Winter Foods of American Black Ducks and Mallards in Tennessee

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Abstract: Primary foods of American black ducks (*Anas rubripes*) and mallards (*A. platyrhynchos*) wintering at Tennessee National Wildlife Refuge were compared by examining esophageal and proventricular contents of ducks collected during winter, 1990–91 and 1991–92. Seeds of natural plants comprised the primary component of the diet of both species. Nodding smartweed (*Polygonum lapathifolium*), wild millet (*Echinochloa crusgalli*), lovegrass (*Eragrostis hypnoides*), and rice cutgrass (*Leersia oryzoides*) were the most common seeds consumed by both species. Water smartweed (*P. hydropiperoides*) also was consumed abundantly by black ducks. Black duck samples contained more ($P < 0.021$) stem and leaf material than mallard samples during both winters and less ($P < 0.002$) agricultural grain during 1991–92. No differences were detected in food consumption between females and males of either species. Species specific differences in food consumption were probably related to differences in areas from which ducks were collected and perhaps reflected microhabitat differences between species.

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American black duck populations have declined recently in North America (Rusch et al. 1989). Hybridization and habitat competition with mallards have been implicated as responsible for these declines (Johnsgard 1967, Ankney et al. 1987). Although most research efforts directed toward managing nonbreeding black ducks and reversing these trends have been conducted in coastal habitats of the Atlantic flyway (Jorde 1986, Conroy et al. 1989, Morton et al. 1989), 25% to 33% of the continental black duck population consistently winters in inland habitats of the Mississippi flyway (Rusch et al. 1989).

Information on food use by wintering ducks is necessary before effective management programs can be implemented. Food use by nonbreeding mallards has been documented for many locations and habitats (Jorde et al. 1983, Heitmeyer 1985, Delnicki and Reinecke 1986, Combs 1987, Gruenhagen and Fredrickson 1990), but similar studies of nonbreeding black ducks have been confined to marine or estuarine environments in the Atlantic flyway (Mendall 1949, Hartman 1963, Kerwin and Webb 1971). Our primary objective was to determine the major foods of black ducks wintering in westcentral Tennessee. Specifically, we desired to test the null hypothesis that black ducks and mallards consumed similar foods in Tennessee and to make management and research recommendations consistent with our results.

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Methods

Our study was conducted on the 20,788-ha TNWR in westcentral Tennessee. We chose TNWR because large numbers of black ducks winter there (10,000 to 60,000 birds, TNWR unpubl. data 1957–92), and no hunting occurs on the refuge. TNWR is comprised of 3 disjunct units, all located on land adjacent to the Tennessee River. We collected ducks only on the Duck River Unit, which contains 8 moist-soil impoundments that support a variety of natural plants. Although corn and milo are grown on TNWR for waterfowl, <2% of the area was planted in agricultural foods during winters of our study because of management constraints related to high water levels during previous summers (J. T. Taylor, TNWR manager, pers. commun.).

Black ducks were collected by shooting on TNWR from November–February 1990–91 and 1991–92 (N = 39 and 23, respectively). When possible, mallards (N = 24 for 1990–91 and 18 for 1991–92) also were collected to compare food use between species. Ducks were collected primarily after observing individuals feeding for at least 5 minutes, but some individuals were collected as they landed in roost locations following feeding flights. An approximately equal number of males and females of both species (21M, 18F for black duck and 14M, 10F for mallards) were collected during 1990–91, but proportionately fewer females (15M, 8F for black duck and 13M, 5F for mallards) were collected during 1991–92 because of concerns for declining waterfowl populations and indications of no sexual differences in foods consumed during the previous winter according to the data we had already compiled.

Contents of the esophagus and proventriculus were removed immediately following collection and preserved in 70% ethanol to prevent postmortem digestion (Swanson and Bartonek 1970). Plant foods were identified using Martin and Barkley (1961) and Godfrey and Wooten (1979, 1981); animal foods were identified using Merritt and Cummins (1984) and Pennak (1978). Food samples were sorted, and dry mass determined after drying samples for 48 hours at 50° C. Mass was measured to the nearest 0.01 g. Foods with mass <0.1 g were listed as trace items. Data were expressed by percent occurrence and aggregate percent dry mass (Swanson and Bartonek 1970). Samples with <0.01 g or <5 food items were excluded from analysis.

