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TIME-ACTIVITY BUDGETS OF DRAKE GADWALL AND NORTHERN SHOVELERS ON INDUSTRIAL COOLING PONDS DURING LATE WINTER AND EARLY SPRING IN CENTRAL UTAH

G. Merrill Webb¹ and J. D. Brotherson²

ABSTRACT.—Time-activity budgets of drake Gadwall and Northern Shoveler ducks were studied in the winter of 1985. Total duck numbers peaked in mid-March. Gadwall numbers increased from late January to mid-March and then declined, while Northern Shoveler numbers declined from late January to mid-February and then increased to mid-March before declining. Behavior categories considered in the time-activity budgets were flying, preening, swimming, courtship, feeding, and resting. Time allocated to these different activities varied for both duck species, with feeding being the only behavior pattern wherein differences were significant. Gadwalls spent 58% of their time feeding, Northern Shovelers only 26%. Possible reasons for these differences are suggested.

The Gadwall (*Anas strepera*) and Northern Shoveler (*Anas chlypeata*), like other Holarctic surface-feeding ducks, occupy a broad geographical range across much of North America (Bellrose 1976). Survey data indicate that the largest winter concentrations of Gadwall occur in the Mississippi Flyway, while the largest concentrations of Northern Shoveler occur equally distributed in the Pacific and Mississippi flyways (Johnsgard 1975). Wintering information indicates that in inland areas they are found on natural ponds and marsh impoundments with the Northern Shovelers preferring artificial impoundments along drainage systems (Stewart 1962). Information from Utah indicates that low numbers of both species remain in the state throughout the winter where there is open water (Hayward et al. 1976).

Behavioral studies of the two species have included aspects of their biology including flocking patterns (Bezzel 1959, Frith 1967, Poysa 1984), pair-forming and copulation (McKinney 1970, Duebbert 1966, Johnsgard 1965), nesting and brooding activities (Girard 1939, Gates 1962, Duebbert et al. 1986, Lokemoen et al. 1984), interspecific relationships (Eddleman et al. 1985, Amat and Soriguer 1984), feeding patterns (Hepp 1985, Nudds and Bowlby 1984), and postbreeding activities (McKinney 1967, Oring 1969, Dubowy 1985). Few studies have involved the daily behavioral patterns or activity bud-

gets of the two birds. This paper is concerned with the daily behavior patterns of Gadwall and Northern Shoveler drakes in central Utah during late January, February, and March.

STUDY AREA

The study area (approximately 86 ha) is on the southeast corner of the large (771-ha) settling pond at U.S. Steel's Geneva plant (Fig. 1). Because the pond is ice-free during winter and access to the pond is restricted, timed observations on selected birds could be accomplished free of public disturbance. The pond depth averages 6 m and is enclosed by earth-filled and slag-filled dikes to the north and west. Water volume changes daily as water is pumped (253 million liters) from the pond to the plant. In the plant the water is used in cooling operations at the various steel-making furnaces. Following use, the water is returned to the billion-liter reservoir for cooling, storage, and reuse. The average temperature of the return flow is 26 C. Ambient air temperatures during the study averaged 6 C.

Vegetation around the study site included peachleaf willow (*Salix amygdaloides*), Russian olive (*Elaeagnus angustifolia*), narrow-leaf cottonwood (*Populus angustifolia*), saltcedar (*Tamarix ramosissima*), Pacific aster (*Aster chilensis*), dogbane (*Apocynum cannabinum*), showy milkweed (*Asclepias speciosa*), motherwort (*Leonurus cardiaca*),

