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ACTIVITY BUDGETS OF MALLARDS AND AMERICAN WIGEON WINTERING IN EAST-CENTRAL ALABAMA

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ABSTRACT.—Mallards (*Anas platyrhynchos*) and American Wigeon (*A. americana*) were studied in Alabama from November through February 1983–85. Resting was the major activity of Mallards (39–54%) and feeding was the major activity of American Wigeon (45–71%). Mallards increased feeding during the colder winter of 1983–84, but wigeon did not. Locomotion (8–21% and 5–26%) and comfort (4–22% and 4–13%) also were dominant behavioral activities of Mallards and American Wigeon, respectively. Total time spent in alert, courtship, and agonistic behavior was low for both species (<11%). Mallards and wigeon rested most on river sites, while managed impoundments were used most for feeding and social activity. *Received 18 July 1986, accepted 27 Feb. 1987.*

Recent studies in North America have used activity budget techniques to investigate nonbreeding waterfowl ecology (e.g., Paulus 1984, Quinlan and Baldassarre 1984). Most investigations, however, spanned only one winter period and focused on one species. A multiple species approach can provide new ecological and behavioral insights (McKinney 1973) relative to nonbreeding waterfowl ecology, and studies longer than one year are necessary to determine the influence of annual effects on various aspects of wintering waterfowl behavior.

We studied activity budgets of Mallards (*Anas platyrhynchos*) and American Wigeon (*A. americana*) because these species are among the most abundant North American waterfowl (Bellrose 1980), yet little is known regarding their wintering ecology. Indeed, Fredrickson and Drobney (1979) noted the lack of data on nonbreeding waterfowl in general, and stressed the need to determine how species allocate time during this portion of the annual cycle. This is significant because events during winter may affect survival and subsequent reproductive performance of these and other waterfowl (Krapu 1981, Heitmeyer and Fredrickson 1981). Jorde et al. (1983, 1984) studied wintering Mallards using, in part, activity budget techniques. Their study site (Nebraska), however, was north of most major wintering areas (Bellrose 1980), and thus may not reflect winter activity of most North American Mallards. Wintering American Wigeon also have received little study except for work by Soutiere et al. (1972) and Wishart (1983a, b), which concentrated on pairing chronology and courtship behavior. Here we determine (1) the activity budgets of

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Mallards and American Wigeon wintering in Alabama, and (2) the influence of habitat selection and weather on activity.

STUDY AREA

Mallards and American Wigeon were observed at the 4520-ha Eufaula National Wildlife Refuge (NWR), which is located along both sides of the Alabama-Georgia border formed by the Chattahoochee River. Wetlands managed for waterfowl total 200 ha and include the Kennedy, Bradley, and the upper and lower Houston impoundments. Observation sites were the three habitat types of (1) the Chattahoochee River, (2) the upper Houston, and (3) the lower Houston.

River sites used by ducks were sandbars and islands characterized by sparse herbaceous and grassy growth, with woody growth on most higher elevations. The lower Houston impoundment is largely a deep (2–5 m), open water area dominated by watermilfoil (*Myriophyllum* spp.) and American lotus (*Nelumbo lutea*); emergent sites support arrowhead (*Sagittaria* spp.), swamp smartweed (*Polygonum hydropiperoides*), and pondweed (*Potamogeton* spp.) (Carroll 1983). Black willows (*Salix nigra*) occupy shallow margins of the unit. The upper Houston is shallower than the lower unit, but submergent vegetation is similar. Emergent vegetation is denser and dominated by smartweeds, American lotus, and spikerushes (*Eleocharis* spp.). Black willows also border this unit (Carroll 1983).

METHODS

Mallards and American Wigeon were observed from November through February 1983–84 and 1984–85. Observations were made from sunrise to sunset during three consecutive days/week. Birds were sampled in each of the three study habitats by drawing random numbers to assign a habitat to a day during the 3-day interval. Days then were divided into three equal time blocks, and time blocks into three equal time periods of approximately one-h. Two of the three periods were sampled within each time block by again randomly drawing numbers to assign Mallards or American Wigeon to a different period.

