DENSITY AND PRODUCTIVITY OF DUCKS ON WESTERN RANGELANDS:

AN ASSESSMENT IN NORTHCENTRAL MONTANA AND

EVALUATION OF METHODOLOGY

A Report to the Central Flyway Council

by

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INTRODUCTION

Declining continental populations of several duck species and deteriorating habitat conditions in the prairie pothole region emphasize the need to better understand duck production in areas where habitat deterioration may be less severe. Relatively high duck densities in conjunction with reduced availability of potential nesting habitat mean that reasonable sample sizes of nests often can be found in the prairie pothole region (Klett et al. 1986, Greenwood et al. 1987). Much lower duck densities (per unit of potential nesting habitat) on western grazing lands makes finding an adequate sample of nests exceedingly difficult.

Objectives of this study were to:

1. test repeated pair counts and brood counts as a method for evaluating duck productivity on western rangelands;
2. evaluate production rates on a sizeable portion of northcentral Montana using this method; and
3. provide an evaluation of the method and recommendation for expansion to the major potential duck production habitats on western grazing lands.

STUDY AREA AND METHODS

A 12,800 mi^2 region in Phillips, Valley, and Blaine counties in northcentral Montana was chosen as an overall study region based upon reasonably good water conditions known to exist in 1987, known presence of a wide variety of wetland and upland habitat conditions, availability of data from previous studies, and our general familiarity with the region.

Selection of survey blocks within the region was conducted to maximize the accuracy of the basic methodology. Essentially, we chose survey blocks where habitat conditions tended to maximize visibility of both pairs and broods and to minimize problems associated with mobility of pairs or broods (i.e., "rollup" of pairs and ingress or egress of broods). Selected study blocks specifically excluded:

1. large (>15 acre) wetlands where we expected difficulties in making accurate pair surveys;
2. natural wetlands where dense emergent vegetation was expected to develop;
3. streams and rivers that we expected would be impossible to census accurately and might serve as corridors for brood ingress or egress;
4. relatively dense concentrations of wetlands where pair rollup problems were expected; and
5. situations where a high proportion of relatively large or relatively small wetlands occurred along the boundary of the survey block. We believed that boundary inclusion of small wetlands would inflate pair counts and that boundary inclusion of large wetlands would inflate brood counts. Thus the ideal situation was to locate a workable block that was contained within one drainage, included both large and small wetlands, and was surrounded by a zone with few or no wetlands.

A few potential survey blocks were eliminated because multiple ownership complicated access. We initially intended to exclude blocks if more than 2 or 3 wetlands could not be approached to within 500 yds by vehicle, but this situation did not arise on any of the blocks considered.

Maximum dispersion of survey blocks over the region was desired, but we felt that travel costs would become prohibitive if more than one trip per block per survey were necessary. Consequently we limited block size to that which we felt could be surveyed in one day. Within this constraint we attempted to include at least 20 wetlands within each block.

We examined BLM 1:154800 maps and USGS quad maps and made a preliminary selection of 15 areas distributed across the region. We then made a reconnaisance flight over the entire region to evaluate individual blocks previously selected and to search for any workable blocks not identified from maps. Ten suitable blocks were selected after the flight, and we decided after trial runs that 7 blocks could be surveyed adequately with available time and manpower (Fig. 1).

Each block was surveyed for indicated breeding pairs at least twice, for early- and late-breeding species (Dzubin 1969, Hammond 1969). Pair survey dates varied somewhat between blocks, but were generally centered upon 5 May and 25 May. A few early broods were tallied during the latest pair counts and at least two surveys specifically for broods were conducted on each block, centered upon mid-June and mid-July. Pairs were counted from vantage points and attempts were made (usually successfully) to avoid flushing pairs. Broods were usually counted by approaching a wetland quietly and watching for 5-10 minutes, then having one observer circle the shore while the other continued to watch from a vantage point. Species, number, and age of ducklings were