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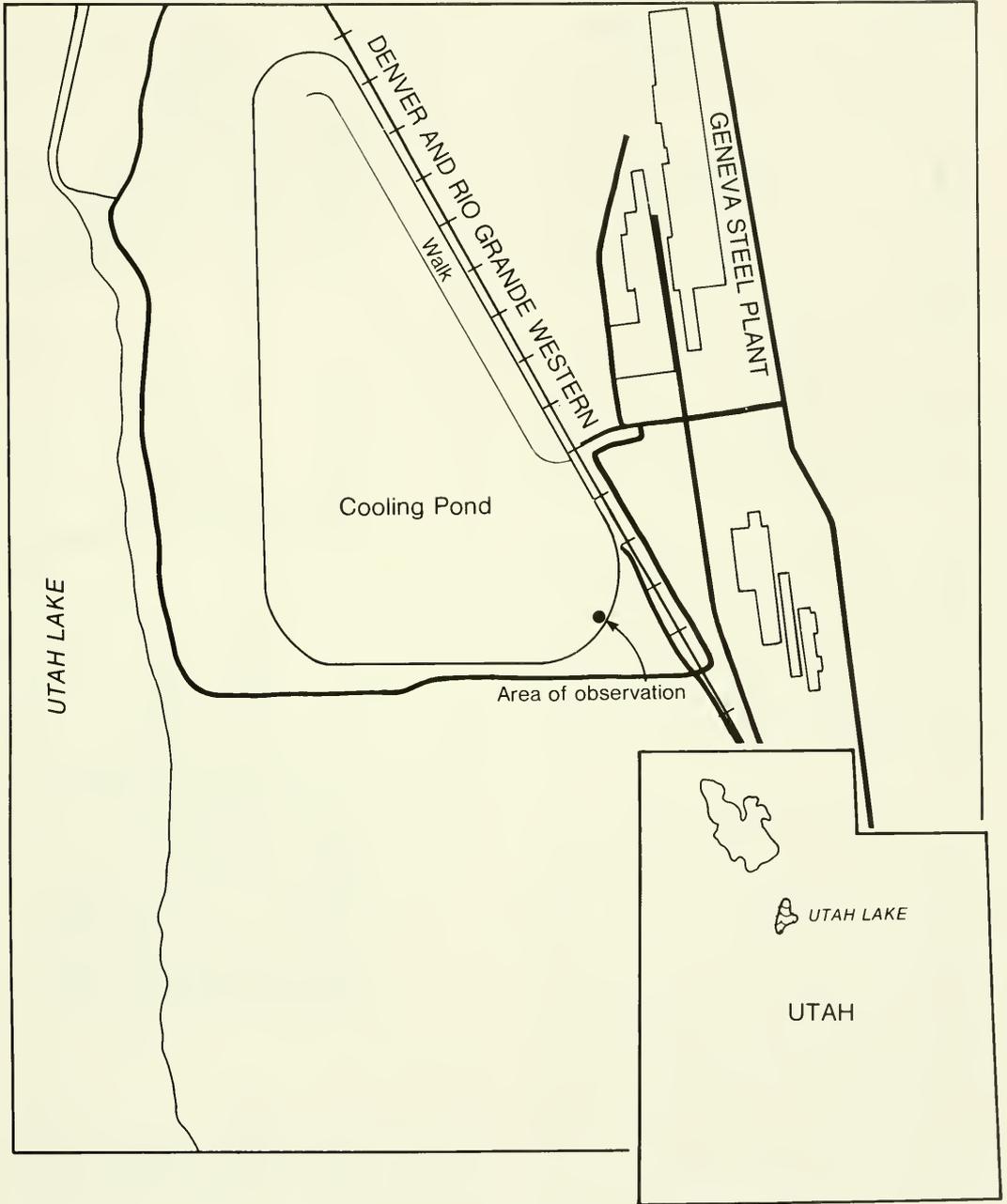


Fig. 1. Map showing location of Geneva Steel cooling pond and observation area on south dike.

rubber rabbitbrush (*Chrysothamnus nauseosus*), sunflower (*Helianthus annuus*), thistle (*Cirsium* sp.), and yellow clover (*Melilotus officinalis*).

METHODS

Thirteen days, 28 January to 31 March

1984, were spent observing Gadwall and Northern Shoveler drakes. Early morning mists, caused by the warm water of the pond coming into contact with the much colder ambient air, precluded observations prior to 10:30 A.M. Therefore, observation periods were selected from 30-minute blocks of time

beginning at 10:30 A.M. and ending at 4:30 P.M. Observations were made with the aid of 7 × 35 binoculars and a spotting scope with a zoom lens. One individual (the focal animal) was selected randomly by looking through a transparent numbered grid and selecting the drake closest to the number selected from the random numbers table for that day. Each bird was observed for 15 minutes and classified as to behavior; then the length of time spent in each behavioral bout was recorded. A stopwatch was used to time each bout.

Six behavior classes were considered: (1) preening—grooming, smoothing, or cleaning the feathers with the beak, (2) swimming—actively moving across the surface of the water, (3) courtship—behavior consisting of conspicuous displays associated with actual pair formation or pair-bond maintenance, (4) resting—not engaged in any of the other behaviors, or a period of inactivity, (5) flight—flying, and (6) foraging—searching for or ingesting food. Before actual observations commenced, total numbers for all species of waterfowl on the 86-ha pond were recorded.

