# Nutrient Reserves of Lesser Scaup in Mid-winter in Southwestern Louisiana

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*Abstract:* We examined the influence of age and sex on body composition and organs of lesser scaup (*Aythya affinis*) during mid-winter in southwestern Louisiana. Except for intestine weight, organs and body components were similar in size between adult and immature lesser scaup. Body components and organs of males generally were larger than those of females. Body weights of lesser scaup in our study were lower than those reported from the same area more than 20 years ago. Declines in condition could result in lowered survival or reproductive performance. Information on winter survival is not available, but harvest age-ratio data suggest that recruitment of lesser scaup has declined in the Mississippi Flyway.

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Nutrient reserves acquired before departure from wintering areas or during spring migration are important determinants of reproductive performance in geese and some ducks (Alisauskas and Ankney 1990, Krapu and Reinecke 1990). The quantity of nutrient reserves accumulated during winter or spring migration may

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vary among years (MacInnes et al. 1974, Ebbinge et al. 1982, Davies and Cooke 1983, Mainguy and Thomas 1985, Miller 1986, Hohman et al. 1988), habitats (Gauthier et al. 1984, Tietje and Teer 1988), and individuals depending on their age, sex, social status, molt chronology, and position in foraging flocks (Krapu and Doty 1979, Peterson and Ellarson 1979, McLandress and Raveling 1981, Reinecke et al. 1982, Teunissen et al. 1985, Alisauskas and Ankney 1985, 1987, Miller 1986, Heitmeyer 1988, Hohman et al. 1988, LaGrange and Dinsmore 1988).

Reproductive performance of lesser scaup (hereafter called scaup) generally increases with female age and varies annually in response to fluctuating environmental conditions on breeding areas, and perhaps on winter or spring migration areas (Rogers 1959, 1964, Trauger 1971, Afton 1984). In 1986, we collected scaup at various locations within the Mississippi Flyway to investigate nutrient-reserve dynamics during spring migration. This paper examines age and sex variations in body composition and organs of scaup during mid-winter in southwestern Louisiana. Finally, we compare body weights of scaup in our sample to those reported from the same area more than 20 years ago.

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## Methods

The study was conducted from 14 to 24 January 1986 in southwestern Louisiana on Rockefeller Wildlife Refuge. Rockefeller Refuge is bounded on the south by the Gulf of Mexico and on the north by the Grand Chenier ridge complex (Wicker et al. 1983). It contains 30,797 ha, of which approximately 2,025 ha are lakes and 16,000 ha are impounded marshes (Chabreck 1960, Wicker et al. 1983).

We collected scaup randomly with a shotgun using several techniques: sneaking, from moving trucks and motorboats, and pass shooting with and without decoys while an airboat flushed birds from surrounding wetlands. Collection method was not considered in the analysis because body weights within each sex-age class did not differ among techniques (1-way ANOVAs, $P > 0.05$). Birds were weighed within 1 hour of collection (= fresh body weight), and esophageal-proventricular contents were then removed and weighed. Individuals were classified as adults (>1 yr) or immatures (in first winter) by examining rectrices, wing plumage, and cloacal characters (Hochbaum 1942, Kortright 1942, Carney 1964). Specimens were labeled, placed in double plastic bags, and frozen for shipment to Minnesota.

In Minnesota, carcasses were thawed and the following components were dissected free of visible fat: breast and leg muscles from the right side (Ankney and MacInnes 1978), heart, gizzard, liver, and intestine (combined small intestine, caeca, and colon). Intestine length (from gizzard to cloaca) was measured and wet weights were taken on all parts. Gizzard and intestine contents were removed, and these organs were re-weighed. Contents of esophagus, proventriculus, gizzard, and intestine were summed and reported as ingesta. Heart, gizzard, and intestine were dried to constant weight at 90° C (Kerr et al. 1982), and subsequently returned to the carcass. Carcass, right breast and leg muscles, and liver were then labeled, placed separately in double plastic bags, and frozen for shipment to the University of Western Ontario.

In Ontario, the carcass was ground 3 times (10, 5, and 3-mm plates) in a Hobart meat grinder. A 100-g sample of the carcass homogenate, the entire liver, and breast and leg muscles were dried separately to constant weight at 90° C. The dried carcass homogenate, liver, and breast and leg muscles were then homogenized separately again with the Hobart grinder (3-mm plate).

