The influence of rest-rotation grazing management on waterfowl production on stock-water reservoirs in Phillips County, Montana
by John Gerhard Mundinger

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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Abstract:
Waterfowl production on the stock-water reservoirs in the Milk River Association Allotment, Phillips County, Montana was studied during 1973 and 1974 to evaluate the influence of rest-rotation grazing management. Breeding pairs, broods and species diversity increased on the allotment since a study which terminated in 1970. Changes in the distribution of breeding pairs and broods, from 1973 to 1974, suggested a positive response by waterfowl to the previous year's rest treatment, and a negative response to heavy grazing pressure during the late summer and fall of the previous year. These conclusions are further substantiated by the histories of five marked females. Waterfowl responded positively to rest and deferred treatments, and negatively to spring grazing during the current season.

Key shrub and grass species on permanent vegetation transects, established in 1968, responded positively to rest-rotation grazing, with greater responses recorded during years of reduced grazing intensity. Shoreline and upland transects established during 1974 indicated that new vegetation accumulates most rapidly in those pastures' deferred from early season grazing. The greatest accumulation of residual, vegetation occurred in the pasture rested and the pasture grazed only during the spring. Regrowths following relief from grazing, did contribute to the accumulation of residual vegetation. Residual vegetation was an important component at six of seven nest sites analyzed during 1974. These data also indicated that females selected nest sites on the basis of the structure rather than species composition of the vegetation. Canada goose (Branta canadensis) production on the study area increased since 1970. This increase is related to the inclusion of islands in reservoirs. Management recommendations are discussed.

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ABSTRACT

Waterfowl production on the stock-water reservoirs in the Milk River Association Allotment, Phillips County, Montana was studied during 1973 and 1974 to evaluate the influence of rest-rotation grazing management. Breeding pairs, broods and species diversity increased on the allotment since a study which terminated in 1970. Changes in the distribution of breeding pairs and broods, from 1973 to 1974, suggested a positive response by waterfowl to the previous year's rest treatment, and a negative response to heavy grazing pressure during the late summer and fall of the previous year. These conclusions are further substantiated by the histories of five marked females. Waterfowl responded positively to rest and deferred treatments, and negatively to spring grazing during the current season. Key shrub and grass species on permanent vegetation transects, established in 1968, responded positively to rest-rotation grazing, with greater responses recorded during years of reduced grazing intensity. Shoreline and upland transects established during 1974 indicated that new vegetation accumulates most rapidly in those pastures deferred from early season grazing. The greatest accumulation of residual vegetation occurred in the pasture rested and the pasture grazed only during the spring. Regrowth, following relief from grazing, did contribute to the accumulation of residual vegetation. Residual vegetation was an important component at six of seven nest sites analyzed during 1974. These data also indicated that females selected nest sites on the basis of the structure rather than species composition of the vegetation. Canada goose *(Branta canadensis)* production on the study area increased since 1970. This increase is related to the inclusion of islands in reservoirs. Management recommendations are discussed.

INTRODUCTION

The construction of stock-water reservoirs has provided waterfowl breeding habitat in regions where such habitat was sparse or absent (Smith 1953; Uhlig 1963; Bue *et al.* 1964; and Shearer and Uhlig 1965). That these reservoirs make an important contribution to the annual production of waterfowl is related to the large area involved (Smith 1953), the relative stability of water levels between years (Bue *et al.* 1964) and a relatively high rate of nest success, associated with a low population density (Smith 1953; and Rundquist 1973).

A potential conflict between breeding waterfowl and grazing animals exists on these reservoirs. Bue *et al.* (1952) demonstrated that grazing by cattle reduced the nesting cover rating of the upland vegetation around stock ponds. Furthermore, the quality of the shoreline cover decreased with increased grazing intensity, and use by breeding pairs and broods was reduced on ponds with poor shoreline cover. Kirsch (1969) found higher nest densities and nest success on ungrazed, as compared to grazed plots.

