# GENERAL NOTES

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**Home range and habitat use of forest-dwelling Mallards in Minnesota.**—Estimates of home range size for radio-equipped female Mallards (*Anas platyrhynchos*) vary from 468 ha in North Dakota (Dwyer et al., J. Wildl. Manage. 43:526–531, 1979) to 210 ha in forested north-central Minnesota (Gilmer et al., J. Wildl. Manage. 39:781–789, 1975). Although the North Dakota study was of rather typical Mallard habitat, albeit with a relatively low density of the species, the Minnesota study was of birds that principally used small wetlands. A range of response by Mallards to the quantity, quality, and spatial arrangement of breeding habitat is thus suggested. This paper provides further data obtained from a sample of birds that used primarily rivers and large (>2500 ha) sand-lake complexes adjacent to the study area discussed by Gilmer et al. (1975).

*Study area and methods.*—The 39-$km^2$ study area was 18 km east of Bemidji, Beltrami Co., Minnesota, along the Mississippi River at the western boundary of the Chippewa National Forest. Six wetland complexes (Cowardin and Johnson, U.S. Fish Wildl. Serv. Spec. Sci. Rept. Wildl. 168, 1973), were present: sand lakes, river marsh, river channel, intermediate lakes, bog lakes, and nonpermanent wetlands. Nonpermanent wetlands >100 m from a lake or river shoreline were designated as interior wetlands; those <100 m were considered adjacent wetlands. Total area of interior nonpermanent wetlands was 38.6 ha. Adjacent wetlands averaged 0.6 ha and occurred at a density of one wetland per 1.6 km of shoreline. Shoreline lengths were 21.7 km for sand lakes and 5.1 km for river channels. Thirty-seven percent of the shoreline was bounded by a mat of floating vegetation consisting primarily of sedges (*Carex lasiocarpa, C. aquatilis, C. lacustris*), bluejoint reedgrass (*Calamagrostis canadensis*), willows (*Salix* spp.), and mountain alder (*Alnus incana*). Other shorelines were bounded by sand and rock beaches, overhanging upland brush, and residential development. River marsh areas constituted 62.0 ha, consisting primarily of floating mat vegetation, as above, and emergent stands of common reed (*Phragmites communis*) and cattail (*Typha* spp.).

In early spring 1971 and 1972, birds were captured by nightlighting from an airboat or with small recoilless rocket nets, and were equipped with radio transmitters (Gilmer et al., J. Wildl. Manage. 38:243–252, 1974) and fitted with Fish and Wildlife Service leg bands. Techniques for locating radio-equipped birds in this area were summarized by Gilmer et al. (J. Wildl. Manage. 41:345–359, 1977). Locations were keyed to habitat by the use of digitized maps (Gilmer et al., J. Wildl. Manage. 37:404–409, 1973); field maps were either photographs with a coordinate grid or vegetation maps made from the photographs and ground survey. Habitat types were those identified by Cowardin and Johnson (1973). To permit comparison with earlier studies, maximum home ranges were delineated by connecting the outermost telemetry locations obtained during the entire breeding season to form a polygon (Odum and Kuenzler, Auk 72:128–137, 1955). Habitat use was calculated as the percentage of total locations, but did not include locations of a bird on a nest. Available habitat was considered only to be that contained within a bird's home range and did not include open water. To reduce bias attributable to inadequate sampling of bird activities, we conservatively selected for home range analysis only those birds for which we had >100 locations recorded over ≥30 days of tracking history, and for which one or more nest attempts were recorded. These restrictions left 13 Mallards (5 marked pairs plus 3 females) having a mean tracking rate of 7.2 locations per day per bird for analysis of home range size.