During a sampling period, two single (unpaired) males, two single females, and two pairs were selected by pointing a 60× spotting scope towards a flock and selecting the bird closest to the center of vision. Pair status was determined using criteria outlined by Hepp and Hair (1984). Individuals or pairs were observed from blinds or a parked vehicle for 10 min, and activities recorded into a tape recorder at 15-sec intervals (Wiens et al. 1970). Activities were defined as feeding, locomotion, resting, comfort, alert, courtship, agonistic, and out-of-sight (Paulus 1984). We obtained general climatic data from the weather station at Columbus, Georgia, 75 km north of the refuge (National Oceanic and Atmospheric Administration 1983–85).

Statistical analysis of percent time spent in each activity was performed after arcsine transformation of the nonnormal percentage data (Zar 1974). Activities during the diurnal cycle were compared by categorizing blocks as (1) early morning (periods 1–2), (2) midday (periods 3–7), and (3) late afternoon (periods 8–9). *t*-tests were conducted to determine differences in activity patterns between sexes and between pairs and singles within each month and year; data were pooled where not significant ($P > 0.05$) or significant with less than a three percent difference between means. Monthly activity patterns were determined for status groups (pairs vs singles) by averaging daily time spent in an activity, thus sample size is the number of days per month that birds in each status group were observed. Activity patterns by species within a habitat were determined by pooling status, years, and months. One-way analysis of variance and Duncan's multiple range test were used to determine

significant differences in activities ($P < 0.05$) among time blocks, months within years, and between species and habitat types. All statistical tests followed Steel and Torrie (1980).

RESULTS

Male vs female activity patterns.—A total of 907 Mallards and 751 American Wigeon was observed for 151 h and 125 h, respectively. Time spent in each activity was similar ($P > 0.05$) for paired and unpaired males and females of both species, except in 12 (2%) of 672 possible comparisons, therefore, data were combined for all further analyses.

Mallard activity patterns.—Resting was the most frequent ($P < 0.05$) activity of Mallards (39–54%) during all months except February 1984 (Fig. 1) and was usually the prevalent activity during each time block in the day. Mallard feeding increased throughout winter (Fig. 1), being lowest during November (7–10%), and highest in January and February, except for single birds in February 1985. Feeding was higher ($P < 0.05$) in December and February of 1983–84 vs 1984–85. Average monthly temperatures were similar ($P > 0.05$) between years, except that December 1983 was unusually cold ($\bar{x} = 7.6$°C) whereas December 1985 was warmer ($\bar{x} = 13.9$°C).

Total time spent in alert, courtship, and agonistic activities was highest in November 1984 (11%) and lowest in January 1984 (4%). Agonistic behavior was higher ($P < 0.05$) in December 1983 than in 1984. Courtship was similar among months in both seasons, but it was always higher ($P < 0.05$) for single compared to paired birds during December.

American Wigeon activity patterns.—There were no differences ($P > 0.05$) in activity of American Wigeon between paired and single birds or between months of different seasons (Fig. 1). Feeding usually dominated activity in all months (45–71%; $P < 0.05$) (Fig. 1), but was variable throughout the day (32–95%). Locomotion varied (0–50%) throughout the day and was lower ($P < 0.05$) in February than in January, when it peaked.

Total time spent in alert, courtship, and agonistic activities was low (<5%) during each month. Courtship activities comprised a small portion (0–1%) of the activity budget and did not differ among months within seasons ($P > 0.05$). Agonistic activities were similar among most months ($P > 0.05$), and low throughout the day for each status (<3%).

Activity patterns by habitat.—Feeding by both species usually was higher on impounded areas than on the river ($P < 0.05$) (Table 1). Time spent in locomotion was similar among habitats for each species, and between species within each habitat ($P > 0.05$). Resting by Mallards was higher ($P < 0.05$) on the lower vs the upper Houston where beaver dams, lodges, and downed trees furnished loafing areas.