Fencing has been suggested as a possible means of minimizing the conflict between livestock and waterfowl on stock ponds (Bue *et al.* 1952; and Berg 1956). However, the cost of installing and maintaining fences, relative to the benefits which might accrue, usually makes this practice prohibitive. Furthermore, fencing a portion of a pond, while protecting the riparian vegetation, is of no value in providing upland

nesting cover. Keith (1961) found that the heavy cover in fenced areas was attractive both to nesting waterfowl and nest predators.

Rest-rotation (Hormay and Talbot 1961) is a grazing system which employs periodic rest to achieve an improved range condition. While the formula may be designed for maximum livestock production, it may also consider other land uses. Gjersing (1971), working in native bunchgrass prairie, found greater amounts of residual vegetation in spring in pastures which were ungrazed or grazed only during spring the previous season, as compared to other pastures in the allotment. The presence of residual cover apparently contributed to increases in waterfowl production in these pastures. Furthermore, breeding success increased on two allotments managed with a rest-rotation grazing system, while decreasing on units subjected to continuous grazing.

This study is a further evaluation of waterfowl responses to rest-rotation management. Field data were gathered during the summer of 1973 and the spring and summer of 1974.

DESCRIPTION OF STUDY AREA

This study was conducted on the Milk River Association Allotment, Gjersing's (1971) south study area. The allotment is located approximately twelve miles south of Malta, Phillips County, Montana, adjacent to U. S. Highway 191 (Fig. 1). The area includes 20,650 acres, divided into five pastures, ranging in size from 3,317 to 4,832 acres. An additional pasture, Unit B, lies adjacent to the southeast corner of the allotment. Although not included in the grazing system, Unit B is used by the Association during the normal livestock operation.

The physiography of the area is rolling plains dissected by deeply entrenched streams and coulees. Rough, broken land is found along most of the streams and in the more feebly glaciated areas (Gieseker 1926).

The climate is characterized by low rainfall, great temperature extremes, and a large number of sunny days (Gieseker 1926). The mean annual temperature is 42.8° F, and the mean annual precipitation is 11.84 inches. Above average precipitation was recorded during 1973 and 1974. However, water conditions of the reservoirs during 1973 was poor, associated with a low spring runoff and below average precipitation during fall 1972 and the first seven months of 1973. Water conditions during 1974 were excellent, associated with above average precipitation during fall 1973, high spring runoff, and heavy rains during the last two weeks in May (U. S. Department of Commerce 1972-1974).