TABLE 1

VARIATIONS IN HOME RANGE OF FIVE MALLARD FEMALES FOLLOWING NEST DESTRUCTION

| Female | 1st nesting period: Home range (ha) | 1st nesting period: Days | 1st nesting period: Stage destroyed | Renesting interval[a]: Home range (ha) | Renesting interval[a]: Days | 2nd nesting period: Home range (ha) | 2nd nesting period: Days | 2nd nesting period: Distance between renests (m) | Overall: Home range (ha) | Overall: Tracking period |
|---|---|---|---|---|---|---|---|---|---|---|
| 5147 | 3.7 | 5 | Early incubation | 7.4 | 12 | 13.2 | 12 | 547.1 | 76.0 | 4/29–6/2 |
| 5200[b] | 97.4 | 15 | Early incubation | 63.2 | 6 | 257.8 | 37 | 3203.2 | 997.7 | 4/19–7/9 |
| 5222 | 82.0 | 19 | Late incubation | 114.3 | 19 | 5.8 | 18 | 1340.8 | 223.0 | 5/17–7/12 |
| 5256 | 6.2 | 8 | Late incubation | 18.0 | 9 | 27.2 | 29 | 82.0 | 32.6 | 4/29–6/13 |
| 5259 | 92.5 | 10 | Early incubation | 181.0 | 17 | 111.9 | 23 | 1443.0 | 389.6 | 5/6–6/24 |

[a] As defined by Sowls (Prairie Ducks, The Stackpole Co., Harrisburg, Pennsylvania, and Wildlife Management Institute, Washington, DC, 1955): the period between destruction of one nest and the laying of the first egg in the next.

[b] Tracked for 11 days prior to her first nest attempt—home range size for this prenesting period was 950 ha (95% of her total breeding home range).

Two females primarily used residential shoreline/marine areas and stands of vegetation in river mouths. As this habitat was available only in the areas used by these birds, we deleted these 2 birds from comparison of habitat use throughout the study area. Four of the six remaining females shifted from using the river channel (the first open water) to using the river marsh or sand lake as the season progressed. Habitat-use data for these birds were therefore analyzed separately for early and late portions of the year; 10 analyses of habitat use by females were then possible. Because of the limitations imposed by the restriction of analysis to only those birds for which we had substantial data, we used Wilcoxon's matched-

TABLE 2

MEAN AVAILABILITY (% OF TOTAL WETLAND AREA LESS OPEN WATER) AND USE (% OF TOTAL RADIO LOCATIONS) OF 9 WETLAND TYPES IN 10 HOME RANGES OF FEMALE MALLARDS IN NORTH-CENTRAL MINNESOTA 1971 AND 1972

| Wetland type[a] | Availability | Use | Preference[b] |
|---|---|---|---|
| Interior nonpermanent wetlands | 13.95 | 2.73 | R |
| Adjacent nonpermanent wetlands | 6.77 | 7.68 | NS |
| *Phragmites communis* | 6.24 | 7.93 | NS |
| *Typha* spp. | 14.85 | 14.16 | NS |
| Deep/shallow marsh | 4.74 | 7.88 | P |
| Bog mats | 21.25 | 32.28 | P |
| Overhanging brush | 8.92 | 8.41 | NS |
| Composite lake shoreline | 24.29 | 25.52 | NS |
| Emergent aquatics/bog mat | 7.66 | 1.66 | R |

[a] Habitat types from Cowardin and Johnson (1973).

[b] Based on the difference between observed and expected use of the types according to their availability in the home range. Preference (P) or rejection (R) indicate significance ($P < 0.10$); NS = nonsignificant.

TABLE 3

MEAN AVAILABILITY (%) AND USE (%) OF WETLAND COMPLEXES BY MALLARD PAIRS GROUPED BY HOME RANGE SIZE AND USE OF RIVER HABITAT ON THE NORTH-CENTRAL MINNESOTA STUDY AREA, APRIL–JUNE 1971 AND 1972

| | Mean home-range size | | | | | |
|---|---|---|---|---|---|---|
| | 53 ha[a] (N = 3) | | 347 ha[b] (N = 4) | | 871 ha[c] (N = 3) | |
| Wetland | Available | Used | Available | Used | Available | Used |
| Nonpermanent wetlands | 5 | <1 | 17 | 9 | 33 | 16 |
| Bog lakes | 0 | 0 | 0 | 0 | 2 | 2 |
| Intermediate lakes | 0 | 0 | 6 | 8 | 2 | 2 |
| Sand lakes | 12 | 3 | 20 | 8 | 42 | 66 |
| River channel | 20 | 35 | 20 | 57 | 8 | 5 |
| River marsh | 63 | 62 | 37 | 18 | 13 | 9 |

[a] 32.6, 49.0, and 75.9 ha.
[b] 147.5, 302.0, 392.6, and 549.2 ha.
[c] 768.7, 851.9, and 988.7 ha.

pairs signed-rank test (Wilcoxon, Biometrics Bull. 1:80–83, 1945), a nonparametric analogue to the paired-sample *t*-test, to test for preference or rejection of various habitats.

