Food Habits of Ring-necked Ducks Wintering in Florida

Clinton W. Jeske,[1] *Florida Cooperative Fish and Wildlife Research Unit, Department of Wildlife and Range Sciences, University of Florida, Gainesville, FL 32611*

H. Franklin Percival, *Florida Cooperative Fish and Wildlife Research Unit, Department of Wildlife and Range Sciences, University of Florida, Gainesville, FL 32611*

James E. Thul,[2] *Wildlife Research Laboratory, Florida Game and Fresh Water Fish Commission, Gainesville, FL 32601*

Abstract: Food habits of wintering ring-necked ducks (*Aythya collaris*) were determined by examining gullets from 597 birds collected in 3 regions of Florida. Fifty-five of the gullets contained trace amounts of food and 148 contained >1 ml. Forty-one foods were identified. Animal matter, principally snails, chironomids, and dragonflies, occurred in 43.6% of the samples containing food. Plant foods, principally hydrilla (*Hydrilla verticillata*), waterlilies (*Nuphar advena, Nymphaea odorata, Brasenia scherberi*), and sawgrass (*Cladium jamaicense*), occurred in 89.1% of the samples containing food. Food habits were significantly different among regions and between the sexes in November and March. The major foods were: waterlily seeds in the north region, waterlily seeds and hydrilla parts in the north-central region, and hydrilla and sawgrass in the south region. Overall, hydrilla and waterlilies were the most important foods.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 47:130–137

The ring-necked duck is a North American pochard that utilizes freshwater wetlands of moderate water depths and with abundant submerged and sparse emergent vegetation (White and James 1978). It breeds throughout the closed boreal forest, winters primarily in the southeastern United States (Bellrose 1980), and selects deep marsh habitats throughout its range (Mendall 1958).

[1]Present address: National Wetlands Research Center, 700 Cajundome Boulevard, Lafayette, LA 70506.

[2]Present address: 14 Garrett Drive, Flemington, NJ 08822.

Similar habitat selection throughout the year has resulted in similar food habits during each season (Cottam 1939, Martin et al. 1951, Mendall 1958). These studies have shown the seeds of deep marsh plants to be generally the most important foods, although Hohman (1985) has shown animal foods to be most important for egg-laying females.

Over half of the Atlantic Flyway ring-necked ducks winter in Florida (Bellrose 1980). Urbanization associated with Florida's increasing human population (Terhune 1983) has substantially affected the state's wetlands. Additionally, several aquatic plants have been introduced with differing potential impacts upon wintering waterfowl. Several studies (Gasaway et al. 1977, Montalbano et al. 1979, Johnson and Montalbano 1984) have suggested that hydrilla benefits wintering waterfowl.

Our study was performed to identify the foods of ring-necked ducks wintering in Florida, identify the changes in diet through the winter, identify age-sex related differences in the diet, and to evaluate the importance of hydrilla as a food for wintering ring-necked ducks.

We thank T. Regan, J. McDanield, T. Hines, J. Sullivan, T. Lindheimer, D. Marvel, and M. Jennings for assisting with bird collection. M. Jennings, M. Welton, J. Brady, and M. Mautino assisted with necropsies. B. Walker and E. Peterson sorted and measured food items. A. Zale and R. Conrow assisted with invertebrate and fish identification. D. Hall provided guidance with seed identification. R. Mulholland and K. Portier advised on statistical analysis. W. L. Hohman provided valuable comments on earlier drafts of this manuscript. This is a contribution of the Florida Agricultural Experiment Station, Journal Series No. R-04293.Work was supported by the Florida Game and Fresh Water Fish Commission and the Florida Cooperative Fish and Wildlife Research Unit (U.S. Fish and Wildlife Service, Florida Game and Fresh Water Fish Commission, University of Florida, and the Wildlife Management Institute cooperating).

