and riparian (Figure 3). These three types (more accurately: subtypes) lie within an area of the Gallatin Valley which, on a much larger scale, would be considered riparian in nature. The area's vegetation is strongly influenced by the presence of the East and West Gallatin Rivers and their floodplains, by a high water table, and by irrigation and its runoff. A given vegetational type as defined in this study may include combinations of species each of which is usually considered indicative of a distinct type. Included in the woodland type are willow (Salix spp.) and alder (Alnus incana), two species normally considered riparian. Even cottonwood (Populus trichocarpa), as the most apparent member of the woodland type on this study, is more often than not considered riparian in nature. Abundant water conditions existing in an otherwise woodland condition create these unusual combinations of woody species (Figure 4).

The woodland type is dominated by cottonwood and aspen (Populus tremuloides) as deciduous overstory. Dogwood (Cornus stolonifera) is the overwhelmingly dominant shrub. Buffalo-berry (Shepherdia argentea) is a common shrub but its locations are more removed from the deciduous woodland canopy; rather, isolated patches are located next to stream banks and standing water sites along edges of the woodland type. Other shrubs in this type, but of restricted occurrence are willow, alder and

FIGURE 3. Vegetational types on the Belgrade intensive study area, including woodland, riparian (center) and upland (foreground).

FIGURE 4. Woodland, riparian (center) and upland (foreground) vegetational types with unusual combinations of woodland species.

rose (Rosa spp.). The woodland type changes into the upland type across a gradient typified by the presence of buffalo-berry.

Inclusion of certain taxa in the upland type must be tempered with the fact that water conditions vary according to the season. Low lying pockets which collect seasonally abundant (spring and early summer) waters in the upland type support such plants as Iris (Iris missouriensis) and Eleocharis spp. This type is characterized however, by the presence of forbs and grasses; snowberry (Symphoricarpos albus) is the only major shrub present and occurs primarily along elevated streambanks, occasionally accompanied by rose. Poa spp. and Bromus spp. represent a majority of the vegetative cover on the upland site.

Mountain thermopsis (Thermopsis montana) is the most abundant forb on this type. Other forbs, found in season, include buttercup (Ranunculus spp.), shooting star (Dodecatheon conjugens), dandelion (Taraxacum spp.), zizia (Zizia aptera) and tobacco-root (Valeriana edulis). On disturbed, dry sites, houndstongue (Cynoglossum officinale), various thistles (Asteraceae family) and poison hemlock (Conium maculatum) are the most common species.

Typical of the lack of distinct separation between types, wire rush (Juncus balticus) is common to both the upland and riparian sites, and is one of the most abundant plant species on the entire study area. Sedges (Carex spp.) however, dominate the riparian type, often to the exclusion of any other species in specific locales.

Cattail (Typha spp.) occurs in scattered localities throughout this type in association with Scirpus spp., Sparganium spp. and Sagittaria cuneata. Watercress (Rorippa nasturtium-aquaticum) is abundant in backwater and standing water areas along water courses, often accompanied by Bidens cernua. Other major plant species which occur in order of decreasing frequency in this type include Potentilla spp., Polygonum spp., Verbena hastata, Rumex spp., and Mimulus guttatus. Manna grasses (Glyceria spp.) and hairgrass (Deschampsia cespitosa) were well distributed throughout this type, yet generally in limited quantities.

Grazing on the Belgrade intensive study area was restricted to the months of early June through mid-October both years of this study; grazing pressure was heavy. Typically, upland pasture sites were grazed during the spring and summer and were closely cropped. The riparian type, most noteably the Carex spp., received heavy grazing pressure during the fall. Cattle activity steadily increased to the point where in the riparian type, the size and number of exposed mud and denuded areas greatly increased (Figure 5).

Other Study Areas

The Jackson study area, Beaverhead County, is a sub-irrigated and wetland range site, with a gently sloping grade to the north (Perry 1934). Drained by the Big Hole River, the valley is defined by mountains on all sides but the northeast. Elevations range from 2164 to 2027 meters

A

B

FIGURE 5. The riparian habitat type before (A) and after (B) heavy cattle use on the Belgrade area. Photo A: summer; Photo B: early fall.

on the valley floor. Agricultural activity is primarily livestock and native hay production (Appendix, Figure 15).

Divide Creek, Silverbow County, originates on the continental divide and enters the Big Hole River 18 kilometers downstream. The narrow drainage is composed of steep foothills which feed this fast flowing, although at times meandering, stream. Elevations within the study area range from 1767 to 1631 meters. Principal land use in this valley is livestock production (Appendix, Figure 16).

At a nearly constant elevation of 1344 meters, the Helmville site (Powell County) is located at the mouth of the Blackfoot Valley, bordered on all sides by mountains. The area is drained by Nevada Creek, a slow, meandering stream supplied by an abundance of small feeder streams. Subsurface and surface waters are abundant throughout most of the year. Native hay and livestock production are the two major land uses in the area (Appendix, Figure 17).

Located 5 kilometers north of Choteau, Teton County, the Choteau study area maintains grains, livestock, and haying operations as major land uses. The site is situated on a nearly level, exposed bench at a mean elevation of 1177 meters. A small-scaled system of irrigation ditches, ponds and seep areas accounts for the presence of snipe habitat (Appendix, Figure 18).