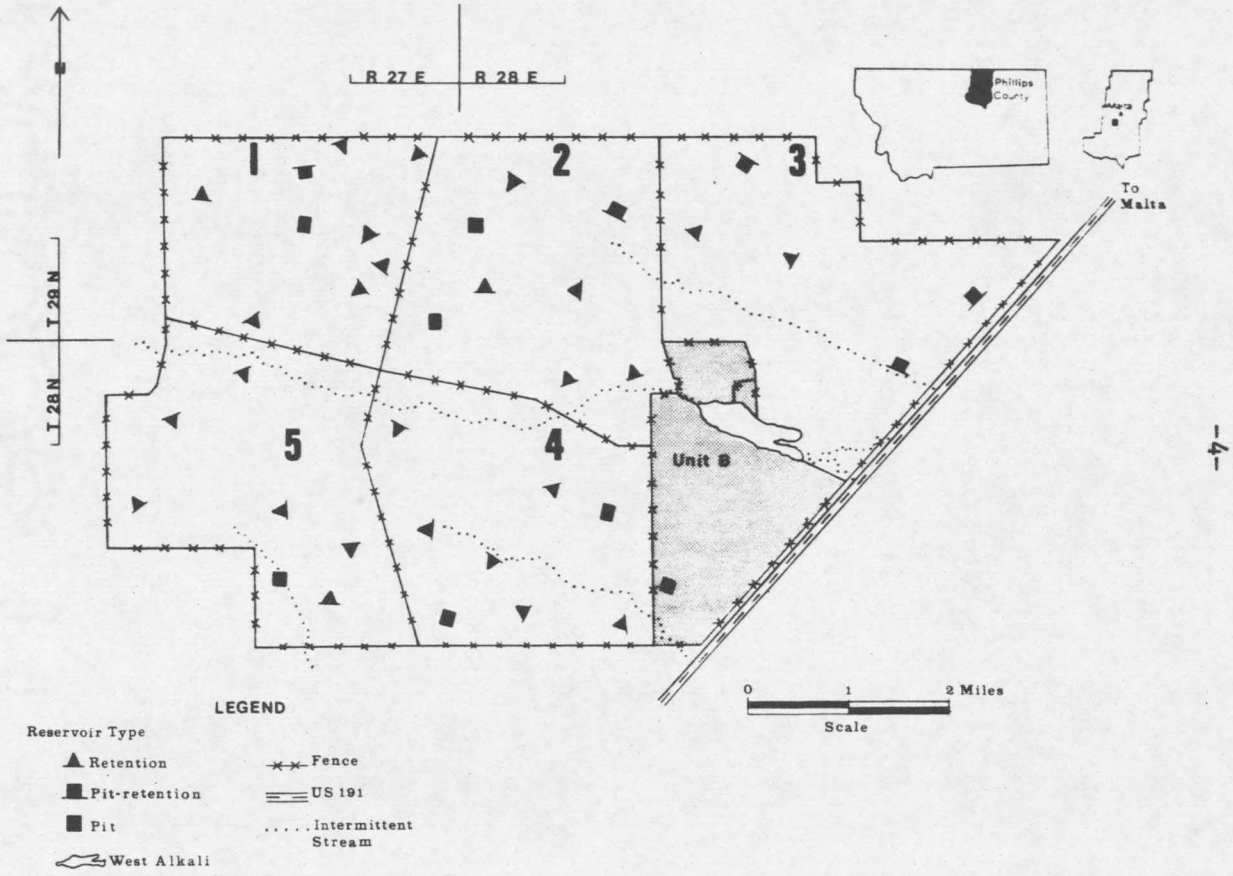

Figure 1. Map of the Study Area.

The vegetation of the area is primarily a grassland community. Upland sites are dominated by clubmoss *(Selaginella densa)* throughout the growing season. Prominent grasses are Junegrass *(Koeleria cristata)* and Sandberg bluegrass *(Poa secunda)* during the late spring, and blue grama *(Bouteloua gracilis)* during the summer. Other major grasslike species include sixweeks grass *(Vulpia octoflora)* and needleleaf sedge *(Carex eleocharis)* during the spring, western wheatgrass *(Agropyron smithii)* and needle-and-thread *(Stipa comata)* during the early summer, and plains muhly *(Muhlenbergia cuspidata)* during the late summer.

Crested wheatgrass *(Agropyron cristatum)* is the dominant species on several upland sites. These areas, totaling 805 acres, were planted with this species. It also occurs as an occasional volunteer.

Fringed sagewort *(Artemisia frigida)* is the dominant forb on upland sites. Other important species include plains prickly pear *(Opuntia polycantha)*, plantain *(Plantago* spp.*)*, milkvetch *(Astragalus* spp.*)*, yarrow *(Achillea millefolium)*, scarlet globemallow *(Sphaeralcea coccinea)*, stiff linen *(Linum rigidum)*, prairie thermopsis *(Thermopsis rhombifolia)*, silver-leaf scurfpea *(Psoralea argophylla)*, broom snakeweed *(Gutierrezia sarothrae)*, and Nuttall saltbush *(Atriplex nuttallii)*. Silver sagebrush *(Artemisia cana)*, with a scattered distribution on some sites, is the only important shrub occurring in the uplands.

Two tracts of upland habitat in Pasture 4 totaling 1,294 acres were contour furrowed and seeded to a range mixture, as a range

renovation practice, in November 1968. Much of the vegetation occurring on the upland sites is also prominent on these areas. There is an increased density of fringed sagewort, western wheatgrass and needle-and-thread. Other important species include green needlegrass *(Stipa viridula)* and alfalfa *(Medicago sativa)*, both included in the seeding mixture, and a variety of annual forbs.