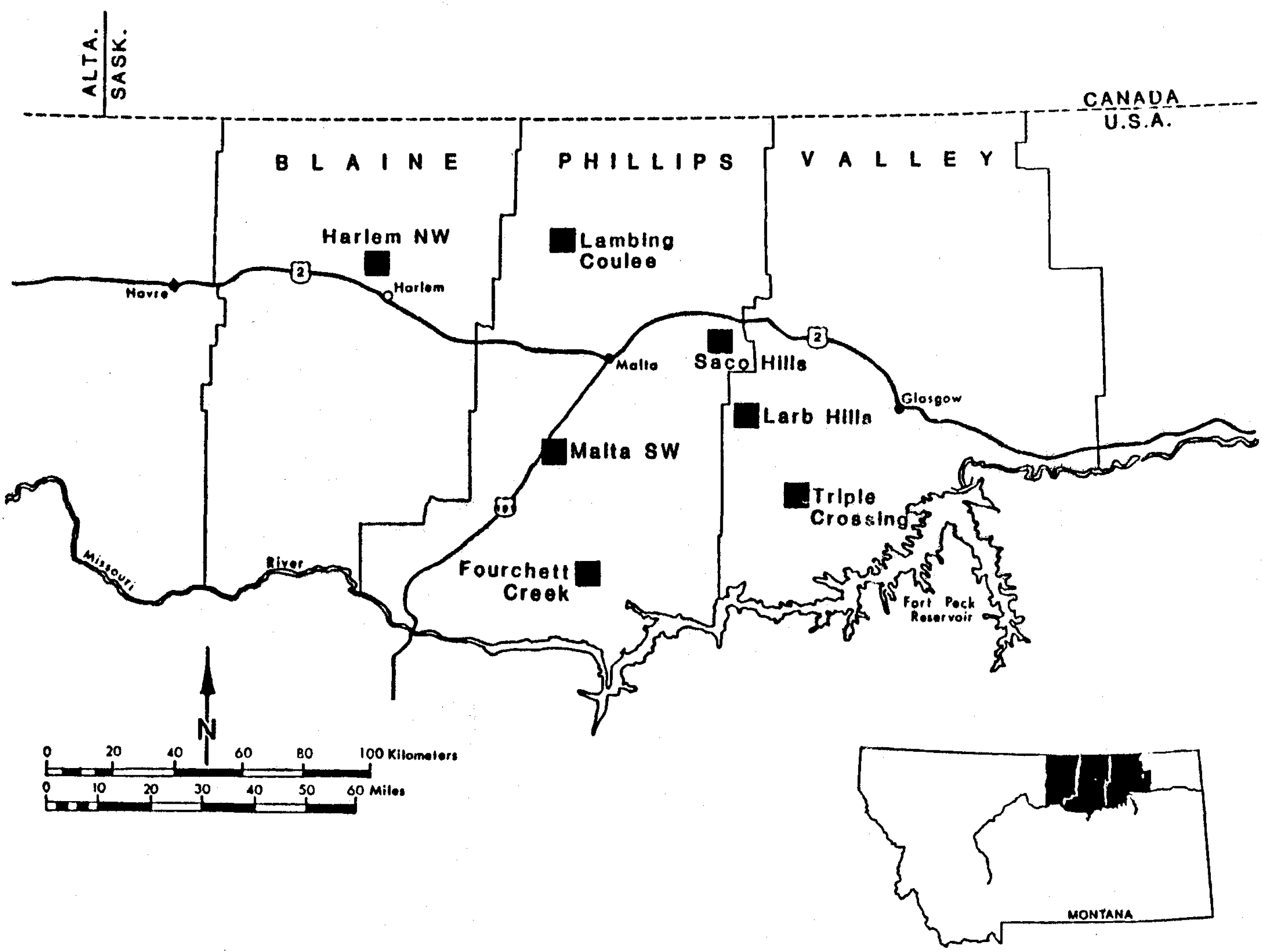

Figure 1. The study region and survey blocks. Survey blocks are not to scale.

recorded, and potential replicate counts were eliminated. In a few instances where many (20+) broods occurred on a wetland, we were forced to focus attention on the youngest broods (most likely to be "new" broods), and a few older but previously untallied broods probably were not recognized as new.

RESULTS

Characteristics of Survey Blocks, Water Conditions, and Pair Densities

Survey blocks varied from 7.8 to 15.4 mi^2 and the total land area surveyed was 77.2 mi^2. Approximately 99% of the land area involved was rangeland, mostly because we avoided streams and their adjacent floodplains. Also, wetlands (particularly stock ponds) were rare or absent on most upland agricultural lands. Stock ponds (pit, retention, and pit-retention) made up >90% of all wetland basins present and approximately 99% of all wet basins on the survey blocks. Water conditions were spotty across the region, varying from fair to excellent. Spring pond estimates for the entire stratum were 21% below the long-term mean, and the region was in the driest portion of the stratum (Solberg 1987). Upland cover on most blocks was poor by conventional standards, consisting primarily of short (<8") grasses, cactus, and club moss with the only substantial residual cover provided by sparse scattered patches of sage.