Behavioral patterns were statistically compared using the Mann-Whitney test (Weiss and Hassett 1982).

RESULTS AND DISCUSSION

The numbers of waterfowl on the pond fluctuated from a beginning total of 282 birds on 28 January to an ending total of 208 birds on 31 March. The greatest number of birds (428) was observed on 10 March during the middle of the spring migration. As the weather ameliorated and the season for migration moved forward, the numbers of ducks using the pond dwindled, especially dabbling ducks such as the Mallard, Pintail, and Widgeon. Totals for coots always exceeded 100 birds and were, therefore, generally estimated.

Differences between the occurrence of Gadwalls and Shovelers during the sampling period are shown in Figure 2. As shown, Gadwall numbers remained fairly stable during February, jumped in early March, and then declined to very low levels by 31 March. Shovelers, on the other hand, underwent a major dip in numbers during mid-February, jumped to their highest levels in mid-March, and then showed declines similar to the Gadwalls by 31 March. Other duck species began

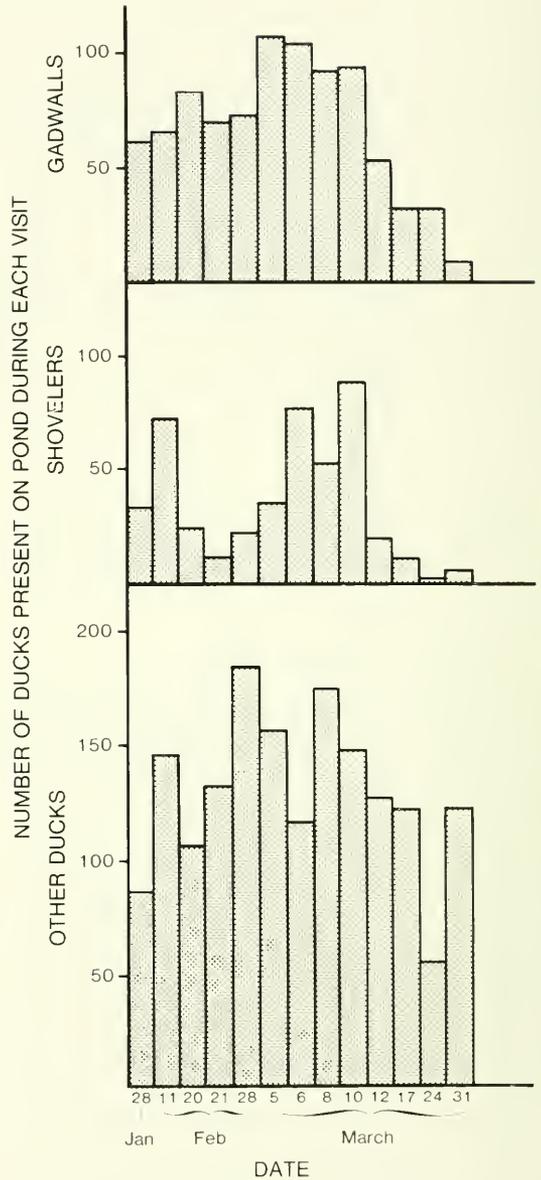


Fig. 2. Histogram showing the number of ducks present on the cooling pond during each of the observation visits. Gadwalls and Northern Shovelers are shown separately, while all other ducks are lumped together.

with 87 birds on 28 January, peaked at 184 birds on 28 February, and then leveled off at 125 birds in the latter part of March.

One reason for the abundance of waterfowl on the pond during the cold winter months may be that it is a way for the ducks to conserve energy through thermoregulation. Not only is the pond ice-free but the water is

TABLE 1. The time-activity budgets (means and standard deviations) for drake Gadwall and drake Shoveler ducks in minutes per observation period (15-minute units) on USX's Geneva Steel cooling pond.