Coulee bottoms include much of the same vegetation as described for the uplands, with an increase in the density of shrubs. Silver sagebrush is common, while big sagebrush *(Artemisia tridentata)* occurs on a few coulee bottom sites typified by heavier soils. These two species appear to be mutually exclusive, perhaps related to edaphic characters.

Moister areas in the coulee bottoms, particularly adjacent to intermittent streams, support dense growths of Woods rose *(Rosa woodsii)* and western snowberry *(Symphoricarpos occidentalis)*. These stands may be intermingled with currant *(Ribes* spp.*)*.

Thirty-nine reservoirs of three types have been constructed on the allotment: (1) twenty-eight retention, (2) six pit, and (3) five pit-retention. At high water, the reservoirs range in size from 0.2 to 10.6 surface acres. The distribution of water, by pasture and reservoir type, during both years of the study is included in Appendix Table 25.

The vegetation associated with the retention reservoirs occurs in rather distinct zones from the open water to the upland. The prominent species in the submerged vegetation zone include pondweed *(Potomogeton* spp.*)*, American milfoil *(Myriophyllum exalbescens)*, and aquatic buttercup *(Ranunculus aquaticus)*.

Spike-sedge *(Eleocharis macrostachya)*, occurring as dense stands in at least a portion of most of the reservoirs, is the dominant species in the zone of emergent vegetation. Giant bulrush *(Scirpus validus)* occurs as well established stands in four of the reservoirs and is gradually pioneering several others. Common cattail *(Typha latifolia)* is well established in one reservoir and was observed in two others. Other prominent species of the emergent zone include American water plantain *(Alisma plantago-aquatica)*, common arrowleaf *(Sagittaria latifolia)*, and colored smartweed *(Polygonum coccineum)*.

A mixture of grasslike species, particularly foxtail barley *(Hordeum jubatum)*, tufted hairgrass *(Deschampsia caespitosa)*, sedge *(Carex* spp.*)*, and bluegrass *(Poa* spp.*)*, dominates the riparian zone of retention reservoirs. Additional species which may occur in this zone include slender rush *(Juncus tenuis)*, needle-spike-sedge *(Eleocharis acicularis)*, American sloughgrass *(Beckmannia syzigachne)*, desert saltgrass *(Distichlis stricta)*, field mint *(Mentha arvensis)*, and dock *(Rumex* spp.*)*. Due to water level fluctuations, the demarcation between the zones of emergent and riparian vegetation is not

distinct.

The vegetation associated with pits is influenced by the site in which they are located. Two pits are situated in coulee bottoms, trapping the water flowing in intermittent streams. The aquatic vegetation in these reservoirs is poorly developed. One of these pits supports a dense growth of vegetation on its banks, similar to the riparian vegetation which occurs at retention reservoirs. The other has a poorly developed shoreline vegetation. Four pits are constructed in large temporary potholes. While the pits support sparse aquatic growth, the adjacent vegetation is strongly dependent upon the water conditions of the potholes. These potholes were full during the spring of 1974 and continued to hold water through the middle of the summer or longer. They were dry in 1973.

Pit-retention reservoirs are constructed in areas of natural runoff, such that water impeded by the dam collects in the pit behind the dam. A narrow band of shallow water surrounds these pits and emergent vegetation is sparsely developed in this margin. Dense growths of spikesedge occur where water overflows the pit, particularly in the upper ends of the reservoirs. A zone of riparian vegetation surrounds these overflow areas.

Natural water areas on the study area include intermittent streams and potholes. Potholes range in size from small depressions to approximately 45 surface acres, with most less than one acre. During

many years, e.g. 1973, the potholes exist briefly following spring run-off and heavy rainstorms. In this condition, the potholes would be classified as ephemeral to poorly developed temporary potholes (Stewart and Kantrud 1969). The vegetation which develops on these sites is quite variable, with much of it appearing after the potholes have dried. During 1974, however, the larger potholes were classified as seasonal potholes and they endured at least through the middle of the summer. In this condition several of the large potholes developed dense growths of spike-sedge. Although the emergent zone was well developed, a distinct riparian zone was not typical of the potholes during 1974.