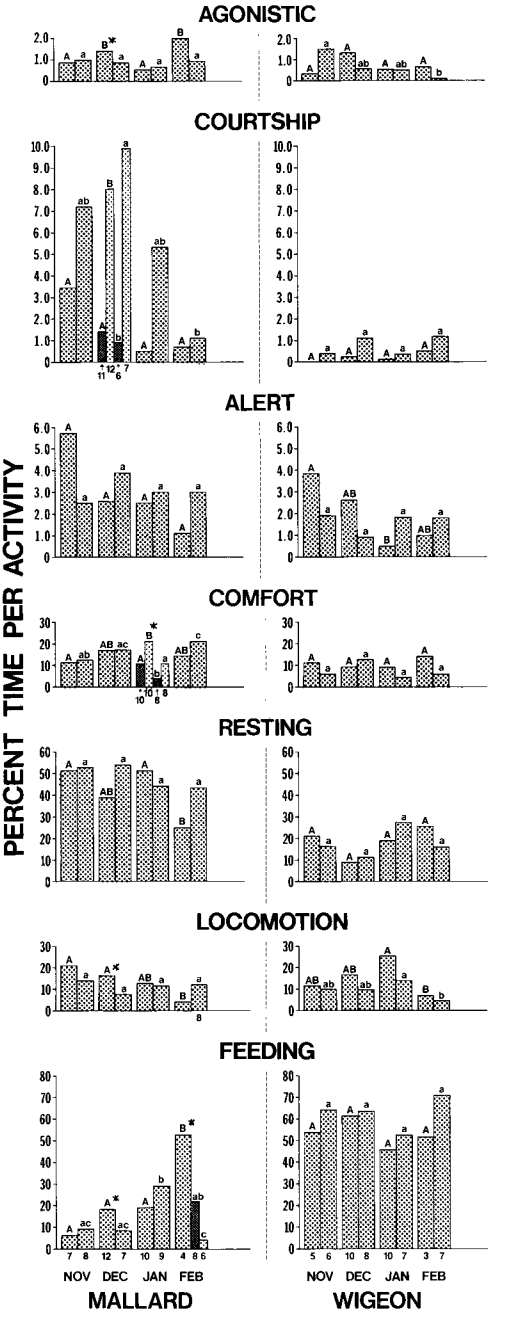
AGONISTIC
COURTSHIP
ALERT
COMFORT
RESTING
LOCOMOTION
FEEDING
PERCENT TIME PER ACTIVITY
NOV DEC JAN FEB
MALLARD
NOV DEC JAN FEB
WIGEON

TABLE 1

ACTIVITY PATTERNS WITHIN HABITAT TYPES FOR MALLARDS AND AMERICAN WIGEON WINTERING AT EUFAULA NWR, ALABAMA-GEORGIA

Activity	Mallard			American Wigeon		
	Lower (20)[a]	River (45)	Upper (18)	Lower (23)	River (28)	Upper (14)
Feeding	15.5[d]	17.5[d]	36.1[c]	63.2[b]	46.1[c]	72.0[b]
Locomotion	14.7[b]	12.7[b]	13.5[b]	17.9[b]	12.6[b]	10.7[b]
Resting	45.9[b]	48.8[b]	27.8[c]	10.2[d]	26.9[c]	6.7[d]
Comfort	10.2[b,c]	16.6[b]	11.4[b,c]	6.0[c,d]	12.4[b,c]	5.1[d]
Alert	5.8[b]	1.7[c]	3.3[b,c]	1.5[c]	1.3[c]	4.0[b]
Courtship	7.0[b,c]	1.8[c,d]	6.7[b]	0.5[d]	0.3[d]	0.6[d]
Agonistic	0.9[b,c]	0.9[b]	1.2[b]	0.9[b,c]	0.4[c]	0.9[b,c]

[a] Number of observation days.
[b,c,d] Means for each activity denoted by the same letters are not significantly different ($P > 0.05$).