Three-way analysis of variance (Neter and Wasserman 1974) was conducted to test if differences existed in aggregate dry mass consumption of various food groups by year, species, and sex. Food groups tested were animal foods, stems and leaves, tubers and rhizomes, agricultural grain, and natural plant seeds. Significance was deemed appropriate at an alpha level of 0.05. Non-normal percentage data were arc sine transformed before all analyses (Neter and Wasserman 1974).

Results

Natural plant seeds comprised the primary food source of both black ducks and mallards collected during our study (Table 1). Seeds of 14 different taxa of plants were collected during 1990–91 and 24 taxa during 1991–92. Nodding smartweed, wild millet, rice cutgrass, and lovegrass were the most abundant seeds in both black duck and mallard samples (Table 1). Water smartweed was also a major food in black duck samples (Table 1).

Although animal foods comprised only a small amount of the winter diet of both species (Table 1), almost 57% of all birds collected contained at least trace amounts of animal material. Sixteen different taxa of invertebrates were observed in samples from 1990–91, and 13 invertebrate taxa were collected during 1991–92 (Table 1). No invertebrate taxa were consistently present in either black duck or mallard samples (Table 1).

Black ducks and mallards consumed proportionally fewer ($P < 0.002$) seeds during 1991–92 than during the previous winter. Black ducks consumed more ($P < 0.021$) stems and leaves than mallards during both winters and less ($P < 0.002$) grain during 1991–92. Mallard consumption of grain was greater ($P < 0.002$) during 1991–92 than during the previous winter, but few black ducks were collected that had fed on grain during either winter. The only significant interaction effect detected in our analysis was between year and species for grain consumption ($P < 0.001$). No other differences were detected in food consumption between black ducks and mallards or between ducks collected during 1990–91 and those collected during 1991–92.

Females and males of both species consumed similar foods during both winters of this study (Fig. 1). No sex-related differences were detected in consumption of any of the 5 food groups. Consumption of animal material, for example, was very similar ($P > 0.781$) between males and females for both species.

Table 1. Percent occurrence (Occ) and aggregate percent dry mass (Mass) of foods from black ducks and mallards collected on the Tennessee National Wildlife Refuge during winter, 1990–91 and 1991–92.

	1990–91				1991–92			
	Black ducks (*N*=39)		Mallards (*N*=24)		Black ducks (*N*=23)		Mallards (*N*=18)	
Food	Occ	Mass	Occ	Mass	Occ	Mass	Occ	Mass
Plant seeds[a]								
Polygonum lapathifolium	84.6	40.8	62.5	40.6	43.5	4.4	16.7	5.7
Polygonum hydropiperoides	64.1	17.9	37.5	5.5	52.2	10.6	22.2	0.1
Leersia oryzoides	51.3	4.3	41.6	1.9	56.5	1.6	44.4	5.0
Eragostis hypnoids	7.7	4.1	4.2	0.1	43.5	6.9	22.2	8.9
Cephalanthus occidentalis	33.3	1.9	20.8	0.2	4.3	tr[b]		
Bidens sp.	20.5	1.3	8.3	0.1	60.9	3.5	22.2	0.3
Echinochloa crusqalli	10.3	0.5	12.5	8.7	73.9	8.1	27.8	16.8
Sorghum halepense			33.3	29.3				
Iva frutescens	2.6	0.4	4.2	0.8	21.7	2.1	5.6	0.1
Ludwigia sp.					17.4	9.7		
Amaranthus sp.					47.8	4.0	27.8	0.8
Cyperus spp.					26.1	1.0	16.7	6.5
Liquidambar styraciflua					4.3	tr	5.6	3.7
Quercus falcata							5.6	1.0
Total plant seeds[c]	92.3	72.0	100.0	87.3	91.3	54.1	72.2	50.0
Grain								
Corn	10.3	4.6					5.6	4.9
Milo	2.6	0.2	33.3	3.4	4.3	4.2	33.3	32.9
Total grain	25.6	5.2	33.3	3.4	4.3	4.2	38.9	37.8
Total stems and leaves	48.7	13.1	12.5	3.3	91.3	23.1	27.8	8.1
Total tubers and rhizomes	25.6	3.9	12.5	1.4	30.4	10.2	16.7	3.4
Animal[d]								
Artrichopogon sp.	25.6	1.5	8.3	0.6				
Lynbaeidae	18.0	0.8	12.5	1.6	17.4	0.5	5.6	0.1
Gryllidae					4.3	1.2	11.1 1	tr
Chironomidae					4.3	4.3		
Total animal[c]	43.6	5.8	62.5	4.6	69.6	8.3	61.1	0.6

[a] Excludes 3 taxa during 1990–91 and 9 taxa during 1991–92 each comprising <1% mass of both species.
[b] tr= <0.1%.
[c] Totals include trace items and items <1% mass.
[d] Excludes 14 taxa during 1990–91 and 10 taxa during 1991–92 each comprising <1% mass of both species.