A complete list of the avifauna observed on the study area during the course of this investigation is included in Appendix Table 26. Prominent resident species, other than Anseriforms, include eared grebe *(Podiceps nigricollis)*, pied-billed grebe *(Podilymbus podiceps)*, great blue heron *(Ardea herodias)*, Swainson's hawk *(Buteo swainsoni)*, marsh hawk *(Circus cyaneus)*, sage grouse *(Centrocercus urophasianus)*, American coot *(Fulica americana)*, killdeer *(Charadrius vociferus)*, long-billed curlew *(Numenius americanus)*, willet *(Cataptrophorus semipalmatus)*, marbled godwit *(Limosa fedoa)*, Wilson's phalarope *(Steganopus tricolor)*, common tern *(Sterna hirundo)*, common nighthawk *(Chordeiles minor)*, eastern kingbird *(Tyrannus tyrannus)*, horned lark *(Eremophila alpestris)*, western meadowlard *(Sturnella neglecta)*, yellow-headed blackbird *(Xanthocephalus xanthocephalus)*, red-winged blackbird

(Agelaius phoeniceus), brown-headed cowbird *(Molothrus ater)*, lark bunting *(Calamospiza melanocorys)*, McCown's longspur *(Calcarius mccownii)*, and chestnut-collared longspur *(Calcarius ornatus)*.

Other vertebrates observed include tiger salamander *(Ambystoma tigrinum)*, leopard frog *(Rana pipiens)*, painted turtle *(Chrysemys picta)*, bull snake *(Pituophis melanoleucus)*, plains garter snake *(Thamnophis radix)*, western rattlesnake *(Crotalus viridis)*, badger *(Taxidea taxus)*, striped skunk *(Mephitis mephitis)*, coyote *(Canis latrans)*, red fox *(Vulpes vulpes)*, Richardson ground squirrel *(Spermophilis richardsonii)*, muskrat *(Ondatra zibethica)*, whitetail jackrabbit *(Lepus townsendi)*, mountain cottontail *(Sylvilagus nuttalli)*, mule deer *(Odocoileus hemionus)*, whitetail deer *(Odocoileus virginianus)*, and North American pronghorn *(Antilocapra americana)*. Blacktail prairie dogs *(Cynomys ludoviciana)* have been reported on the area in previous years, however, the towns were erradicated.

The primary land use of the study area is cattle production. The allotment provides summer pasture for cattle and is grazed from approximately 1 May through 31 October each year. The history of this area is one of heavy use by livestock. An Allotment Management Plan was formulated and rest-rotation grazing initiated in 1967.

METHODS

A waterfowl census was conducted from mid-June through mid-September 1973 and from late March through mid-September 1974. Visits were made to each reservoir at approximately four-day intervals. Observations were made either from the vehicle parked at a distance from the reservoir, or by approaching the reservoir on foot from the base of the dam. As described by Gjersing (1971), this census method minimized waterfowl disturbance. Observations were made with the aid of a 10x40 binocular and a 15-60 variable power spotting scope.

The breeding pair census followed the criteria described by Hammond (1969). Pairs and lone males were used to estimate the breeding pair population. Female diving ducks in courting parties were also counted. The breeding population of Canada geese *(Branta canadensis)* was estimated from observations of pairs and females on nests.

All broods observed were recorded by date as to species, age-class and size. The calculation of brood production followed the procedure outlined by Gollop and Marshall (1954). Broods observed during two or more visits to a reservoir were considered "resident", while broods observed only once were considered "transient" (Berg 1956).