Methods

Ring-necked ducks ($N = 599$) were collected from 3 regions of the state, Leon and Jefferson counties in the north, Alachua and Putnam counties in the north-central, and Collier and Brevard counties in the south, from November to March 1979–82. Migrating and wintering ring-necked ducks were collected by legal methods during the hunting season, and by shooting from a moving airboat during closed seasons. Birds were necropsied soon after collection, and the gullet (esophagus and proventriculus) was removed and frozen. The gullets were later thawed and the contents washed and sorted. Foods were identified to the lowest possible taxonomic classification (Martin and Barkley 1961, Musil 1963, Merritt and Cummins 1978, Pennak 1978), and measured by volumetric displacement.

Gullets containing <1 ml food were included in the percent occurrence calculations. Aggregate volume and aggregate percent were calculated using only gullets containing >1 ml of food (Martin et al. 1946). Differences in food habits

among months, region of collection, and sex and age of birds were tested using the von Mises distribution (Stephens 1982). For the major foods, we calculated an Index of Relative Importance (IRI = Percent Occurrence [Aggregate Volume + Aggregate Percent]) according to Sanger and Jones (1984). The IRI attempts to correct for differential digestion rates and distortion of volumes by combining all 3 measures to identify important components of the diet.

Results

Of the 599 gullets examined, 55 had trace amounts of food and 148 had >1 ml of food. Of those containing measurable amounts of food, 9 were from the north region, 123 from the north-central region, and 16 from the south region. Overall, 42 different food items were found: 14 foods were of animal origin, 22 of plant origin, and 6 others (Table 1). Animal matter occurred in 43.6% of the samples and plant matter in 89.1%. The major foods (>5% aggregate volume or aggregate percent) were hydrilla tubers, turions, and vegetation, waterlily seeds, snails (*Hellsama* spp), chironomid larvae, and grit (Table 1).

Food habits varied significantly by region ($P < 0.05$) and were as follows: waterlily seeds in the north, waterlily seeds and hydrilla parts in the north-central region, and hydrilla and sawgrass in the south. We limited further analyses to north-central birds since this sample spanned all months of collection (Nov–Mar). No age-related differences ($P > 0.05$) in food habits were detected. Male and female diets (Fig. 1) differed significantly by aggregate volume in November ($P = 0.041$) and March ($P = 0.013$), but not other months. The differences in November resulted from a greater abundance of invertebrates and, within the waterlily category, females ate more *Nymphae adonato* seeds than males and males ate more *Nuphar advena* seeds than females (Fig. 1). *Nuphar advena* was the only waterlily seed found in males. The difference between diets of males and females in March was due to the greater abundance of waterlily seeds, lower abundance of invertebrates and hydrilla in females than males (Fig. 1).

Discussion

Our finding that plant food was extremely important in the diet of ring-necked ducks agrees with previous studies (Cottam 1939, Martin et al. 1951, Mendall 1958, Conrad 1965, Kerwin and Webb 1971, Landers et al. 1976, Perry and Uhler 1982, Hoppe et al. 1986). Waterlily seeds, pond weeds (*Potamegeton* spp.), sedges, and smartweeds (*Carex* spp.) have been identified as important foods. Insects and gastropods are the most important animal foods during the breeding season when consumption of animal foods is increased to meet higher protein demands (Cottam 1939, Mendall 1959, Hohman 1985). Although consumption of animal foods was reduced in wintering ring-necked ducks, we found that insects and gastropods remained the most important animal foods.

The regional differences in food habits reflect variation in availability of

Table 1. Gullet contents of ring-necked ducks wintering in Florida, November–March 1979–82.