Bowdoin National Wildlife Refuge (Phillips County) is the site of the Malta study area. The census route lies within the refuge, although

coverage at times extended beyond refuge boundaries. The mean elevation is 686 meters. Snipe habitat is mostly a result of impounded waters forming ponds and one large lake. The site is located on the extreme border of the Milk River Valley, and according to Gieseker (1929), is typically one of rolling uplands, glacial in origin (Appendix, Figure 19).

In the northeast corner of the state, the Medicine Lake study area (Sheridan and Roosevelt Counties) is located within the Medicine Lake National Wildlife Refuge. The area is characteristically one of undulating, rolling uplands of a sedimentary origin (Gieseker 1929). Mean elevation is 594 meters. As at the Malta site, the presence of snipe breeding habitat is primarily due to the many impounded bodies of water and associated stream and runoff sites on the refuge (Appendix, Figure 20).

Climatic conditions at these remaining six sites vary considerably, and are largely a function of physiography as well as relative position on the North American land mass. While only the Helmville study site is located west of the continental divide, the weather patterns at all sites except Malta and Medicine Lake are to some degree influenced by mountainous terrain. The distance between sites also accounts for considerable variation in weather patterns. The Jackson study area and the Medicine Lake area, for example, are situated at extreme opposing corners of the state, separated by a distance of 790 kilometers. Table 1 summarizes climatic conditions at these six areas.

TABLE 1. Climatic conditions at all census areas except Belgrade.

Location	Climate[a]	Mean Annual: Temp.	Precip.[b]	Frost Free Days[c]
		(°C)	(cm)	
Jackson	Modified North Pacific Coast	2.3	30-35	30
Divide	Modified North Pacific Coast	3.7	30-35	65
Helmville	Modified North Pacific Coast	4.1	35-40	70
Choteau	Continental	6.4	25-30	105
Malta	Continental	6.0	30-35	131
Medicine Lake	Continental	5.2	30-35	107

[a]Cordell, 1974.

[b]Southard, 1973.

[c]Caprio, 1965.

METHODS

Selection of Study Areas

Each potential study site was visited periodically during the summer of 1976. Sites were screened for the following factors which might affect census attempts: water levels, livestock use, human influence and wind regularity and severity. Robbins (1954) concluded that a minimum wind speed of 5 m.p.h. (8 km/hr) was by far the most important single factor influencing winnowing that he tested.

Migration Chronology

Spring arrival of snipe was documented by direct observation at the Belgrade and Jackson areas in 1976 and at all areas in 1977. No attempt was made to obtain direct counts. Observation commenced the last week of March both years. Birds were observed by walking weekly routes through ice and snow free areas of likely snipe habitat.

Fall migration chronology was studied by conducting twice-weekly direct counts (Sanderson 1977) along two pre-determined routes on the Belgrade area only. Route lengths were 1.0 and 2.3 kilometers. The total number of birds flushed and their behavior was recorded. All spring census areas were not observed to determine fall chronology due to the difference in and lack of knowledge of migration patterns between spring and fall.

Winter

Winter observations were made on a twice monthly basis during the winters of 1976-1977 and 1977-1978. These observations began in mid-November and continued through late March on the Belgrade intensive study area. Observations were made along foot routes which paralleled stream edges and any other locations utilized as winter habitat by snipe. These observations simply reflected the presence of wintering snipe and were not used to project densities or total bird numbers on the area. Total route length walked was 3.3 kilometers.

Breeding

Spring breeding densities of snipe were determined through use of weekly winnowing counts on all areas (Burleigh 1952, Robbins 1954, Tuck 1972, Sanderson 1977). Vehicle census routes established at each area were used beginning with spring bird arrival. Of two distinct daily periods of snipe winnowing activity, Tuck (1954) considered post-sunset (as opposed to pre-sunrise) to be the most reliable for conducting a winnowing census since this period best samples the "peak interval" of winnowing activity.

Winnowing counts were begun fifteen minutes after sunset and lasted a maximum of one hour. Two minute stops at minimum intervals of 0.8 kilometers were made on each route.

Fifteen minutes post-sunset was chosen as the standard time for initiation of the evening winnowing census because of several interacting factors. Aerial displays are commonplace during daylight hours, but highly erratic, thus poorly representing the number of actual displaying birds on the area. Although undocumented, inclement weather conditions often seemed to moderate after sunset. This appeared to stimulate winnowing activity and also afforded improved conditions for obtaining accurate counts and locations of performing birds. Other factors taken into consideration were the dynamic changes in light intensity and temperature (Tuck 1954).

The census route layout was not necessarily a straight line, so allowances were made in the spacing of some stops to avoid potential overlap. Data recorded at each stop included the number of winnowing birds, weather conditions (wind, temperature, cloud cover, precipitation) and any special notes on bird activity. At each stop, the observer left the vehicle and located a vantage point where unrestricted observation could be made. Each stop on every route was maintained for the duration of seasonal census activity.

Nesting

On the Belgrade census area, approximately 1.3 square kilometers was intensively searched for nests both years of this study. Various combinations of one man up to 5 men and 2 dogs were used in the searches.