Proximate analysis of carcass homogenate, liver, and breast and leg muscles was done as detailed by Alisauskas and Ankney (1985). For each bird this involved: 1) removing lipids from a subsample (about 10 g) of each constituent using petroleum ether (Dobush et al. 1985) in a modified Soxhlet apparatus, 2) multiplying the dry weight of each constituent by the proportion of lipid that it contained (derived from Step 1) to determine its total lipid weight, and 3) subtracting total lipid weight from the dry weight of each constituent to determine its lean dry weight (LDW). Lean dry samples of carcass homogenate (6–9 g) were then ashed in a muffle furnace at 550° C for 6 hours. The proportion of ash in each sample was used to calculate the total ash (ASH) in the carcass of each bird. ASH was subtracted from LDW of each carcass to obtain ash-free lean dry weight (AFLDW), an estimate of protein (Mainguy and Thomas 1985:1767). Thus, for each bird:

$$\text{PROTEIN} = \text{AFLDW}_{\text{carcass}} + \text{LDW}_{\text{leg}} + \text{LDW}_{\text{breast}} + \text{LDW}_{\text{liver}}$$

and

$$\text{FAT} = \text{fat}_{\text{carcass}} + \text{fat}_{\text{leg}} + \text{fat}_{\text{breast}} + \text{fat}_{\text{liver}}.$$

Ash contents of the liver and breast and leg muscles were assumed to be negligible (Robbins 1983:211). ASH, PROTEIN, and FAT are herein referred to as nutrient reserves, which are defined as the measure of a fraction (fat, protein, or mineral) of the whole bird that may respond to changes in energy balance (Alisauskas and Ankney 1985:134).

We used 2-way ANOVAs to evaluate the influence of age and sex on various body components and organs (PROC GLM, SAS Institute Inc. 1987). The level of significance for all analyses was $P < 0.05$.

## Results

Seventy-two lesser scaup were collected and analyzed (Table 1). There was no age-by-sex interaction ($P > 0.05$) in any of the analyses. Except for FAT ($P > 0.05$) and leg LDW ($P > 0.05$), body components of males were larger ($P < 0.05$) than those of females. Body components were similar ($P > 0.05$) in size between age classes. Males had larger ($P < 0.05$) hearts, livers, and gizzards than did females, whereas intestines were similar ($P > 0.05$) in size between sexes. Except for intestine weight ($P < 0.05$), organs were similar ($P > 0.05$) in size between age classes.

## Discussion

### Age variation

We found that body components and organs generally were similar in size between adult and immature scaup during mid-winter. In contrast, several of these parameters varied significantly between age classes (adults > immatures) of scaup collected during fall migration in Minnesota (A. D. Afton, unpubl. data). Similarly, immature ring-necked ducks (*Aythya collaris*) were lighter than adults in fall, but body weights were equivalent by late winter (Hohman et al. 1988). Heitmeyer (1988)

**Table 1.** Body composition and dried organ weights by sex-age class for lesser scaup during mid-winter on Rockefeller Refuge in southwestern Louisiana, 1986.

| Variable | Adult males (N = 28) | | Immature males (N = 11) | | Adult females (N = 22) | | Immature females (N = 11) | |
|---|---|---|---|---|---|---|---|---|
| | $\bar{X}$ | SE | $\bar{X}$ | SE | $\bar{X}$ | SE | $\bar{X}$ | SE |
| Body composition | | | | | | | | |
| Body weight, fresh (g) | 721.4 | 8.8 | 726.9 | 16.6 | 679.8 | 10.0 | 668.8 | 12.5 |
| Body weight, corrected (g)[a] | 696.9 | 9.1 | 701.2 | 17.6 | 657.9 | 10.2 | 652.9 | 12.3 |
| Ingesta weight (g) | 24.4 | 2.0 | 25.7 | 3.7 | 21.9 | 2.5 | 15.9 | 0.8 |
| Fat (g) | 78.5 | 8.3 | 93.4 | 12.2 | 94.8 | 9.5 | 90.2 | 8.7 |
| Ash (g) | 27.2 | 0.4 | 26.8 | 0.8 | 23.8 | 0.6 | 23.2 | 0.7 |
| Protein (g) | 160.3 | 1.8 | 154.5 | 3.0 | 147.2 | 1.4 | 145.0 | 2.4 |
| Breast LDW (g)[b] | 14.6 | 0.2 | 14.5 | 0.3 | 13.8 | 0.2 | 14.0 | 0.3 |
| Leg LDW (g) | 5.6 | 0.1 | 5.5 | 0.1 | 5.5 | 0.1 | 5.4 | 0.1 |
| Liver LDW (g) | 5.9 | 0.3 | 5.9 | 0.3 | 5.3 | 0.1 | 5.4 | 0.2 |
| Organs | | | | | | | | |
| Heart weight (g) | 1.3 | 0.03 | 1.3 | 0.07 | 1.2 | 0.02 | 1.2 | 0.05 |
| Liver weight (g) | 6.3 | 0.3 | 6.2 | 0.3 | 5.6 | 0.1 | 5.6 | 0.2 |
| Gizzard weight (g) | 7.6 | 0.4 | 6.9 | 0.7 | 5.4 | 0.2 | 6.0 | 0.4 |
| Intestine weight (g) | 5.6 | 0.2 | 6.1 | 0.4 | 5.3 | 0.2 | 6.4 | 0.4 |
| Intestine length (mm) | 1844.6 | 29.5 | 1834.1 | 56.2 | 1816.4 | 22.9 | 1827.3 | 28.2 |

[a]Corrected body weight is weight of bird minus ingesta.
[b]LDW is lean dry weight.

reported that body composition of wintering mallards (*Anas platyrhynchos*) was similar between adults and immatures of the same molt and pair-status groups. Although we did not classify molt or pair status of scaup, all specimens probably were unpaired given the late-pairing chronology of this species (Bluhm 1988).