A "permanent" 100-foot transect (Canfield 1941) was established in 1968 by BLM personnel in each of three shrub types. In June 1974 the canopy intercept along the line was measured on the transect in the silver sagebrush and Nuttall saltbush types. The numbers of

individual plants of key species of shrubs and grasses, occurring in a square foot frame placed at ten-foot intervals along the line, were also counted. The Woods rose transect could not be located.

Five sets of permanent transects were established in 1974, each set depicting the riparian and upland vegetation for one representative reservoir in each pasture. Canopy coverage on these transects was estimated using a modification of Daubenmire (1959). Twenty 2x5 decimeter plots were located at five-foot intervals along a 100-foot line. Within each plot the percent canopy coverage for each taxon was visually determined and assigned to one of six classes: Class 1 = 0-5; class 2 = 5-25; class 3 = 25-50; class 4 = 50-75; class 5 = 75-95; class 6 = 95-100. The midpoint of each class was used for calculations. The three-dimensional aspect of the vegetation within each plot was also estimated by recording the total canopy coverage at three-inch intervals from 0 to 12 inches above the ground. Bare ground, lichen, rock, and lodged and standing litter were also recorded. Transects were established in April, just prior to "green-up", and read again at intervals corresponding to the grazing formula. Two additional shoreline transects, one each in Pastures 4 and 5, were established just prior to grazing during 1973 and read at weekly intervals thereafter.

Most of the reservoirs were photographed at least twice during 1973. Permanent photo-stations were established on two reservoirs in each pasture during April 1974. Photographs were taken at approximately

two-week intervals through the summer. A 6x48 inch gridded board was placed ten yards down the shoreline from the photopoint. Each photograph provides both a general aspect and a point description of the shoreline. Aspect photographs were substituted on two of the reservoirs when rising water levels in late May eliminated the photoplots.

Intensive nest searches were not conducted. When located, nests were recorded as to date, species, clutch size, fate, vegetative cover, and distance to water. Canopy coverage was estimated at seven of the nests located in 1974. The method employed required a total of forty-four plots. Twenty plots were located at five-foot intervals along a 100-foot line. The midpoint of this line was placed twenty-five feet from the nest. Five plots were located at five-foot intervals, beginning at two-and-a-half feet from the nest, along each of four, twenty-five foot lines running in the cardinal directions from the nest. One plot was placed on each of the four sides of the nest. Vegetation was analyzed as described for the permanent riparian and upland transects.

Two-hundred-and-three juvenile ducks and six adult females were captured and banded with a Bureau of Sport Fisheries and Wildlife leg-band during the summer of 1973. Of these birds, the 6 adults and 160 juveniles were equipped with a colored, plastic nasal-saddle provided by the Northern Prairie Wildlife Research Center (Dane, Greenwood and Bartonek, Pers. Comm.). A similar technique is described by Sudgen

and Poston (1968). The nasal-saddles were of three colors, red, white and black. Symbols were applied to the saddles with a paint that bonded to the plastic. By applying a given symbol and color combination only once to a particular species and sex, the marked birds were recognizable as individuals. Marked birds were identifiable, with the aid of a binocular, to distances of about 200 yards. Maximum distances varied with light conditions and color combinations.

The physical characteristics of the reservoirs on the study area were described by Gjersing (1971). For those reservoirs constructed since his study, the shoreline length was measured with a calibrated wheel. As a more recent set of aerial photographs was not available, it was not possible to determine acreages for these reservoirs.

Plant nomenclature follows Booth (1950) and Booth and Wright (1959). Avian nomenclature follows the American Ornithologists' Union (1957).

RESULTS

Waterfowl Production

Spring Migration

Information regarding spring migration is based on the 1974 season. Eighteen species of ducks were observed as spring migrants. Twelve of these remained on the study area through the breeding season.

Mallards *(Anus platyrhynchos)* and pintails *(Anas acuta)* did not show an abrupt migration peak. Both were present in small numbers when field work began on 17 March. At this time the reservoirs were still frozen. Numbers of these species gradually increased during late March and early April, while larger increases occurred during mid-April. Stable populations of 32 pairs of mallards and 63 pairs of pintails were established by the last week in April.