These searches began in late April and continued through mid-August. Nests were inconspicuously marked to facilitate further visits. Data recorded on the initial visit included location (plotted on a map), clutch size and egg measurements which were made with a vernier caliper.

Each nest was visited periodically to determine final clutch size and its fate. Based on an incubation period of 19 days (Tuck 1972), each successful nest was back dated to determine onset of incubation. In most cases, a successful hatch could be determined by the presence of chicks, the actions of 'defending' snipe, or by the presence of pliable shell membranes (Sowls 1948, Ellig 1955). Conversely, egg shells present but in a crushed state with or without remaining egg contents were considered indicative of mammalian predation (Rearden 1951). While in the field during the breeding and nesting seasons, field notes were maintained on all snipe activity.

Vegetation

During all field seasons of 1976, plants on the Belgrade census area were collected and identified according to Hitchcock and Cronquist (1974). This collection and the subsequent species list facilitated further vegetational analysis. Representative plants were further prepared for inclusion in the Montana State University herbarium.

Upon completion of activities at each nest, further analysis was made of the site; this included a vegetational description based on

species canopy coverage of 25, 2x5 dm plots located around the nest. Five plots were located on and immediately next to the site while the remaining twenty were positioned at intervals of 0.5, 1.25, 1.75, 5.0 and 10.0 meters from the nest. These radiated in cardinal directions from the site.

Aerial photographs were used to describe gross vegetational types on all census areas in conjunction with on-site inspection. Each area was flown and photographed in July 1977 using both color Ektachrome and infrared film. Maps of each site were then constructed and vegetational types delimited. Total area of each habitat type was measured with a Lietz planimeter and cross checked with a dot grid.

Banding

Incidental to other field work, snipe were captured and banded with standard U. S. Fish and Wildlife Service leg bands. Two methods of capture were used. Snipe were mist netted with a single 7 x 42 foot, 2-3/8 inch mesh net during the summer and early fall of 1976 and the spring, summer and early fall of 1977. This method yielded both adults and birds of the year. Secondly, newly hatched birds were hand captured when located at or near the nest site.

With mist nets, most success came by selecting choice daytime feeding and/or loafing sites. Birds were then flushed towards the net by walking in the direction of the net.

Harvest Survey

The annual Montana Game Bird Harvest Questionnaire, distributed by the Montana Department of Fish and Game, was used to obtain hunter harvest information for the 1976 and 1977 snipe seasons. Recorded data included total snipe killed, days hunted and location (county) hunted.

Direct contact with individual snipe hunters was attempted throughout the state. Various media coverage, including radio, television, magazine and newspaper was used in an attempt to locate snipe hunters. Personnel at each regional Montana Fish and Game office were contacted and their assistance requested. A detailed snipe hunter survey was made available to any responding hunter. That survey requested information on the nature of the snipe hunt (whether incidental to waterfowl hunting or not), days hunted, total number of snipe killed, area (county and specific location) hunted, dates hunted and any comments.

RESULTS AND DISCUSSION

Spring Arrival

Based on data from all study areas in 1977 and the Belgrade and Jackson areas in 1976, spring snipe migration appeared tied to the availability of open marsh and stream edge habitat which provided feeding and loafing areas. The earliest recorded arrival date for this study was April 11, the date in both years that migrating snipe were first observed on the Belgrade area. This arrival date excludes the small number of wintering birds already present. The sudden increase in snipe numbers observed along foot routes and increasing aerial displays (winnowing) were two observations which were used to conclude that migratory snipe had arrived. Initial snipe arrival dates at all areas are summarized in Table 2.

TABLE 2. Spring migrant arrival dates at all Montana census sites.

Area	Arrival Dates	
	1976	1977
Belgrade	April 11	April 11
Jackson	April 23-29	April 21-28
Divide	-	April 20-27
Helmville	-	April 18-22
Choteau	-	April 14-23
Malta	-	April 24-May 2
Medicine Lake	-	May 3-11

Within one week of initial arrival, migrants were numerous at all study areas, with the exception of Medicine Lake where high numbers were never recorded. The apparent late arrival of birds at Malta and Medicine Lake needs further consideration. Unlike other census sites, spring migrants at these two sites were not observed until winnowing activity began. However, winnowing activity may have been delayed upon arrival because of later spring phenology and ice-out. This activity appeared to be dependent upon environmental stimuli such as the presence of open waters and the availability of snow free sites suitable for nesting. At sites other than Malta and Medicine Lake, these requirements were met immediately upon the male's arrival on breeding territory. Since the Malta and Medicine Lake census sites were located in the prairie portion of the state and thus subject to more stressful conditions in April and early May than the mountain valley census sites, it becomes apparent that winnowing was inhibited prior to the advent of the harsh, late spring season.

Ground censuses were conducted prior to observed winnowing, but no snipe were located at Medicine Lake. Snipe had been observed here by other personnel (Bellinger 1977, pers. comm.) prior to the dates indicated, thus further suggesting delayed winnowing activity and the possible presence of snipe prior to the dates indicated.

Breeding

In Canada, the sedge bog and the fen, both of which have sedges (Carex spp.) as prominent plant taxa, are considered prime breeding habitat for snipe (Tuck 1972). The sedge bog, while comprising a very small portion of available breeding habitat, supports relatively high breeding pair densities. On the other hand, the fen, simply because of its greater range across Canada, is considered the most important breeding habitat for snipe.