*Results and discussion.*—Mean home range size was 540 ha (40–1440 ha) for eight female Mallards and 620 ha (70–1140 ha) for five males. Five home ranges of individual birds were less than 100 ha and six exceeded 750 ha. The extreme variability in home range sizes and the scarcity of intermediate values contrasted markedly with the data obtained from Mallards using interior wetlands in an adjoining area (Gilmer et al. 1975). In that study, home range size averaged 210 ha for females and 240 ha for males and only one pair had a home range in excess of 750 ha.

We found it difficult to assess within-season mobility of the female Mallards because they were captured during different portions of the nesting cycle, and substantial nest destruction occurred. Differential mobility of females during various portions of the nesting cycle (generally reduced from nest site selection through incubation) has been documented by several authors (Dzubin, Trans. N. Am. Wildl. Conf. 20:278–298, 1955; Gates, Wilson Bull. 74:43–67, 1962; Derrickson, Auk 95:104–114, 1978; Titman, Can. J. Zool. 61:839–847, 1983), but less is known of changes between individual nesting attempts by the same bird. We obtained enough data to analyze five renesting attempts (Table 1). Four of the five females used larger areas between nesting attempts than during the nesting periods, and larger areas during the second than the first nesting interval, but the latter may have been an artifact of the truncation of the first nesting cycle. Renesting thus certainly had a positive effect upon home range size of the female, unlike the conclusion reached by Derrickson (1978:109) from review of the literature and study of Northern Pintails (*Anas acuta*) in North Dakota.

Wilcoxon's matched-pairs signed-rank test indicated preference and rejection of four of the wetland types at a low level of significance (Table 2). We interpreted these data to indicate a preference for undisturbed shorelines with emergent vegetation and overhanging brush, which provided isolation and concealment, and of bog mat shorelines, which provided similar resources and numerous loafing sites. All birds frequented areas with substantial interspersion of physical and floral features and spent little time along sparsely vegetated shorelines. Overhanging brush attracted many birds even in the absence of emergent vegetation in the adjacent water. *Phragmites communis,* a vegetation type not usually associated with substantial use by Mallard pairs, provided roosting and loafing cover and isolation for the birds. The shoreline types used most by Mallards in our study were those used most by Mallards in adjacent areas (Gilmer et al. 1975). The major difference between the birds in the two areas was the fact that nonpermanent wetlands were not used by the birds initially captured on sand lakes and on river marshes.

Birds with small and intermediate home ranges had consistently high use of river marsh and river channels (Table 3), and home range size was negatively correlated with percent use of river habitat ($r = -0.929$, $P < 0.01$). River–marsh areas were preferred for night roosting by birds in all three categories of home range size, as is shown by the differences in percent of day vs night use of this habitat: small home range—day 63% and night 67%, medium home range—day 14% and night 83%, large home range—day 6% and night 40%. During spring nightlighting operations near the peak of nesting activities, we found as many as seven Mallard pairs along a densely vegetated 50-m river channel. This sharing of habitat during certain periods differs from the behavior of the obligatory river-dwelling African Black Duck (*Anas sparsa*), which demonstrates no home range overlap and maintains a strict defense of territory boundaries (Ball et al., Wildfowl 29:61–79, 1978; McKinney et al., Z. Tierpsychol. 48:349–400, 1978). The African Black Duck defends a small exclusive territory; the Mallard in Minnesota uses large areas that overlap with the areas of other pairs. Separation of Mallard pairs was nevertheless accomplished in time and space; we observed few encounters between pairs. The ability of birds to join loose flocks at night has obvious survival advantages in an area with numerous predators and few appropriate roosting sites.