Food	% Aggregate occurence[a]	Aggregate volume[b]	%[b]
Animal	**43.6**	**15.3**	**18.2**
Insecta			
Libellulidae	16.8	3.0	5.0
Chironomidae—larvae	19.2	3.0	5.4
Unidentified	8.4	0.2	2.1
Chironomidae—adult	5.4	0.1	0.8
Dytiscidae	4.0	Tr[c]	Tr
Unidentified Coleoptera	1.0	Tr	Tr
Hemiptera	0.5	Tr	Tr
Mollusca			
Helisoma sp.	16.8	8.0	4.1
Gyraulus sp.	4.0	0.8	4.1
Physidae	6.4	0.4	0.2
Sphaeriidae	4.0	0.4	0.7
Arachnoidea			
Hydracarinae	0.5	Tr	Tr
Crustacea			
Palaemonetes paludosus	0.5	Tr	Tr
Pices			
Heterandria formosa	0.5	Tr	Tr
Plant	**89.1**	**81.0**	**72.6**
Seeds			
Nuphar advena	28.6	29.0	24.2
Nuphar odorata	13.3	8.5	5.2
Zea mays	1.0	2.5	1.3
Brasenia scherberi	9.4	0.8	6.1
Cladium jamaicense	25.6	0.7	4.7
Myrica cerifera	8.9	0.4	1.5
Ceratophyllum demersum	9.9	0.1	0.3
Unidentified	3.0	0.1	0.6
Polygonum spp.	6.4	Tr	Tr
P. hydropipoides	1.5	Tr	Tr
Rhynchospora cephalantha	2.5	Tr	Tr
R. inundata	1.0	Tr	Tr
R. sp.	0.5	Tr	Tr
Scirpus etuberculatus	0.5	Tr	Tr
Najas sp.	0.5	Tr	Tr
Cyprus sp.	0.5	Tr	Tr
Tuber			
Hydrilla verticillata	17.2	28.3	13.1
Turion			
Hydrilla verticillata	25.8	7.2	7.8
Vegetation			
Hydrilla verticillata	29.1	3.1	6.8
Ceratophyllum demersum	0.5	0.1	0.3
Unidentified	4.4	Tr	0.5

(continued on next page)

Table 1. *(continued)*

Food	Aggregate occurence[a]	Aggregate volume[b]	%[b]
Unidentified	**32.5**	**1.1**	**1.7**
Grit	**33.0**	**0.7**	**6.0**
Lead shot	**2.0**	**Tr**	**Tr**
Steel shot	**1.5**	**Tr**	**Tr**
Mylar	**3.5**	**Tr**	**Tr**
Plastic	**0.5**	**Tr**	**Tr**

[a] Calculation based on $N = 203$.
[b] Calculation based on $N = 148$.
[c] Tr represents <0.1%.

foods. Watershield and spatterdock are the dominant vegetation in the deep marshes of northern Florida and accounted for 82.5% of the aggregate volume of food items. Likewise, sawgrass, hydrilla, and white waterlily, abundant in south Florida, accounted for 72.1% of the aggregate volume, and spatterdock and hydrilla, dominant in north-central Florida, comprised 68.2% of the aggregate volume.

Hydrilla tubers and turions were important foods of wintering ring-necked ducks, composing 35.5% of the aggregate volume and 20.8% of the aggregate percent (Table 1). Although the vegetative parts of hydrilla were found in 29% of the specimens, it was rarely found in measurable amounts. We believe that vegetative parts are ingested incidentally with other food items.

Previous studies (Montalbano et al. 1978, 1979; Joyce et al. 1980) report hydrilla commonly utilized as a food by wintering waterfowl. We found hydrilla in 59.5% of the birds collected in north-central Florida, whereas Joyce et al. (1980) reported hydrilla in 22 of 23 birds collected from the same region.

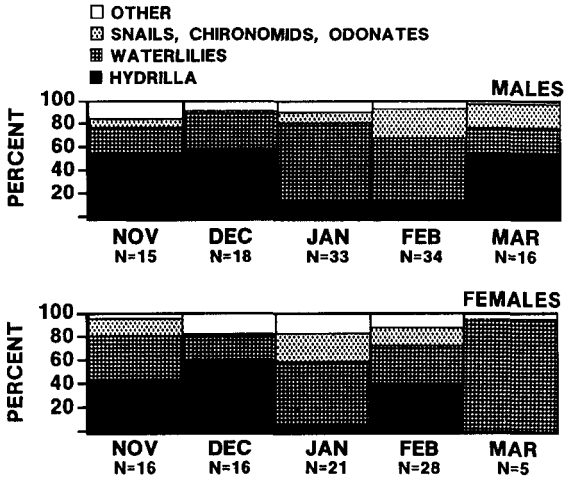

Figure 1. Monthly food habits of male and female ring-necked ducks in north-central Florida.