In Montana, snipe breeding habitat and the occurrence of the genus Carex appear to a large extent to be synonymous. Certain Carex species require a semi-aquatic or at least a moist environment; the presence of these Carex species was used initially as a site evaluation criterion when attempting to establish study sites throughout Montana. These sites typically were located in areas with seasonally abundant water in some form, whether natural or artificial.

Breeding habitat in the state's western half is found in the intermountain valleys and on sites which receive transported waters used for agricultural purposes. In eastern Montana, irrigated sites and their associated drainages provide breeding habitat for snipe; isolated water storage facilities such as stock ponds and larger reservoirs provide limited breeding habitat.

In an effort to estimate breeding densities at sites throughout Montana, available breeding habitat was quantitatively measured. The

presence of Carex species and water availability were given prime consideration in defining the breeding habitat limits of a given site. Table 3 lists the amount of available breeding habitat at each census site as measured by the above criteria.

Male snipe arrive at breeding areas ten to fourteen days before females (Tuck 1972). In Montana, snipe commenced winnowing immediately upon arrival on all areas with the possible exceptions of Malta and Medicine Lake. Winnowing counts indicated continual migrant movement until counts peaked and stabilized in early May. Table 4 summarizes weekly counts of winnowing snipe per route at each census site. Breeding pair densities per hectare of available breeding habitat at each area are presented in Table 5. Scattered, discontinuous breeding habitat, coupled with highly variable water levels and alkaline water and soil conditions probably contributed to low snipe density at Medicine Lake. Ironically, many of the same conditions existed at the Malta site, where breeding pair densities were highest for this study. The principal difference was in the localized presence of fresh (non-alkaline) water areas at Malta (Foster 1977, pers. comm.), which supported snipe breeding habitat.

On both the Malta and the Medicine Lake census sites, grazing is non-existent; consequently, the vegetation reaches expected heights and densities. Johnson (1975) found ungrazed or tall vegetation (20 to 70+ cm)

TABLE 3. Size, route length and stops for census areas in Montana

Location	Total Area Censused	Available Breeding Habitat	Breeding Habitat as Percent of Total Area	Route Length	Number of Stops
	(ha)	(ha)		(Km)	
Belgrade	1950	86.7	4.5	8.9	12
Jackson	1555	268.9	17.3	9.7	13
Divide	2592	72.3	2.9	13.7	16
Helmville	1942	191.4	9.3	10.5	14
Choteau	1814	127.4	7.0	9.7	12
Malta	1424	26.2	1.8	7.2	9
Medicine Lake	1295	62.6	4.8	7.2	8

TABLE 4. Weekly counts of winnowing snipe from all study sites, 1977

Location	April				May		
	2-8	9-12	16-22	23-29	30-6	7-13	14-20
Belgrade	6	13/14[a]	10/19	29	14	28	-[b]
Jackson	-	-	0	23	27	38	33
Divide	0	-	0	7	12	8	10
Helmville	0	0	0/24	18	26	25	26
Choteau	-	1	17	27/26	19/21	23	-
Malta	0	0	-	7	11	13	12
Medicine Lake	0	-	0	0	0	5	4

[a]Sample period includes two counts.

[b]No count conducted during this period.

TABLE 5. Breeding pair densities at all census sites, 1977

Location	Winnowing Bird Counts	Area (ha)	Pairs/ hectare	Pairs/ 100 ha
Belgrade	29	86.7	0.34	34
Jackson	38	268.9	0.14	14
Divide	12	72.3	0.17	17
Helmville	26	191.4	0.14	14
Choteau	27	127.4	0.21	21
Malta	13	26.2	0.50	50
Medicine Lake	5	62.6	0.08	8

to support comparatively low breeding snipe densities as opposed to grazed sites with naturally low growth (5 to 30 cm) vegetation.

At the Belgrade and Choteau census sites, snipe breeding habitat is part of a diverse community of vegetation types. This distribution of types provides for more easily delineated breeding snipe habitat and a more predictable occurrence of snipe on suitable sites. At both locations, water levels are relatively constant and grazing is moderate to heavy. This results in low vegetal heights during the breeding season. Densities of breeding pairs per 100 hectares were 34 and 21 pairs for the Belgrade and Choteau sites, respectively.

Breeding pair densities at Helmville, Jackson and to a lesser degree Divide, were a function of large expansive areas of continuous snipe breeding habitat. The percentage of breeding habitat in the total area surveyed amounted to 17.3 and 9.3 percent for the Jackson and Helmville

areas respectively, the two highest values for this study. Although breeding habitat at Divide is mostly continuous, the percentage of breeding habitat compared to the total area surveyed does not reflect such. This is due to the confinement of breeding habitat along a single stream. Pair densities for Helmville, Jackson and Divide were 14, 14 and 17 pairs per 100 hectares, respectively. All three sites received light grazing pressure.