Spring surface area of water within blocks ranged from 37.1 to 101.3 acres and totalled 443.4 acres. Breeding duck pairs of all species numbered 1379 or 3.1 pairs per acre of water. Individual blocks varied from 1.7 to 5.2 pairs per acre of water and from 3.0 to 12.3 pairs per pond (Table 1).

Previous studies in Phillips County, Montana, documented breeding pair densities averaging roughly 3 pairs per acre of water (Gjersing 1970, Mundinger 1975, Hudson 1979), indicating that the densities we documented were not unusual for the region.

Species Composition

Wigeon were the most common breeding species at about 19%, followed by mallard, gadwall, and pintail at 13-14% each (Table 2). Lesser scaup made up a surprising 13.2% of breeding pairs, and other species each accounted for <10%. We recognize that constraints followed in selecting survey blocks resulted in some bias in the indicated species composition. Avoiding streams and rivers probably led us to underestimate mallards, which seemed most abundant on and near streams. Also, breeding pintails were extremely common on the few areas in the region where spring sheet water and wet natural basins occurred in 1987, but none of these areas were present in survey blocks.

Table 1. Characteristics of study blocks, and densities of breeding duck pairs in northcentral Montana, 1987.

	Triple Crossing	Larb Hills	Saco Hills	Lambing Coolee	Harlem NW	Malta SW	Fourchett Creek	ALL BLOCKS
Land area (mi^2)	10.3	12.0	15.1	8.6	15.4	7.8	8.0	77.2
No. ponds	21	34	26	28	28	23	17	177
Water area (acres)	70.1	41.0	37.1	68.4	101.3	68.7	56.8	443.4
No. indicated pairs	138	101	194	345	275	229	97	1379
per mi^2 land	13.4	8.4	12.8	40.1	17.9	29.4	12.1	17.9
per pond	6.6	3.0	7.5	12.3	9.8	10.0	5.7	7.8
per acre water	2.0	2.5	5.2	5.0	2.7	3.3	1.7	3.1

Table 2. Species composition of breeding duck pairs on survey blocks in northcentral Montana in 1987.

Species	No. pairs	(%)
American Wigeon	261	(18.9)
Mallard	194	(14.1)
Gadwall	182	(13.2)
Northern Pintail	180	(13.1)
B.W./Cinn. Teal	132	(9.6)
Northern Shoveler	130	(9.4)
G.W. Teal	57	(4.1)
Lesser Scaup	182	(13.2)
Other Divers	61	(4.4)
Total	1379	(100.0)

Productivity

Among all species of dabbling ducks, productivity (expressed as broods/100 pairs) averaged 48.1 (Table 3). Variability among species was quite low, with 6 of 7 dabblers ranging between 43.3 and 53.3 broods/100 pairs. Among blocks, productivity ranged from 31.2 to 73.1. Mallard broods clearly were the most difficult to survey (i.e., the most easily missed) and yet averaged 49.0 broods per 100 pairs. We recognize that a few mallard and pintail broods must have been missed in surveys but doubt that broods such as gadwalls and wigeon would have been missed if present. We believe that pairs of all dabbling duck species could be counted with good precision, and thus consider the productivity rates to be reasonably accurate, although perhaps slightly conservative for mallards and pintails. Previous estimates of productivity in Phillips County, Montana, have ranged from about 40 to 70 broods per 100 pairs (Gjersing 1970, Mundinger 1975, Hudson 1979), indicating that the production rates we documented were not unusual for the region.

Densities of Breeding Pairs in Comparison to Other Areas

Pair densities averaged 17.9 pairs per mi^2 on survey blocks versus 125 per mi^2 on prime breeding areas in Canada and South Dakota during peak population years in the 1950's and 1960's (Table 4). However, when one considers pairs per acre of water area, the Montana study blocks supported about 1.4 times greater densities (3.1 vs. 2.2 pairs/acre). The contrast is particularly striking when one considers that our study occurred during a year when spring pond numbers in the stratum were 21% below the long-term mean and total breeding pairs were 33% below the long-term mean (Solberg 1987). Conventions for selecting the current study blocks also led us to avoid much of what appeared to be the "best" pair habitat. Conversely, the prairie data derive from some of the best breeding areas known during peak years for water conditions and pair populations. Pair densities in North Dakota during 1987 were <1 pairs per acre of water (L. M. Cowardin, pers. comm.).