Age variation in reproductive performance is positively correlated with age variation in nutrient storage in other ducks (Krapu and Doty 1979, Hohman et al. 1988). If age variation in reproductive performance of scaup (Trauger 1971, Afton 1984) is related to nutrient reserves, then our results indicate that such differential storage must occur (if at all) later in winter, during spring migration, or after arrival on breeding areas.

### Sex variation

We found that body components and organs of males generally were larger than those of females. However, absolute amount of FAT did not differ between sexes, indicating that female scaup had proportionately more lipid reserves than did males. Similarly, female brant (*Branta bernicla*) accumulated proportionately larger lipid reserves just before leaving wintering areas than did males (Vangilder et al. 1986).

### Body weight comparisons

Harmon (1962) collected 32 scaup (sex ratio = 5.4 males-to-females, age ratio = 1.91 immatures-to-adult) in the Gulf of Mexico adjacent to Rockefeller Refuge, and reported an average weight of 946.9 g. Scaup trapped on Rockefeller Refuge ($N$ = 4,969, sex and age ratios not reported) during the same period weighed, on average, 20% less (Chabreck 1964, Joanen 1964), or 757.5 g by our estimate. Unfortunately, these studies did not report means by sex-age class or any variance estimates. Assuming similar variances in weight among studies, $t$-tests indicated that weights of scaup (ages and sexes combined) in our sample ($\bar{x}$ = 701.5, SE = 6.1, $N$ = 72) were less than those trapped on Rockefeller Refuge ($P < 0.0001$) or shot in the Gulf ($P < 0.0001$) more than 20 years ago.

Body weights of ducks vary throughout winter (Hohman et al. 1988); thus, differential timing of collections within winter could influence results. However, ours and earlier collections were made at similar times within winter (R. H. Chabreck, pers. commun.). Differences could reflect typical annual variation in weights caused by annual variations in: 1) reproductive effort (Afton 1984), 2) food resources on fall migration and winter areas (Chabreck 1964, A. D. Afton, unpubl. data), or 3) severity of winter weather (Whyte and Bolen 1984). Differences also could reflect long-term declines in condition of scaup, perhaps influenced by deterioration of food resources or increased disturbance on fall migration and winter areas (Mills et al. 1966, Korschgen et al. 1985). It is noteworthy that fall weights of hunter-killed ring-necked ducks and redheads (*Aythya americana*) in Minnesota from a recent sample were lower than those reported more than 30 years earlier (Hier 1989).

Declines in body condition could result in lowered survival (Haramis et al. 1986, Hepp et al. 1986, Conroy et al. 1989) or reproductive performance. Data on

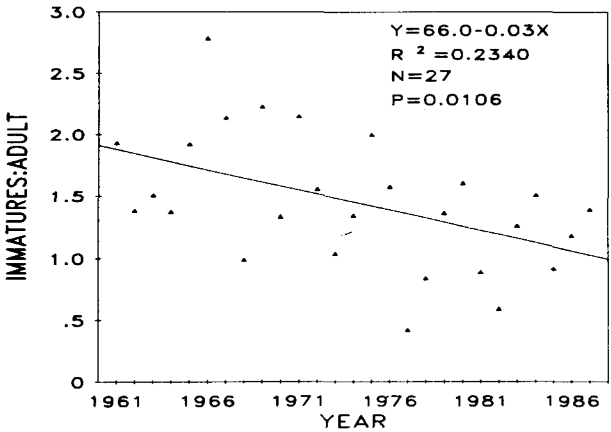


**Figure 1.** Relationship between the ratio of immatures-to-adult in the harvest for lesser scaup in the Mississippi Flyway, 1961–87 (data on file, Off. Migr. Bird Manage., U.S. Fish Wildl. Serv.).

winter survival are not available, but harvest age-ratio data suggest that recruitment of scaup has declined in the Mississippi Flyway (Fig. 1).

Our preliminary results clearly point out needs for further research on nutrient reserves of wintering scaup. Subsequent studies should be conducted throughout winter, over several years, and in a variety of habitats, and also should consider individual variation. Concurrent information on distribution, abundance, and quality of foods consumed in various habitats also is needed, and is critical for directing habitat management. Finally, the relationship between nutrient reserves and reproductive performance of lesser scaup, and factors responsible for the apparent decline in recruitment in the Mississippi Flyway, should be investigated.

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