Tuck (1972) recorded breeding densities ranging from 5.5 to 13.2 pairs per 100 hectares in Canadian sedge bogs, from 3.5 to 7.7 pairs in fens, and from 9.5 to 17.2 pairs in willow and alder swamps. Johnson (1975), working with snipe in Colorado, derived total snipe densities (unlike pair densities) of 0.6 and 0.7 snipe per hectare during breeding seasons of 1974 and 1975, respectively.

Montana breeding densities are equal to or higher than breeding densities in Canada and total bird densities in Colorado. Apparently, restricted breeding habitat, rather than large continuous expanses of the same offer increased edge, thus providing greater snipe densities. Restricted breeding areas, one component in a large, diverse collection of habitat types throughout the state, are the rule.

Nesting

Intensive searches on the Belgrade study area yielded a total of 19 nests. Nine nests were located in 1976, ten in 1977. Six other nests were discovered at sites including Jackson, Helmville and Choteau

(Table 6). Of 20 total nests with a known history on and around the Belgrade area, one was initiated in April, eighteen in May and one in June (Figure 6).

Evidence of nesting activities in June and July was found at the Belgrade, Jackson and Helmville sites. A single nest was located on 14 July 1977 at the Belgrade site. Its estimated onset date of incubation according to embryo development was 1 July.

On the Belgrade area, repeated observations were made of snipe exhibiting distress postures or distraction moves associated with defense of young. Based on time and location of these observations with respect to known nest sites, they were considered to represent nesting pairs separate from those previously located. Five chicks ("nests") were located as a result of these observations, three in 1976 and two in 1977 (Figure 7—expected nest sites). Using age curves constructed by Bishop (1966) and Tuck (1972) based on bill length, ages were assigned to each chick. Dates of hatch and onset of incubation were then derived (Table 7). At Jackson, a single chick was captured 11 August 1976 with a bill length of 20.5 cm. Calculated starting date of the originating clutch was 18 July.

Defense activities were also observed at both Jackson and Helmville in late July, although no chicks were located. According to Tuck (1972), snipe chicks become independent of the parent by six weeks of age, so young snipe (less than six weeks) were probably present.

TABLE 6. Snipe nesting data, Montana 1976 and 1977.

Location	Year	Date Located	Initiation of Incubation[a]	Date of Hatch	Clutch Size	Number of Eggs Hatched
Belgrade	1976	7 May	2 May	21 May	4	4
	1976	15 May	12 May	31 May	4	4
	1976	16 May	3 May	22 May	4/3[b]	3
	1976	22 May	6 May	25 May	4	4
	1976	22 May	7 May	26 May	4	4
	1976	23 May	4 May	23 May	4	4
	1976	24 May	16 May	4 June	4	4
	1976	27 May	18 May	6 June	4	4
	1976	28 May	23 May	11 June	4	4
Jackson	1976	5 June	---Data Unavailable---		4	-[c]
Belgrade	1977	5 May	27 April	16 May	4	3
	1977	16 May	7 May	26 May	4	4
	1977	17 May	1 May	20 May	4	4
	1977	17 May	14 or 15 May	2 or 3 June	4	4
	1977	20 May	2 May	-	4	0[d]
	1977	20 May	8 May	27 May	4	4
	1977	23 May	6 May	25 May	4	4
Helmville	1977	24 May	---Data Unavailable---		4	4
Belgrade	1977	26 May	8 May	27 May	4	4
Choteau	1977	30 May	---Data Unavailable---		3[e]	-[c]
	1977	30 May	---Data Unavailable---		4	-[c]
	1977	30 May	11 May	30 May	4	4
Jackson	1977	8 June	27 May	15 June	4	4
Belgrade	1977	12 June	2 June	21 June	4	4
	1977	14 July	1 July	-	3	0[f]

[a] Based on 19 day incubation.

[b] Single egg destroyed; nesting successful.

[c] Unknown fate.

[d] Mammalian predation.

[e] Incomplete data; possibly an incomplete clutch.

[f] Nest destroyed by human interference.