Productivity in Comparison to Other Areas

Production rates of all dabbling duck species combined appear to be 3 to 4 times higher on survey blocks in northcentral Montana than in the prairie pothole region of Canada (Table 5). Both data sets were generated using repeated pair and brood counts and were conducted relatively recently. We believe that conditions for brood surveys were better on our survey blocks than in most areas, so one might argue that the difference was

Table 3. Peak counts of indicated breeding duck pairs in comparison to total individual broods observed in 1987.

	Study Blocks							
	Triple Crossing	Larb Hills	Saco Hills	Lambing Coulee	Harlem NW	Malta SW	Fourchett Creek	ALL BLOCKS
Land area (mi^2)	10.3	12.0	15.1	8.6	15.4	7.8	8.0	77.2
No. ponds	21	34	26	28	28	23	17	177
Water area (acres)	70.1	41.0	37.1	68.4	101.3	68.7	56.8	443.4
Species	Pairs/Broods (broods/100 pairs)							
Amer. Wigeon	29/19 (65.5)	25/9 (36.0)	41/25 (61.0)	73/23 (31.5)	47/28 (59.6)	24/5 (20.8)	22/11 (50.0)	261/120 (46.0)
Mallard	11/5 (45.5)	18/9 (50.0)	32/18 (56.3)	49/23 (46.9)	39/29 (74.4)	28/7 (25.0)	17/4 (23.5)	194/95 (49.0)
Gadwall	16/11 (68.8)	13/5 (38.5)	22/17 (77.3)	52/19 (36.5)	53/37 (69.8)	19/6 (31.6)	7/2 (28.6)	182/97 (53.3)
N. Pintail	19/3 (15.8)	15/7 (46.7)	18/4 (22.2)	50/26 (52.0)	37/26 (70.3)	33/12 (36.4)	8/0 (-)	180/78 (43.3)
B.W./Cinn. Teal	11/4 (36.4)	14/3 (21.4)	15/11 (73.3)	40/15 (37.5)	23/21 (91.3)	26/15 (57.7)	3/5 (166.7)	132/74 (56.1)
N. Shoveler	13/4 (30.8)	4/2 (50.0)	17/7 (41.2)	29/18 (62.1)	22/20 (90.9)	37/12 (32.4)	8/2 (25.0)	130/65 (50.0)
G.W. Teal	9/5 (55.6)	6/0 (-)	1/4 (400.0)	12/5 (41.7)	2/2 (100.0)	19/1 (5.3)	8/0 (-)	57/17 (29.8)
SUBTOTAL DABBLER	108/51 (47.2)	95/35 (36.8)	146/86 (58.9)	305/129 (42.3)	223/163 (73.1)	186/58 (31.2)	73/24 (32.9)	1136/546 (48.1)
Lesser Scaup	21	5	26	32	44	35	19	182
Other Divers	9	1	22	8	8	8	5	61
SUBTOTAL DIVERS	30	6	48	40	52	43	24	243
TOTAL PAIRS	138	101	194	345	275	229	97	1379

Table 4. Densities of breeding duck pairs of all species: prime prairie and parkland habitats during peak years versus northcentral Montana in 1987.

Area	Years	Breeding pairs per mi^2	Acres water per mi^2	Pairs/acre of water
Lousana, Alb.[a]	53-58	173	42	4.1
Caron, Sask.[b]	56-58	185	46	4.0
Redvers, Sask.[b]	52-53	119	40	3.0
Success, Sask.[b]	55-56	85	40	2.1
Minnedosa, Man.[b]	63-66	121	83	1.5
Waubay, S.D.[b]	50-53	65	84	0.8
Mean		125	56	2.2 *
Saco Hills, Mont.	87	12.8	2.5	5.2
Lambing Coulee, Mont.	87	40.1	8.0	5.0
Malta SW, Mont.	87	29.4	8.8	3.3
Harlem NW, Mont.	87	17.9	6.6	2.7
Larb Hills, Mont.	87	8.4	3.4	2.5
Triple Crossing, Mont.	87	13.4	6.8	2.0
Fourchett Creek, Mont.	87	12.1	7.1	1.7
Mean		17.9[c]	6.2	3.1 *

Footnotes: [a]Smith 1981, adjusted by us to pairs/mi^2 land area.