DISCUSSION

The major difference in activity patterns between Mallards and American Wigeon at Eufaula NWR was the higher feeding and lower resting time of American Wigeon. Nonbreeding American Wigeon feed extensively on algae and leafy aquatic vegetation (Wishart 1983b), which were abundant on both study impoundments. Few American Wigeon were observed feeding in flooded cornfields or upland sites, and they probably spent more time feeding than did Mallards in order to obtain and process the lower quality natural foods that apparently dominated their diet at Eufaula NWR. Paulus (1982) noted that watermilfoil and algae are comparatively poor waterfowl foods and that species using them must feed extensively to meet nutritional needs.

Mallards may have spent less time feeding because they participated in evening feeding flights to flooded cornfields on the refuge. Corn provides an available, high energy food source that can increase foraging efficiency and minimize feeding time of Mallards and other ducks (Baldassarre and Bolen 1984). This reduced feeding time allows additional time for other activities such as resting.

←

FIG. 1. Seasonal activity patterns of Mallards and American Wigeon. For each species by activity, monthly comparisons that were not significantly different ($P > 0.05$) within seasons have identical letters above histobars (upper case = 1983–84, lower case = 1984–85). Within each month, differences between seasons are denoted by an asterisk. Significant status differences for each month within a year are noted by split histobars (solid = pairs, stippled = singles). Numbers below histobars denote sample size (number of observation days).

Increased feeding by Mallards during cold periods differs from reports of decreased feeding in response to colder temperatures in Nebraska (Jorde et al. 1984). Duration and severity of cold periods, however, render associated stresses more severe in northern versus southern areas, thus Mallards could use different strategies to maintain homeostasis. For example, waterfowl in northern areas often encounter inclement weather that renders natural foods unavailable (Jorde et al. 1983, Baldassarre and Bolen 1984). Mallards wintering farther south can still feed during cold weather because snow, and especially ice, seldom occur for long periods and inhibit food availability. Mallards may then increase feeding time rather than depend on accumulated lipid reserves.

Perhaps American Wigeon did not increase feeding in response to cold weather (i.e., December 1983 vs December 1984) because they could not meet increased metabolic demands by increasing already high feeding rates. American Wigeon may use stored body reserves as do other waterfowl during winter (Raveling 1979), or perhaps they select favorable microclimates at this time (Brodsky and Weatherhead 1984). Further research examining intraspecific geographical variation in lipid content and activity patterns is necessary to test this hypothesis.

Social activities comprised a small portion of overall time budgets of both species, but appeared important and possibly influenced by other flock activities. For example, increased alert time of paired Mallards in early mornings during December (9%) may be a response to higher courtship activities of single birds during this time (23%). Increased agonistic activity in December also may relate to courtship, or reflect increased aggressiveness as feeding time increased.

Differences in courtship activities during December appear influenced by pairing chronology and its effects on the ratio of paired and single birds. Pairing by Mallards occurs mainly from September through December, with 90% of individuals paired by January (Johnsgard 1960). Thus, increased courtship by single birds may reflect competition for fewer potential mates. Paired birds did not appear to court as frequently (Fig. 1), but remained in close association and occasionally engaged in displays and copulations. These activities may aid females in assessing breeding suitability of males or maintaining and strengthening pairbonds (Afton and Sayler 1982). Courtship activities by American Wigeon were lower possibly because only 60% are paired by mid-February (Soutiere et al. 1972).

Activity patterns by habitat.—Both species usually fed more on impoundments, which are managed for waterfowl, probably because these areas provided more natural food than did river sites. River sites, however, were used for resting and comfort because sandbars provided areas

for loafing and preening activities. Also, birds concentrated on southern and leeward sites, which appeared to maximize exposure to solar radiation and protection from northern winds.

Courtship was higher on impoundments perhaps because these areas provided habitat more suitable for pair formation. For example, the Houston impoundments, with higher structural diversity of vegetation, probably provided isolated areas, which can be important during pair formation (cf. Afton and Sayler 1982, Wishart 1983a).

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