Table 2. Index of Relative Importance (IRI) values for major foods[a] for ring-necked ducks collected in Florida, November–March 1979–82.

Food	Part	IRI
Nuphar advena	seed	1,519
Hydrilla verticillata	tuber	713
H. Verticillata	turion	382
H. Verticillata	vegetation	289
Grit		221
Helisoma sp.		203
Nymphaea odorata	seed	182
Chironomidae	larvae	160
Cladium jamacense	seed	138
Libellulidae	nymph	133

[a] Foods that comprise >4.0 percent of the aggregate volume or aggregate percent.

Although hydrilla was a prominent component of the diet, traditional foods, such as waterlily seeds, remained important. IRI values indicated that spatterdock seeds are twice as important as hydrilla tubers (Table 2). Watershield was the most important food in the north, spatterdock in the north-central, and sawgrass in the south. When hydrilla parts were considered together, hydrilla (IRI = 4,240) was slightly more important than all waterlilies (IRI = 3,372) in the north-central region. In the south, hydrilla was more important than snails, and the relative importance of foods in the north was unchanged.

The "preference" of hydrilla habitats by waterfowl wintering on Florida lakes (Gasaway et al. 1977, Johnson and Montalbano 1984) may result from factors other than habitat selection based solely on food availability. Reduced wave action and reduced human disturbance (boaters tend to avoid hydrilla), in combination with the food resource, may result in preference for hydrilla habitats by wintering ring-necked ducks.

The percent occurrence of shot (lead and steel) was of interest because ring-necked ducks are known to frequently ingest shot pellets (Wobeser 1981). The occurrence of shot in 7 of 599 birds is high considering the short time that food remains in the proventriculus, and the low probability of collecting a bird during that time. The occurrence of shot in 7 of 599 birds is evidence of a high ingestion rate in wintering ring-necked ducks. Shot pellets usually persist about 21 days in the gizzard (Bellrose 1952). The high frequency of ingested shot pellets led to a 25.3% prevalence of ingested shot in the gizzards of ring-necked ducks (Jeske and Thul, unpubl. data). The occurrence of fine quartz grit and absence of gravel and stones in the proventriculi suggest that the birds are mistaking shot for food items, such as sawgrass or smartweed seeds, rather than eating pellets as grit.

Indiscriminant control of waterlilies or hydrilla can adversely affect abundances of wintering ring-necked ducks because the availability and abundance of

either food may determine local duck distributions (Gullion 1966). On a broader scale reduced habitat quality could reduce the number of birds supported or possibly influence physical condition. Reduced physical condition during winter could reduce subsequent reproduction in ring-necked ducks (Heitmeyer and Fredrickson 1981). The abundance of waterlilies and hydrilla appear to determine the use of wetlands by wintering ring-necked ducks and control of these plants should be minimal to attract and maintain Florida's concentrations of wintering ring-necked ducks.

Literature Cited

Bellrose, F. C. 1980. Ducks, geese, and swans of North America. 3rd ed. Stackpole Books, Harrisburg, Pa. 540pp.

Conrad, W. B., Jr. 1965. A food habits study of ducks wintering on the lower Pee Dee and Waccamaw Rivers, Georgetown, South Carolina. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 19:93–98.

Cottam, C. 1939. Food habits of North American diving ducks. U.S. Dep. Agric. Tech. Bul. 643. 140pp.

Gasaway, R. D., S. Hardin, and J. Howard. 1977. Factors influencing wintering waterfowl abundance in Lake Wales, Florida. Proc. Annu. Conf. Southeast. Assoc. Fish and Wild. Agencies 31:77–83.

