RELATIONSHIP BETWEEN WATERFOWL NUTRITION AND CONDITION ON AGRICULTURAL DRAINWATER PONDS IN THE TULARE BASIN, CALIFORNIA: WATERFOWL BODY COMPOSITION

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Abstract: We examined carcass composition and proximate food composition of ruddy ducks (Oxyura jamaicensis), northern shovelers (Anas clypeata), and northern pintails (Anas acuta) wintering on agricultural drainwater ponds in California during 1983–84. Lipids varied seasonally in northern shovelers and northern pintails. Protein did not fluctuate except in ruddy ducks whose protein mass increased over winter, suggesting that some protein was catabolized prior to arrival on wintering areas or that a buildup of protein occurred prior to spring migration. Waterfowl diets varied among species and time, but the nutritional composition of the diets was relatively stable. Ruddy ducks and shovelers consumed mostly animal foods rich in protein (53–60%) and low in Nitrogen Free Extract (NFE)(1–7%). Pintail diets contained more NFE (23–38%) and less protein (14–38%) because of greater consumption of plant foods. Nutritional composition of pintail diets varied with lower protein consumption occurring from November through January.

Key Words: body condition, California, evaporation ponds, nutrition, northern pintails, northern shovelers, ruddy ducks, wintering waterfowl

INTRODUCTION

Waterfowl forage in a variety of habitats to meet their nutrient needs during winter. Availability of carbohydrate-rich plant foods is believed to influence the rate of lipid deposition in some ducks in late winter (Heitmeyer 1985, Miller 1986a), thereby possibly influencing the amount of nutrients available for reproduction (Krapu 1981) and survival (Haramis et al. 1986, Conroy et al. 1989). Aquatic invertebrates form a substantial portion of the winter diet of dabbling ducks (Connelly and Chesemore 1980, Heitmeyer 1985, Euliss and Harris 1987) and provide a major source of essential amino acids (Krapu and Swanson 1975). Whether diet shifts are motivated by nutrition or food availability is unclear.

The loss of most of the wetland habitat traditionally used by wintering waterfowl over the past century in the southern United States has drastically changed for-
agricultural areas and potentially affected diet (Loesch and Kaminski 1989). For example, in the Central Valley of California, a major wintering ground for waterfowl of the Pacific Flyway, only 6% of the original 2 million ha of wetland habitat remains. Clearly, habitat loss has not occurred equally across wetland types, nor has the current availability of predominately impounded wetlands, and the influence on waterfowl has been more dramatic on some species than others. Some species such as the northern pintail (Anas acuta L.) have partially adjusted to the loss of wetland habitat by increasing their reliance on foods found on agricultural lands (Miller 1986a). Species such as northern shovelers (A. clypeata L.) and ruddy ducks (Oxyura jamaicensis Eyton) that feed primarily on aquatic invertebrates are potentially most affected by wetland habitat loss.

In the Tulare and Buena Vista Lake Basins in the southern part of the Central Valley, approximately 250,000 ha of shallow wetlands have been converted to agriculture (Gilmer et al. 1982). In this landscape in recent years, approximately 2,000 ha of nutrient-enriched man-made and man-altered wetland habitats have been created by agriculture, supporting exceptionally high standing crops of some invertebrates on some wetlands (Euliss et al. 1991a). Shallow evaporation pond systems (EPS) constructed for farmers since the 1970s for disposal of agricultural drainwater have become important wintering areas for waterfowl, particularly ruddy ducks and northern shovelers, which forage heavily on aquatic invertebrates. However, little information is available on the suitability of these habitats in meeting nutrient needs during winter and as conditioning sites in preparing birds for migration and reproduction. Our objectives were to determine the nutritional composition of the diet of northern shovelers, ruddy ducks, and northern pintails using EPS and to examine effects on carcass protein and lipid.

STUDY AREA

Our study was conducted on 3 EPS in the Tulare Lake Basin (TLB) of Kings and Kern Counties, California. Agriculture is the primary industry in the TLB. Major crops include cotton, barley, wheat, safflower, and alfalfa. Annual precipitation averages only 21 cm (Kahrl 1979), and most crops require irrigation. Waterfowl use in the area is confined to habitats provided by the Kern National Wildlife Refuge (NWR), private duck clubs, water storage basins, flooded agricultural fields, and EPS. Euliss et al. (1991b) provide a complete description of the EPS study areas.

METHODS

Waterfowl Samples

We collected pintails, shovelers, and ruddy ducks actively feeding on EPS during September 1983 through March 1984. We used plumage characteristics (Carney 1964) and bursae to sex and age collected ducks. However, we could not distinguish age classes of female ruddy ducks in February and March because immatures begin replacing tail feathers in December and January (Joyner 1969) and we were not always able to detect bursae. In those cases (5 out of 50), we used carcass mass to separate immatures from adult females. Bellrose (1980) lists 454 g as the minimum weight for adult females and 344 g as the maximum weight for immature females. To reduce misclassification of age, we considered females to be immatures if weights were <454 g.

In the laboratory, we plucked and sheared feathers from the partially frozen carcasses after removing bills and feet. We then weighed each carcass prior to dicing and grinding in a commercial meat grinder. Food material in duck esophagi had been removed to assess diet and was not included in the proximate analysis. We reweighed ground material and homogenized it with a known quantity of water. We sent duplicate 20-g samples of homogenate from each bird to the Department of Agricultural Chemistry, Oregon State University to determine lipid (ether extraction in a soxhlet apparatus) and protein content (Kjeldahl nitrogen × 6.25) (Horowitz 1970: 16, 127). Water content was determined by drying 2 replicates of the homogenate from each bird at 55°C to a constant weight.

We used the techniques of Swanson and Bartonek (1970) to quantify the dry mass of esophageal contents of collected waterfowl. The nutritional composition of waterfowl foods from EPS was derived from published sources (Table 1). For each individual duck collected, we expressed dry mass of Nitrogen Free Extract (NFE), protein, and lipid content of individual food items as aggregate percents (Swanson et al. 1974). We then estimated the nutritional composition of the diet. Not all food item taxa had published data available on proximate composition; hence, in those cases, we used the average values provided in Table 1. Diet analysis was based on a total of 185 ruddy ducks, 104 northern shovelers, and 58 northern pintails collected in September through March in 1982–1983 and in 1983–1984.

We used a lipid index (Fat/Fat-free wet mass) to examine trends within and among duck species. This index compensates for structural size variations among birds (Johnson et al. 1985). Although dry masses were used by Johnson et al. (1985), there is little variation in water content of birds on a fat-free basis (Raveling...