The need for seclusion and isolation by Mallard pairs, and the species' intolerance and avoidance of conspecifics during the breeding period have been emphasized by several authors (Barclay, Ph.D. diss., Ohio State Univ., Columbus, Ohio, 1970; Dzubin, Can. Wildl. Rept. Ser. 6:138–160, 1969; McKinney, Wildfowl Trust Ann Rept. 16:92–106, 1965; Titman 1983; and others). As expected, more than 50% of the daytime locations of pairs with large home ranges were in habitats, such as sand bars and rock beaches, where birds were fairly visible and were separated by great distances from conspecifics. Almost 90% of the locations of pairs with small home ranges, but only 17% of the locations of pairs with large home ranges were in communities providing the most cover, such as cattails, bog mat shorelines, and overhanging brush shorelines. Pairs with intermediate-size home ranges were found in high-concealment communities 60% of the time.

Dwyer et al. (1979) concluded that major differences in type and distribution of water areas are reflected in home range size differences between Mallards on the prairies and in forested areas. Results of our study suggest that similar relationships exist within forested regions. The ability of pairs to share certain parts of their home ranges and to respond quickly to various local conditions (McKinney 1965:104) is adaptive for Mallards in north-central Minnesota.

We have documented a wider range of home range sizes than heretofore indicated for Mallards in forested areas. This suggests a continuum of response by Mallards to the set of habitat conditions engendered by wetlands of varying quality and distribution, a conclusion reached by Nudds and Ankney for dabbling ducks generally (Wildfowl 33:58–62, 1982). The need for site-specific assessments of Mallard behavior and habitat use, as well as further studies of Mallards in forested habitat, is apparent.

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**Observations of the formation of a Sage Grouse lek.**—Sage Grouse (*Centrocercus urophasianus*) commonly use disturbed areas as breeding arenas (Dalke et al., J. Wildl. Manage. 27:811–840, 1963; Connelly et al., J. Range Manage. 34:153–154, 1981); however, few data are available on the establishment of leks by Sage Grouse. During a study of Sage Grouse use of a prescribed burn site, observations of three wing-tagged male and three radio-collared female grouse on a recently burned area provided some insight into the establishment of an arena.

My study was conducted on a 300 km² segment of the Idaho National Engineering Laboratory (INEL) in southeast Idaho. The area surrounding the burn site is dominated by big sagebrush (*Artemisia tridentata*), green rabbitbrush (*Chrysothamnus viscidiflorus*), and perennial grasses (mostly *Pseudoroegnaria spicata* and *Elymus elymoides,* McBride et al., Natl. Tech. Inf. Serv. IDO–12084, 1978). Mean elevation of the burn site is 1515 m. A more detailed description of the physical and biotic environments of the study area is given in Gates (M.S. thesis, Montana State Univ., Bozeman, Montana, 1983).

Four hundred ha of the study area were control-burned in Aug. and Oct. 1981. Prior to burning, arenas occurred on (Arena A) and adjacent to (Arena B) the burn site. Ten male grouse were captured (Giesen et al., Wildl. Soc. Bull. 10:224–231, 1982) on Arena B in 1981; 10 males and five females were marked there in 1982. Five males and one female were marked on Arena A in 1982. Seventy grouse were captured and marked on three other arenas within 6.5 km of the burn site. In addition, 113 grouse were marked in irrigated cropland 6.4 km north of the burn site. Captured grouse were marked with numbered patagial tags (males), poncho tags (females; Pyrah, J. Wildl. Manage. 34:466–467, 1974), or radio-collars (both sexes; Amstrup, J. Wildl. Manage. 44:214–217, 1980).

Five arenas within 6.5 km of the burn site were censused in the springs of 1981–1983. The maximum number of males attending Arena B declined from 45 in 1981, to 25 in 1982, and 18 in 1983. Arena A, which was used by grouse in 1981 but not censused, declined from 12 males in 1982 to three in 1983. A similar decline of males from 39 to 20 to 16 occurred between 1981 and 1983 on an arena 6.5 km east of the burn site. No grouse were observed in 1982 and 1983 on an arena 3.5 km southeast of the burn site that had 18 males in 1981. The apparent cause of the downward population trend between 1981 and 1983 was poor production resulting from abnormally cold, wet weather during the springs of 1980 and 1981 (Gates 1983).

A new arena (Arena C) was discovered on the burn site on 10 Apr. 1982, 1.5 and 2.0 km south of Arenas A and B. Arena C was observed on six mornings between 10 and 29 Apr.