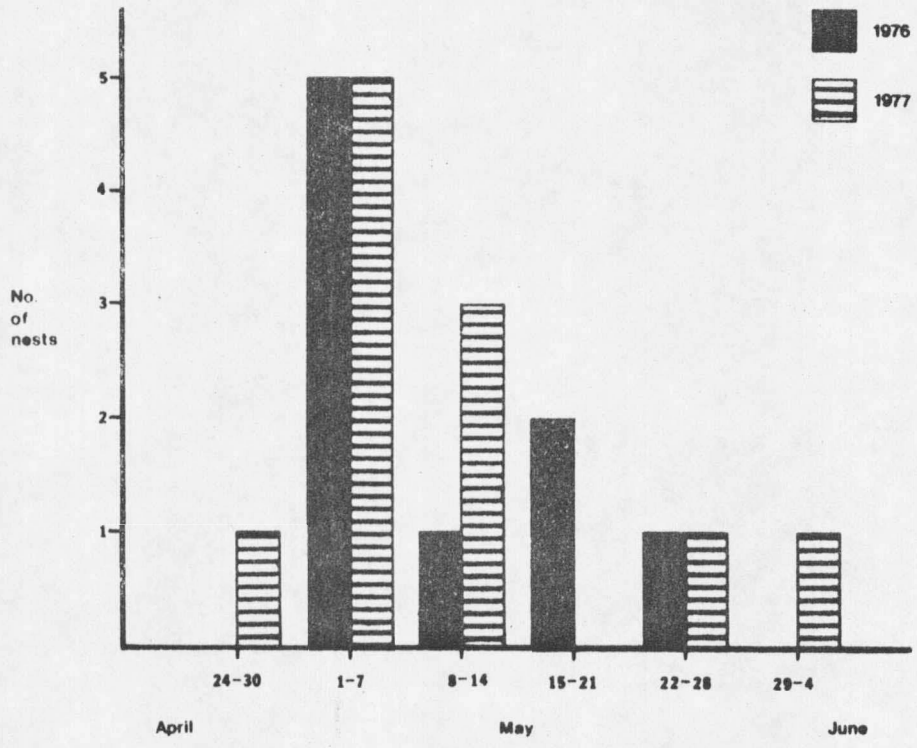

FIGURE 6. Initiation of incubation, 1976 and 1977 on the Belgrade intensive study area.

FIGURE 7. Location of 1976 and 1977 nest sites on the Belgrade intensive study area.

TABLE 7. Nest activity as represented by location of chicks on the Belgrade area.

Date Located	Bill Length (mm)	Assigned Age (days)	Date of Hatch	Incubation Initiation
6 July 1976	21.5	6-8	June 28-30	June 9-11
10 July 1976	23.0	9-11	June 29-July 1	June 10-12
27 July 1976	31.0	14-16	July 11-13	June 22-24
10 July 1977	30.0	13-15	June 25-27	June 6-8
1 August 1977	24.5	11-13	June 30-July 2	June 19-21

Perching snipe were also considered indicative of the presence of chicks. This is an uncommon trait, except immediately after a successful hatch. Parent snipe were observed to perch on fence posts, telephone poles and dead trees. In the Labrador peninsula, Todd (1963) made reference to this same activity. As interpreted by Tuck (1972), trees (perching sites) are desirable to the snipe's nesting economy. This study showed perching to be more specifically associated with the post-hatching aspects of the nesting economy. Two chicks were found at Belgrade after locating perching snipe and searching the immediate area. Because perching was observed up to a month after the hatching peak, these chicks could not be considered representative of unrecorded nests. Increased brood mobility would make it difficult to assign unmarked birds to a specific nest site. Perching snipe were observed on all census areas.

Working in Newfoundland, Canada, Tuck (1972) found the peak hatch to be during the first two weeks of June. Peak hatching in Colorado (based

on onset of incubation plus a 19 day incubation period) occurred the first three weeks of June (Johnson 1975). In this study, the last week of May and the first week of June were peak hatching periods, based on 20 known dates.

Of 25 nests, 23 contained a complete clutch of 4 eggs. One nest, subsequently destroyed and found to be in mid-stages of incubation, had a complete clutch of three eggs. Another nest was found with three eggs although incomplete data prevented determining whether or not it was a complete clutch.

Nest success (minimum of one successful egg), was 95 percent (20 of 21 nests). The single unsuccessful nest was lost to mammalian predation. This nest was one of two located in the upland vegetation type. Egg success was also high, with 78 of 84 eggs hatching. The following example suggests that the incubating female is strong willed in attempting to successfully hatch the eggs. A completed nest was found 16 May 1976 by stepping on it. One egg was crushed and its contents were removed. On 22 May the remaining three eggs successfully hatched. Fledged juveniles were first observed on the Belgrade area June 9 and June 6 in 1976 and 1977, respectively.

Eighty-seven eggs were measured and had a mean length of 37.2 mm and a mean width of 28.2 mm. The range of measurement extended from 36.8 to 42.0 mm in length and 26.2 to 30.0 mm in width.

Of 25 nests located during this study, all but five were immediately

associated with sedges as part of a riparian habitat type. On the Belgrade intensive study area, 17 of 19 nests were located in the riparian type (Figure 7). Sedges comprise the major plant genus in this type. Of the 19 nests, an average vegetative description of the nest site was obtained for 17 (Table 8). The two nests not situated in the riparian type were included in the nest site analysis.

TABLE 8. Average percent plant species composition at 17 nest locations on the Belgrade study area.

	Distance from the nest (meters)					
	(nest) 0(site)	0.6	1.3	1.8	5	10
Carex spp.	62	62	55	49	40	26
residual vegetation	18	15	12	12	9	6
Juncus balticus	7	8	14	15	23	25
bare ground	4	6	5	7	6	5
Glyceria spp.	4	3	4	4	4	1
Potentilla anserina	2	2	2	2	-	1
Geum macrophyllum	1	1	2	1	1	-
Potentilla gracilus	1	-	1	1	-	1
Verbena hastata	1	-	1	-	-	-
Cornus stolonifera	-	-	-	-	5	10
water	-	-	-	4	5	11
Typha spp.	-	-	-	-	1	3
Symphoricarpos albus	-	-	-	-	3	2
Mimulus guttatus	-	-	-	-	-	1
unknown grasses	-	3	4	5	3	8