Discussion

Plant seeds comprised the primary component of the diet of black ducks and mallards collected during this study. Although plant foods often predominate in the diet of black ducks wintering in fresh and brackish habitats (Kerwin and Webb 1971), black ducks in maritime habitats consume primarily animal foods (Lewis and Garrison 1984). In maritime habitats, wintering black ducks are usually restricted to feeding on ice-free mudflats and tidal areas where mollusks are abundant and plant foods scarce (Lewis and Garrison 1984). Waterfowl are oppor-

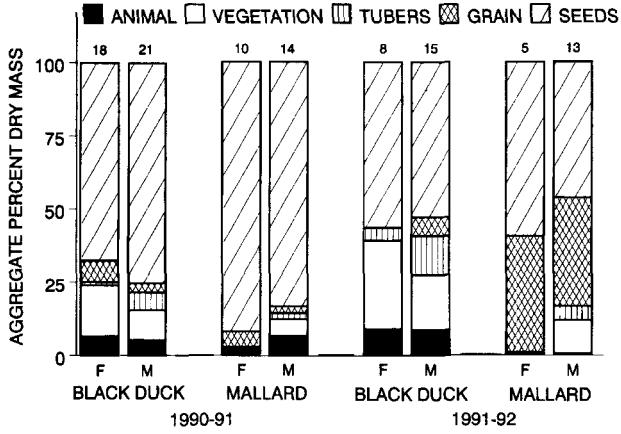

Figure 1. Aggregate percent dry mass of seeds of various food groups consumed by female and male black ducks and mallards collected on the Tennessee National Wildlife Refuge during winter, 1990–91 and 1991–92. Numbers above bars represent sample sizes.

tunistic and often use the most abundant foods available (Fredrickson and Drobney 1979). Results from our study indicate that specific foods consumed by black ducks vary among wintering locations, perhaps as influenced by food availability.

Plant foods provide energy needed for winter metabolism, thermoregulation, and locomotion between habitats (Prince 1979), but they often are lacking in protein and minerals needed for body maintenance (Delnicki and Reinecke 1986). Small quantities of invertebrates may have been consumed to fill these nutritional deficiencies thus accounting for the high percent occurrence, but low aggregate percent mass, of invertebrates in the diet of black ducks and mallards. Similar patterns of invertebrate consumption have been reported in other studies (Jorde et al. 1983, Delnicki and Reinecke 1986, Combs 1987).

Heitmeyer (1985) reported a relationship between consumption of animal material and molt intensity of female mallards wintering in southeast Missouri, presumably as related to protein requirements of molt (Heitmeyer 1988). Invertebrate consumption did not appear to be related to molt intensity of wintering male mallards at the same location (Combs 1987), nor of migrating female mallards in northwest Missouri (Gruenhagen and Fredrickson 1990). We did not determine molt status of ducks collected in our study, but the low amount of invertebrate consumption by female and male ducks of both species indicate that either significant molt was not occurring or ducks were able to meet their protein requirements with foods other than animal material.

Although foods consumed by black ducks and mallards wintering in west-central Tennessee were similar, a few minor differences were detected in our study. Black ducks consumed more stem and leaf material and some types of seeds than

mallards, and mallard samples contained more grain than black duck samples. These differences were partially influenced by differences in collecting locations. For example, no black ducks were collected from agricultural fields during 1991–92 because we were restricted from collecting ducks from agricultural fields during early winter and because few black ducks used agricultural fields during late winter when mallard samples containing grain were collected. Few mallards were collected from open water habitats, areas where black duck samples were collected that contained leaf and stem material and water smartweed seeds.

Black ducks appeared to use open water habitats more extensively and agricultural fields less extensively than mallards during our study, and differences in foods consumed perhaps reflect differences in microhabitat selection between species. However, our data should not be used to establish habitat management strategies for wintering black ducks because habitat use data were not collected concurrently. Additional studies are needed to determine if differences exist in microhabitat selection and how such selection relates to food consumption by wintering black ducks and mallards.

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