[b]Stoudt 1969, presented as pairs/mi^2 land area.

[c]From Table 1.

Table 5. Production rates (broods/100 peak pairs) for 3 prairie provinces during 1980-83 and northcentral Montana in 1987. Canadian data are from Hochbaum et al. (1987).

	Prairie provinces			
Species	Alberta	Saskatchewan	Manitoba	Northcentral Montana
B.W. Teal	3	15	17	56
Gadwall	8	8	16	53
G.W. Teal	6	5	4	30
Mallard	9	10	19	49
Pintail	9	7	16	43
Shoveler	5	11	20	50
Wigeon	13	9	12	46

caused by differential observability of broods between areas. This suggestion would be difficult to refute for species like the mallard and pintail, but would make little or no sense for wigeon or gadwalls. Brood surveys also were repeated about twice as often in Canada as in Montana, which should tend to minimize any difference caused by brood visibility.

Alarmingly low nest success in the prairie pothole region has been reported for mallards (Greenwood et al. 1987) and for dabbling ducks of several species (Klett et al. 1987). Nest success estimates of 5-15% are common. Production rates reported in this study must not be confused with nest success rates. Additional components include renesting and loss of entire broods prior to census. We can relate our production rates to nest success only very crudely. Using relationships examined and modeled by Cowardin and Johnson (1979) for the mallard, we made the following approximations (the reader is cautioned that some of the values used may be highly variable and are unknown on our study area and for the species involved). If 30% of all of the broods hatched perished prior to being surveyed, then 48 dabbling duck broods surveyed would derive from about 68 nests hatched/100 pairs. This is equivalent to Cowardin and Johnson's hen success (H) and would equate to about 55% Mayfield nest success. This value seems reasonable in that Holm (1984) found Mayfield nest success rates of 61.8% on natural grassland/brush nesting habitat at Bowdoin NWR near the center of our study region (1983 and 1984 data, all duck species, 250 nests).

ASSESSMENT OF METHODS

Repeated pair and brood counts appeared to give reasonable estimates of pair densities and productivity of dabbling ducks on the selected survey blocks. The major limitation in the data is that the study blocks were not a random sample and hence cannot be claimed to be representative of the region as a whole. We do argue that the data are reasonably representative of the pair densities and production rates occurring on stock ponds within large blocks of grazing land in the region. We speculate that production rates on wet natural basins within large blocks of grazing lands should be at least as high as those we documented on stock dams. However, we also caution that production rates are virtually certain to be much lower than we documented in portions of the region where upland habitat is fragmented and dominated by tillage-based agriculture. Conditions in the most intensively farmed portions of the region appear similar to those in the core prairie pothole areas, and predator populations appear high in some areas.

RECOMMENDATIONS FOR MANAGEMENT

High pair densities and productivity rates suggest that providing additional water areas on areas like our survey blocks would prove to be a relatively cost effective method for increasing duck production. We suspect that the water areas present must be saturated with breeding ducks, or very nearly so, and we predict that any new wetlands created soon would be occupied by comparable densities of birds. In essence, we maintain that duck populations in northcentral Montana are driven primarily by amount of available water. If this is true, then populations in North Dakota (with <1/3 the density of pairs per acre of water) must be driven primarily by a different factor--almost certainly low nest success. We emphasize that the most effective techniques for increasing duck production in an area will depend largely on what factors currently limit the population in that area.

RECOMMENDATIONS FOR AN EXPANDED STUDY

The technique of repeated pair and brood counts proved practical and reasonably efficient in the types of habitat where we worked. Pair densities and productivity of dabbling duck pairs proved to be remarkably high. One would next like to know the extent of the geographical region over which similar densities and productivity occurs. We suggest that as a first step toward answering this important question, the distribution of stock dams or other small impoundments in the Central Flyway be plotted from available sources (BLM, SCS, etc.). We would then envision asking state or province biologists to visit a relatively small sample of water areas once in mid-May and once in mid-July to count pairs and broods. Results from this preliminary survey would then be used to delineate boundaries on the region of concern and as an aid to designing an expanded study. Qualified statisticians should be involved in designing the study so that weaknesses in the design used in northcentral Montana can be minimized. We suggest that the possibility for matching study funds from BLM and USFWS be investigated and that personnel from Northern Prairie Wildlife Research Center be involved if possible.

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