Vegetation data from the immediate vicinity of the next indicated a high degree of selection for stands of Carex spp. Within a stand, the actual nest site selected showed a greater percent Carex spp. composition than the stand as a whole. At 17 nest sites, the cover components at 0 meters (Table 8) averaged 62 percent Carex spp., 7 percent Juncus balticus and 9 percent other forbs and grasses, all representing current years growth. Additional components included 18 percent residual vegetation (previous years vegetational growth) and 4 percent bare ground. Ten meters from the nest site, these same cover components averaged 26 percent Carex spp., 25 percent Juncus balticus, 6 percent residual vegetation and 5 percent bare ground. Except for bare ground, these differences in components at 0 and 10 meters were significant. Other vegetation of importance in the 10 meter plots was dogwood (Cornus stolonifera; 10 percent) and unknown grasses (8 percent). Water had a value of 11 percent. These last three categories reflect the nest location in the riparian type relative to other vegetative types and water. Typically, the nest was stationed away from open water and was seldom located in the upland or woodland types which are characterized by the unknown grasses and dogwood, respectively.

Fall Migration

Peak fall migration at the Belgrade area occurred through the periods of October 5-19 in 1976 and October 18-27 in 1977 (Figure 8). This was characterized by a threefold increase in bird numbers. Observations of

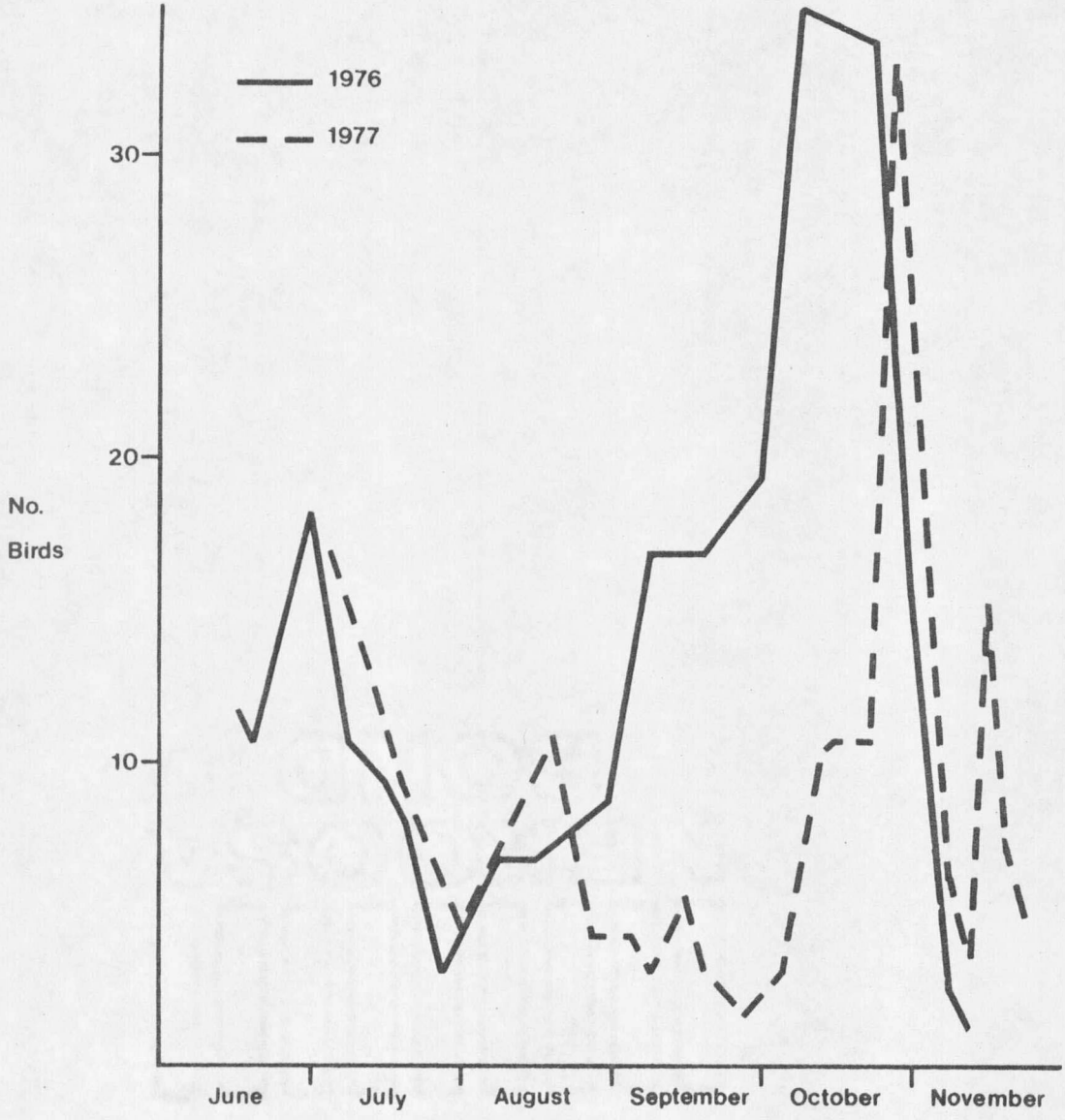

FIGURE 8. Fall migration chronology at the Belgrade study area, 1976 and 1977.

loosely grouped snipe in the air in numbers from five to ten birds and the increased use of open, barren and flats was also considered indicative of fall migration.