Gullion, G. W. 1966. A viewpoint concerning the significance of game bird food habits. Condor 68:372–376.

Heitmeyer, M. E. and L. H. Fredrickson. 1981. Do wetland conditions in the Mississippi Delta influence mallard recruitment? Trans. N. Am. Wildl. Nat. Resour. Conf. 46:44–57.

Hohman, W. L. 1985. Feeding ecology of ring-necked ducks in northwestern Minnesota. J. Wild. Manage. 49:546–557.

Hoppe, R. T., L. M. Smith, and D. B. Wester. 1986. Foods of wintering doing ducks in South Carolina. J. Field Ornithol. 57(2):126–134.

Johnson, F. A. and F. Montalbano. 1984. Selection of plant communities by wintering waterfowl on Lake Okeechobee, Florida. J. Wild. Manage. 48:174–178.

Joyce, J. C., W. T. Haller, and D. Colle. 1980. Investigation of the presence and survivability of hydrilla propagules in waterfowl. Aquatics 2:10–14.

Kerwin, J. A. and L. G. Webb. 1971. Foods of ducks wintering in coastal South Carolina, 1965–1967. Proc. Southeast. Assoc. Fish and Wildl. Agencies 25:223–245.

Landers, J. L., A. S. Johnson, P. H. Morgan, and W. P. Baldwin. 1976. Duck foods in managed tidal impoundments in South Carolina. J. Wildl. Manage. 40:721–728.

Martin, A. C., R. H. Gensch, and C. P. Brown. 1946. Alternative methods in upland gamebird food analysis. J. Wildl. Manage. 10:8–12.

——— and W. D. Barkley. 1961. Seed identification manual. Univ. Calif. Press, Berkley. 221pp.

———, H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants, a guide to wildlife food habits. McGraw-Hill Book Co., Inc. New York, N.Y. 500pp.

Mendall, H. L. 1958. The ring-necked duck in the northeast. Univ. Maine Bul. 60:1–317.

Merritt, R. W., and K. W. Cummins. Eds. 1978. An introduction to the aquatic insects of North America. Kendall/Hunt Publ. Co., Dubuque, Iowa. 441pp.

Montalbano, F., III, S. Hardin, and W. M. Hetrick. 1979. Utilization of hydrilla by ducks and coots in central Florida. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 33:36–42.

———, W. M. Hetrick, and T. C. Hines. 1978. Duck foods in central Florida phosphate settling ponds. Pages 247–255 *in* Proc. Symp. Surface Mining and Fish/Wildlife Needs in the Eastern United States. U.S. Dep. Int. Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/81.

Musil, A. F. 1963. Identification of crop and weed seeds. U.S. Dep. Agric., Agric. Handb. No. 219. 171pp.

Pennak, R. W. 1978. Freshwater invertebrates of the United States, 2nd ed. John Wiley & Sons, New York, N.Y. 803pp.

Perry, M. C. and F. M. Uhler. 1982. Food habits of diving ducks in the Carolinas. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:492–504.

Sanger, G. A. and R. D. Jones, Jr. 1984. Winter feeding ecology and trophic relations of old-squaws and white-winged scoters on Kachemak Bay, Alaska. Pages 20–28 *in* Marine birds: their feeding ecology and commercial fisheries relationships. Can. Wildl. Serv., CW 66-65/1984.

Stephens, M. A. 1982. Use of von Mises distribution to analyze continuous proportions. Biometrika 69:197–203.

Terhune, F. W., ed. 1983. 1983 Florida statistical abstract. Univ. Presses Fla., Gainesville. 700pp.

White, D. H. and D. James. 1978. Differential use of fresh water environments by wintering waterfowl of coastal Texas. Wilson Bul. 90:99–111.

Wobeser, G. A. 1981. Diseases of wild waterfowl. Plenum Press, New York, N.Y. 300pp.