WINTER CONDITION OF GADWALLS (ANAS STREPERA) IN SOUTHWESTERN LOUISIANA

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Abstract—Lipid reserves of Gadwalls (Anas strepera) wintering in southwestern Louisiana were determined from specimens collected from November 1984 through March 1985. Lipid levels of adults Gadwalls increased from November to March. However, a midwinter low in lipid reserves as reported in a previous investigation did not occur in the overall Gadwall population. Lipid levels of adult female Gadwalls decreased after January.

We hypothesize that the differences between midwinter lipid levels observed in this study and those of previous studies resulted from environmental factors which correlated with temperature, and that the absence of a midwinter decline in lipids commonly occurs in Gadwalls during mild winters.

Key words: Anas strepera, Gadwall, winter condition, lipids, Louisiana.

Introduction

Waterfowl investigations have emphasized the importance of understanding waterfowl winter ecology and physiological condition (Lack 1968, Fretevill 1972, Jorde 1981, Krapu 1981, Reinecke et al. 1982, Haramis et al. 1986). Recent investigations of Gadwalls (Anas strepera) wintering in southwestern Louisiana showed increased deposition of body lipids in early winter, and that lipid reserves sharply declined during midwinter (Paulus 1980, 1983). Paulus (1980) hypothesized that January and February were critical months for Gadwalls because of a decline in abundance and nutritional quality of available foods, which caused a decline in Gadwall lipids.

We studied the winter condition (lipid levels) of Gadwalls, hypothesizing that lipid levels of Gadwalls may not decline during mild winters along the Gulf Coast. Paulus' (1980, 1983) data were not statistically significant, probably because of small sample size. We wanted to use enough samples to adequately test the hypothesis that lipid level decline is an obligatory event, and provide additional data for future hypotheses on winter condition of Gadwalls.

Methods

We collected 243 Gadwalls from November 1984 through March 1985 (Table 1) from the Rockefeller State Wildlife Refuge (SWR), Cameron Parish,

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Table 1. Numbers and weights (N, W, SD) of Gadwalls collected during winter 1984-1985, from Rockefeller State Wildlife Refuge (Cameron Parish, Louisiana).

<table>
<thead>
<tr>
<th>Age and sex</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>W</td>
<td>SD</td>
<td>N</td>
<td>W</td>
</tr>
<tr>
<td>Adults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>24</td>
<td>995</td>
<td>88.6</td>
<td>33</td>
<td>973</td>
</tr>
<tr>
<td>Females</td>
<td>13</td>
<td>884</td>
<td>79.0</td>
<td>13</td>
<td>905</td>
</tr>
<tr>
<td>Juveniles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>924</td>
</tr>
<tr>
<td>Females</td>
<td>13</td>
<td>836</td>
<td>57.6</td>
<td>1</td>
<td>966</td>
</tr>
</tbody>
</table>
in coastal southwestern Louisiana. Specimens were parred dry, weighed, aged, sexed, and feathers were removed in the field. In the laboratory the esophagus and gizzard were removed for gut-contents analyses. Age was determined by examination of the orange scapulars, white speculum, bill coloration (Bellrose 1980), and, when possible, presence of the bursa of Fabricius. Methods of lipid analysis followed Paulus (1980); each whole carcass (including esophagus and gizzard) was cut into small pieces and homogenized by passing the pieces repeatedly through a meat grinder. Lipid content of 10-g homogenates from each Gadwall were determined by 4-hr Soxhlet extractions using petroleum ether (A.O.A.C. 1970, Raveling 1979).

Paulus (1980) provided means and variances of Gadwall lipid weights for months when Gadwalls occurred in southwestern Louisiana. We used his estimate of the mean monthly decrease in lipid weights and the monthly variance in lipid weights to calculate the sample size required to demonstrate statistical significance of such a decline. Using methods for finding the 'sample size required for a test' (Sokal and Rohlf 1981), the value was determined to be 50 Gadwalls per month.

We analyzed the physiological condition (sensu Wishart 1979, Whyte and Bolen 1984, Miller 1986) of Gadwalls by comparing changes in biomass and lipid content over time. We used analysis of covariance (ANCOVA, Sokal and Rohlf 1981) to test for differences in lipid weights of adult Gadwalls, between sexes and among months with nonfat (lean) weight as covariate. This was a two-way ANCOVA, one treatment being sex (2 levels, female and male), the other being month (5 levels, corresponding to November through March). Juvenile Gadwalls were analyzed separately by ANCOVA. We designated lean weight as the covariate because ANCOVA allowed a sensitive detection of differences in lipid weights between sexes and among months by correcting for differences that simply reflected the lean weights of the individual Gadwalls. We compared adjusted (corrected) means for lipid weights of each sex in each month (i.e., means of lipid weights after correction for different lean weights). Significance of differences among adjusted means was assessed using the error mean-square estimate generated by the analysis (Sokal and Rohlf 1981). In particular, we compared the amounts of lipids in Gadwalls collected during different months. An assumption of ANCOVA is that the covariate can be measured in a categorical fashion. In our study, lean weights of Gadwalls were categorized into 25-g units (e.g., all Gadwalls weighing between 901 g and 925 g were placed in the same weight category). We also reported lipids as a percentage of body weight, but did not use statistical tests on percentages because the sample sizes required to find significant differences among groups were found to be extremely large.

Results

We compared the temperature and precipitation data of the 1977–1978 winter, when Paulus (1980) collected his Gadwalls, and the 1984–1985 winter of our study. Minimum temperatures at Rockefeller SWR (calculated from daily lows) averaged 3°C (37°F) per day colder from October to March
1977–1978 than during our study (Fig. 1). Monthly and seasonal precipitation totals were similar for the two study periods.