The peak of the American green-winged teal *(Anas crecca carolinensis)* migration occurred during the second week in April, when approximately 50 birds were observed. Occasional migrant groups of 20 or more were observed through late May. Except for these groups, the number of green-winged teal on the study area rapidly declined following the peak of migration. Four breeding pairs were established by the first week in May.

American wigeons *(Anas americana)* were first observed in small numbers on 8 April. The migration peak for this species occurred during the last week in April and the first week in May, when

approximately 200 birds were on the study area. Fifty-one pairs were established by 1 June.

The first group of northern shovelers *(Anas clypeata)* was observed on 9 April. Few shovelers were seen until the first week in May, when approximately 75 birds were present. Numbers of shovelers declined slightly thereafter. By the first week in June the population had stabilized at 34 pairs.

Gadwalls *(Anas strepera)* were first observed on 9 April. The peak of migration, approximately 100 birds, occurred during the first week in May. Gadwalls decreased in numbers during mid-May and increased again during late May and early June. The breeding population of approximately 38 pairs was established by the second week in June.

Blue-winged teal *(Anas discors)* were not observed until 19 April. Few blue-winged teal were on the study area until 1 May. The peak of migration for this species occurred between the last week in May and the first week in June. At that time approximately 75 birds were observed. Thirty-two breeding pairs were established by the second week in June.

Cinnamon teal *(Anas cyanoptera)* were not common on the study area. Occasional observations of singles and pairs were made from late April through May. One migrant flock, composed of two females and four males, was seen on 8 June. Two resident pairs were established at about the same time.

Lesser scaup *(Aythya affinis)* first appeared during the second week in April. Approximately 75 birds were observed during the peak of migration, between the last week in April and the first week in May. Scaup numbers decreased during May, but increased again during June. A stable population of 12 pairs was established by the third week in June.

Approximately 50 redheads *(Aythya americana)*, in two groups, were present during the second week in April. No redheads were classified as breeding pairs, although one brood, which hatched in late July, was reared on the study area.

Canvasbacks *(Aythya valisineria)* migrated, in smaller numbers, with the redheads. One pair of canvasbacks remained on the area during the latter part of June.

Ruddy ducks *(Oxyura jamaicensis)* were never observed in groups. Occasional observations of singles were made during June. One resident pair was established during July. Three broods, all of which hatched during late July, were observed.

Migrant common goldeneyes *(Bucephela clangula)*, approximately 20 birds, were present during the first two weeks in April. Buffleheads *(Bucephela albeola)* were observed as individuals and in small groups from the last week in April through the third week in June. One group of six ring-necked ducks *(Aythya collaris)* was observed on 21 April. Individuals of this species were observed through the first week in June. One pair of common mergansers *(Mergus merganser)* was observed

on 12 April. One female with three male red-breasted mergansers *(Mergus serrator)* was seen on 24 April. Two female hooded mergansers *(Lophodytes cucullatus)* were observed on 20 June.

The migration sequence observed on this study area during 1974 generally agrees with that reported by Ellig (1955) for Greenfields Lake, Montana, during 1952; by Keith (1961) for southeastern Alberta, from 1953 through 1957; and by Rundquist (1973) for south Phillips County, Montana, during 1971 and 1972. The migration peak for green-winged teal occurred about three weeks earlier than that reported by Ellig (1955); wigeons and blue-winged teal were about two weeks later. Migration peaks for the other species were consistent with his information.

Of the eight species of puddle ducks observed, only the American wigeon and green-winged teal appeared to represent a greater proportion of the migrant than the pair population. This discrepancy was particularly evident for the green-winged teal. All of the diver species comprised a smaller proportion of the breeding than of the migrant population.

Breeding Pairs

The distribution of breeding pairs, by species, for both years of this study is included in Table 1. As field work was not begun until June 1973, no estimate could be made for the 1973 pintail population. For this same reason, the estimated populations of mallards and shovelers