By November 4, 1976 and November 13, 1977, a majority of snipe had passed through the Belgrade area and fall migration was considered to have ceased. Ground counts continued through November of both years and revealed no further observable passage of snipe through the area.

The increased numbers of snipe observed in early July (Figure 8) is partly due to the increased observability of recently fledged birds of the year. These juveniles became apparent at this time, and were easily classified in hand by the presence of incomplete adult plumage. At about two months of age, traces of natal down can still be recognized on the thighs and the nape of the neck (Tuck 1972). Juveniles up to this same age could be classified by their awkward flight characteristics although such identification proved more difficult than birds in the hand.

Systematic fall counts were conducted only on the Belgrade study area. Elevational and topographical differences within the state precludes drawing conclusions for statewide fall migration patterns from one site. Observations at the Jackson census area indicated the fall exodus of snipe began the second week of August in 1976 and in late August of 1977. It is unknown whether this movement represented actual migration or only a movement to pre-migratory staging areas. However, by early September of both years, only scattered birds were located

during extensive searches on this area. At Jackson, the average date of the first fall freeze is August 13 (Caprio 1965), a date corresponding closely with bird departures. At this area, in the absence of warm water springs or open stream edge habitat, feeding sites were non-existent after the first hard freeze.

Winter Observation

On the Belgrade intensive study area observation routes totaling 3.3 kilometers were walked. Bird numbers, which ranged between two and nine snipe, fluctuated such that no trends in bird numbers were evident.

The presence of open water with exposed streamside feeding sites (Figure 9) dictated the selection of winter habitat. In the event of a hard freeze or heavy snows, pockets of winter habitat were maintained by the presence of permanent warm water springs (Figure 10). Both the stream edge and warm water spring sites typically contained short, sparse vegetation and abundant exposed mud flats. These conditions provided the only known available feeding sites in the area, and undoubtedly account for the presence of wintering snipe at latitudes this far north in Montana (45°50').

Banding

Eighty-four snipe were leg banded during this study, sixty-eight at Belgrade and sixteen at the Jackson area. Forty-two adults, forty-one juveniles and one bird of unknown age were banded. Except for two instances where adult females were captured on the nest, sex was

FIGURE 9. Winter feeding site with exposed mud flats on the Belgrade study area.

FIGURE 10. Warm water spring providing a winter feeding site during extremely inclement winter weather on the Belgrade area.

undetermined. Chicks less than one day old were banded on the nest or in the immediate vicinity. Fledged juveniles and adults were mist netted.

Two indirect recoveries of banded snipe were made. Both birds were banded as adults in the summer of 1976, and recaptured by mist netting in the summer of 1977. Banding and recapture both took place on the Belgrade area. Tuck (1972) found that adult snipe, banded on their breeding grounds, were faithful to those same grounds in subsequent years.

Harvest Assessment

Snipe harvest data for Montana (Montana Game Bird Harvest Questionnaire, Department of Fish and Game) compare favorably with information from adjacent states and those with comparable hunting pressure (Table 9). Based on the 1976 annual harvest survey, 450 snipe hunters bagged 1350 birds in 1125 days afield. No distinction was made between hunters specifically seeking snipe and those who might kill snipe incidental to other (waterfowl) hunting.

Further analysis of the 1976 snipe season in Montana showed that 84 percent of the snipe kill and 80 percent of the hunting pressure occurred in the Pacific flyway portion of the state (Figure 11).

Efforts to personally contact individual snipe hunters with a questionnaire of an expanded and detailed format were not productive. The relatively sparse number of snipe hunters coupled with the large size of the state served to thwart efforts to obtain harvest information by this method. The failure of this attempt in itself points out the relative priority given the Common Snipe by bird hunters in Montana.

TABLE 9. Harvest data from states with snipe hunter surveys (from Sanderson 1977).

State	Number of Hunters	Number of Snipe Harvested	Year	Average Harvest
Alaska	10,400	3,100	1971	3,100
California	12,200	92,000	1971	82,200[a]
Colorado	500	1,400	1971	1,100[b]
Delaware	200	500	1972	500
Florida	16,600	204,000	1972	197,300[a]
Idaho	ND	1,900	1971	1,900[b]
Iowa	3,600	7,700	1972	7,600[a]
Maryland	600	800	1972	1,300[a]
MONTANA	450	1,350	1976	1,350[c]
Nebraska	ND	1,200	1971	2,100[a]
New Mexico	100	100	1969	100[a]
Oregon	4,100	14,300	1971	13,500[b]
Utah	1,700	4,000	1971	4,900[a]
Virginia	1,800	7,900	1969	7,900
Washington	7,000	34,700	1972	36,000[a]

[a]Based on latest three years of available data.

[b]Based on latest two years of available data.

[c]Based on a single year's data.

Distribution of Breeding Snipe in Montana

In Montana, major snipe breeding habitat coincides with the extent of sub-irrigated and naturally moist intermountain valleys in the western and west-central portions of the state and with flood irrigated portions of river drainages in the central and eastern parts of Montana. Breeding sites within these areas include sedge bogs, stream edges, some grazed pastures and "waste" areas which collect excess waters. In eastern Montana, the latter is especially true. Other suitable breeding habitat of less importance, in terms of total birds produced, may include the