Adult male mean weight changed little \( (P > 0.05) \) during the study period. For example, by March, average weight of adult males (985 g) had declined only slightly from values observed in November (995 g, Table 1). Mean weight of adult females increased slightly until January, decreased in February, then increased slightly in March. Mean weight of juvenile females declined from 836 g in November to 801 g in March.

Lipid reserves were independent of lean body weight during any month and for either sex, suggesting that an individual might have any of a range of lipid weights, no matter what its size. For example, despite their smaller sizes, adult female Gadwalls stored as much fat as males (i.e., \( P > 0.05 \); there was no significant difference between the sexes in amount of lipid reserves). Mean lipid levels of adult males increased steadily and significantly \( (P < 0.01) \) from 111 g (11% of body weightA) in November to 197 g (20%) in March (Fig. 2). Lipid levels of adult females increased \( (P < 0.01) \) from 90 g (10%) in November to 177 g (19%) in January, then decreased to 157 g (18%) in March. Differences in lipid levels were found among all months sampled for both sexes and no significant decline in fat levels was found during midwinter (Fig. 2). Generally, adult Gadwalls stored more lipids than juveniles (Table 2). Lipid levels of juvenile males and females comprised only 6% and 15%, respectively, of body weight in March. Most Gadwalls had migrated from the study area by early April.
Discussion

Many investigators documented a sharp winter decrease in lipid reserves and total biomass of overwintering migratory waterfowl (e.g., Blem 1976, Peterson and Ellarson 1979, Reinecke et al. 1982, Whyte and Bolen 1984, Hobaugh 1985, Delnich and Reinecke 1986, Miller 1986, Whyte et al. 1986). Most authors attributed winter lipid declines to a negative energy balance, which occurs as waterfowl maintain a high metabolism during vigorous midwinter environmental conditions. However, because waterfowl wintering in coastal Gulf States experience a milder winter, they may use fewer fat reserves than waterfowl wintering farther north (Whyte et al. 1986). Whyte et al. (1986) tested this hypothesis by comparing Mallards wintering in northern Texas to Mallards in Nebraska and Missouri, and noted that Mallards in northern Texas used fewer lipid reserves. Thus, it seems unlikely that a winter decline in lipid reserves of ducks is obligatory. We suggest that the absence of a winter lipid decline in Gadwalls is simply evidence of environmental effects, as suggested for snow geese wintering in southeastern Texas (Hobaugh 1985).

Even though there was no sharp midwinter decline in lipid levels of Gadwalls that we collected, lipid reserves accumulated by March were not excessive. In November, lipid content of the Gadwalls totalled 10% (adult females) and 11% (adult males) of body weight, values similar (within 1%) to those observed by Paulus (1980). By March, lipid content totalled 20%
Table 2. Body lipids (W, SD) in grams of Gadwalls collected at Rockefeller State Wildlife Refuge (Cameron Parish, Louisiana) during winter 1984–1985. Sample sizes are in Table 1.

<table>
<thead>
<tr>
<th>Age and sex</th>
<th>Nov  W  SD</th>
<th>Dec  W  SD</th>
<th>Jan  W  SD</th>
<th>Feb  W  SD</th>
<th>Mar  W  SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult males</td>
<td>111 40.4</td>
<td>147 46.7</td>
<td>164 44.1</td>
<td>188 54.9</td>
<td>197 41.8</td>
</tr>
<tr>
<td>Adult females</td>
<td>90 40.2</td>
<td>135 34.3</td>
<td>171 44.0</td>
<td>163 45.0</td>
<td>157 41.6</td>
</tr>
<tr>
<td>Juvenile males</td>
<td>—</td>
<td>123 22.6</td>
<td>150 56.3</td>
<td>113 89.1</td>
<td>51 56.3</td>
</tr>
<tr>
<td>Juvenile females</td>
<td>64 40.4</td>
<td>143 —</td>
<td>86 29.3</td>
<td>147 56.0</td>
<td>126 34.2</td>
</tr>
</tbody>
</table>

of body weight in adult males and 18% in adult females. These values were similar to data in previous studies of premigration Gadwalls (Paulus 1980).

It may seem paradoxical that lipid reserves of Gadwalls in our study and those in waterfowl wintering farther north were similar. However, Hepp (1985) observed that Gadwalls may increase their foraging speed and rate of dipping in relation to shorter days and colder temperature. Such behavior may help Gadwalls overcome a negative energy balance in mild or moderately cold winters if ample food resources are available. One may hypothesize that during colder winters in Louisiana, when preferred food resources are reduced or eliminated, Gadwalls may undergo the winter lipid decline observed in other waterfowl species. Such conditions may have led to Paulus' (1980) observations. Additionally, because Gadwalls feed almost exclusively on leafy vegetation and seldom ingest grains, Gadwalls may be especially susceptible to cold weather that destroys aquatic plants. Such cold conditions may be minimal during mild winters along the Gulf Coast, such as occurred during the winter of 1984–1985 (Fig. 1).

Although our study was conducted during a mild winter, we do not suggest that temperature alone is responsible for the results. Hepp (1985) reviewed the various environmental factors that may affect waterfowl behavior, many of which may be interrelated with lipid establishment and maintenance. Colder temperatures during winter and early spring are probably associated with lower winter production of submerged aquatic vegetation, less surface vegetation, and delayed initiation of spring production by plants in the study area. Reduced food resources and decreasing temperatures may stimulate higher metabolic rates and lead to greater energy expended in searching and competing for available food resources (Smith and Prince 1973).

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LITERATURE CITED