	Gadwall		Shoveler	
	% of time	Mean	% of time	Mean
Flight	.50	.07 ± .13	2.56	.38 ± 1.22
Preening	2.50	.37 ± .93	16.93	2.54 ± 4.87
Swimming	28.58	4.29 ± 6.05	28.06	4.21 ± 6.23
Courtship	6.03	.90 ± 3.53	6.31	.95 ± 3.54
Feeding	57.68	8.65 ± 7.03	24.28	3.64 ± 6.20
Resting	4.32	.65 ± 2.75	21.86	3.28 ± 5.54

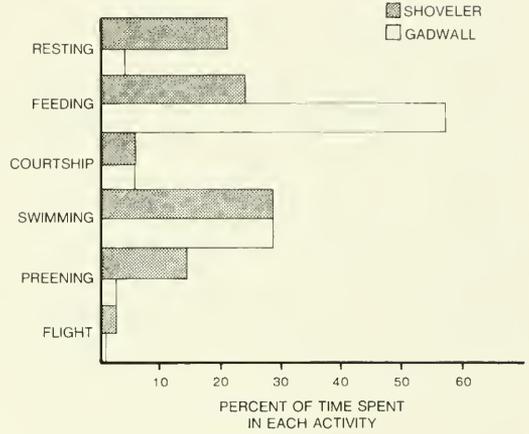


Fig. 3. Time-activity budgets for the Gadwall and Northern Shoveler drakes during the observation visits. The histogram bars represent the percentage of time (15-minute intervals) the ducks spent in each activity.

warm; therefore, the ducks should undergo less stress from the cold. When the weather warmed, the numbers of ducks on the pond declined. This decrease may be attributed to two factors. First, by the end of March hundreds of California Gulls (*Larus californicus*) began to move in and compete for nesting places on the dikes, gradually displacing the ducks from their resting areas. And, second, as the season warmed, resulting in snow and/or ice melt on agricultural fields and other ponds, food availability on foraging areas outside the confines of the study area increased.

Behavior categories were compared within and between drakes of Gadwall and Northern Shoveler ducks on the pond (Table 1, Fig. 3). As shown, time allocated to the different behavior categories by both duck species varied greatly. Both species spent little time in flight during the observation hours and much time in feeding and swimming. Differences between the behavior patterns of the two species were observed for time spent in resting, preening, and feeding, with feeding being the only behavior pattern in which differences were significant ($p \leq 0.05$). The large percentage of their daily activity budgets (58%) spent by the Gadwalls in feeding corresponds well to a study made in Louisiana (Paulus 1984) wherein nonbreeding Gadwalls spent 64% of their time feeding. Time spent in courtship activity was low for both species and averaged about 6% of the observation hours.

We suggest several possible reasons the

Gadwall spends so much more time feeding than the Northern Shoveler. First, in a deep, open-water pond such as the Geneva holding pond, Gadwalls may be less-efficient feeders in relationship to bill size and lamellae number. The bill of the Gadwall is narrower in proportion to its length and has fewer lamellae than those of other dabbling ducks (Bellrose 1976, Nudds and Bowlby 1985), while the Northern Shoveler has an extraordinarily large bill and a great number of lamellae. In fact, the bill's breadth and spoon-shaped tip make it unique in size among waterfowl (Johnsgard 1975). Its width near the tip, about twice as wide as at the base, has several rows of comblike lamellae. This makes the Northern Shoveler highly efficient as a surface-feeder with respect to straining out small organisms in the water column (Dubowy 1985). Second, the feeding behavior of the Northern Shoveler is such that it tends to enhance its feeding efficiency (Kortright 1967). The birds feed in small groups, each bird rotating in a "pinwheel" motion that stirs up the suspended material in the water column (Bellrose 1976). Third, in studies done on food types, the Gadwall has consistently shown a granivorous diet low in animal material and high in vegetable material. Conversely, the Northern Shoveler is zoophagous, consuming large amounts of small aquatic animal life (Johnsgard 1975, Pirot et al. 1984). This consumption of animal material should be energetically more efficient for the Northern

Shoveler. Fourth, drake body weight for the Gadwall generally exceeds that of the Northern Shoveler by nearly 30%, or about 295 g (0.65 lbs) (Johnsgard 1975). Assuming that the two species show equivalent abilities to metabolize food (Miller 1984), the greater Gadwall body weight and higher activity level relative to foraging would require more energy for maintenance under the winter conditions observed during this study. Needing less time for foraging, the Northern Shoveler should allocate a greater percentage of its time to other activities. This was observed in our study; the Northern Shoveler spent nearly 37% of the time resting or preening while the Gadwall spent an average of only 7% of the time in such activities.

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