Food Habits of the Common Moorhen and Purple Gallinule in North-Central Florida[1]

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Abstract: The food habits of common moorhens (*Gallinula chloropus*) and purple gallinules (*Porphyrula martinica*) on a north-central Florida lake were studied through monthly analysis of gizzard contents from May 1981 through April 1982. Common moorhens consumed an average volume of 93% plant and 7% animal food, whereas purple gallinules consumed an average volume of 71% plant and 29% animal food. The major foods of the common moorhen were leaves and stems of *Hydrilla verticillata*, seeds of *Polygonum* spp., and snails, *Planorbella* spp. The major foods of purple gallinules were seeds of *Nuphar luteum* and *Polygonum* spp. and insects of the family Chrysomelidae.

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The common moorhen and purple gallinule are common in the southeast and are well represented in Florida. Published information on both species is scarce and most information in the literature is limited to sight records and scattered nesting records (Holliman 1980 and Strohmeyer 1980). Food habits are casually mentioned, and most observations of specific food items were made visually at long range. Simpson (1939) described food habits, but the data were limited to 7 specimens of breeding common moorhens in Tennessee. Reagan (1977) included a detailed list of food items but combined the data into a single list for both species. Wetmore (1916) commented on the percentages of animal and plant food consumed by common moorhens but did not elaborate on specific food items.

The common moorhen and purple gallinule utilize the same habitats during the breeding season. Accordingly, there is potential for competition

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between the 2 species. Knowledge of moorhen and gallinule food habits would increase the understanding of their environmental and nutritional requirements and of the degree of overlap in dietary requirements between these 2 sympatric species. This study concerns the food habits of the common moorhen and purple gallinule on a north-central Florida lake over 1 annual cycle.

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Methods

Orange Lake is a large (4,921-ha), shallow (mean depth = 2.9 m), eutrophic lake located 32 km southeast of Gainesville, Florida, in Alachua County (Shireman and Haller 1979). The center of the lake is lacustrine limnetic open water with unconsolidated bottom, and the shoreline is palustrine emergent with a semi-permanent water regime (Anon. 1981). The extensive littoral zone is characterized by floating, emergent, and submerged vegetation. Cowlily (*Nuphar luteum*) and hydrilla (*Hydrilla verticillata*) are the dominant plant species. Water hyacinth (*Eichhornia crassipes*), hornwort (*Ceratophyllum demersum*), smartweed (*Polygonum* spp.), pennywort (*Hydrocotyle* spp.), and fanwort (*Cabomba* spp.) are interspersed with the cowlily and hydrilla. Open water covers 23% of the lake. Dense populations of the common moorhen and purple gallinule breed on Orange Lake (Sprunt 1954). The common moorhen is a resident while the purple gallinule is only present from April to October.

Moorhens and gallinules were collected by shooting from an airboat. Esophageal tracts and gizzards of at least 10 common moorhens and 5 purple gallinules were collected monthly during daylight hours from May 1981 through April 1982 (purple gallinules were not available for collection from December 1981 to March 1982). Fewer purple gallinules than common moorhens were collected because the purple gallinule population is from ½ to ⅔ less than the common moorhen population. To assure an even distribution of collections, Orange Lake was divided into 5 approximately equal sized areas. Two common moorhens and 1 purple gallinule were collected

from each area. When possible, feeding birds were collected. A total of 126 common moorhens and 45 purple gallinules were collected. After each individual collection, the esophagus and gizzard were removed and placed on ice to prevent post-mortem digestion of food items (Dillery 1965). The esophagi and gizzards were frozen upon return from the field and were kept frozen until analysis. Analysis was generally performed within 2 months of collection.

Esophagi and gizzards were opened separately in the laboratory and the contents placed in petri dishes. The total volume of food and grit was measured by volumetric displacement. References for identification were Martin and Barkley (1961) and Merritt and Cummins (1978). Items not identified in the laboratory were submitted to qualified professionals for identification.

Individual analyses were pooled into the mean monthly composition of food items for each bird species on the basis of volumetric measurements. Percent occurrence, aggregate volume, and aggregate percent (Swanson et al. 1974) were calculated monthly and seasonally for each bird species.

A Spearman rank correlation coefficient (Snedecor and Cochran 1980: 192) was used to compare the monthly ranks given to foods by aggregate volume and agrgegate percent to determine if the 2 calculations produced significantly different results.

The proportions of animal and plant foods in the diets were calculated for each bird species. The mean monthly proportions of animal and plant foods were compared using Duncan's multiple range test for means (Snedecor and Cochran 1980:234).

The Sorenson similarity coefficient (Greig-Smith 1964:137) was used to determine the degree of similarity between the diets. This coefficient expresses the number of food items common to the 2 species as a percentage of the number of food items per species, that is $[2c/(a + b)] \times 100$ where each species consumes a and b items, and there are c items in common between the species.

Results and Discussion

Swanson and Bartonek (1970) and Korschgen (1980) suggest examining esophageal tracts in order to avoid having food items subjected to physical and chemical breakdown. However, during the first 3 months of our collections, 70% (23/33 birds) of the esophageal tracts were either empty or contained only a trace (<0.1 ml) of food. Because the esophageal tracts were so often empty, further analysis was restricted to gizzards.

The Spearman rank coefficients for aggregate volume and aggregate percent were significantly ($P < 0.05$) different in only 1 month of the total 20 months (12 months for moorhen and 8 months for gallinule). Further dis-

Table 1. Food Items from Gizzards of 119 Adult Common Moorhens Collected from May 1981 to April 1982 on Orange Lake, Florida (Spring = February–April, Summer = May–July, Fall = August–October, Winter = November–January)

Food Item		Spring		Summer		Fall		Winter	
Latin Name	Common Name	% Occurrence[a] $n = 25$	Aggregate %[b] $n = 25$	% Occurrence $n = 27$	Aggregate % $n = 27$	% Occurrence $n = 37$	Aggregate % $n = 37$	% Occurrence $n = 30$	Aggregate % $n = 30$
Plant									
Seeds:									
Ampelopsis arborea	Peppervine					2.7	0.5		
Brasenia schreberi	Watershield							3.2	T[c]
Cladium jamaicense	Sawgrass	23.1	0.5	7.1	T	5.4	T	3.2	T
Cyperus sp.	Flatsedge							3.2	T
Hydrocotyle spp.	Pennywort	23.1	7.7	17.9	0.6	10.8	0.1	25.8	0.5
Ludwigia leptocarpa	Marshpurslane							3.2	T
Myrica cerifera	Waxmyrtle	7.7	T					6.5	T
Nuphar luteum	Cowlily	3.8	2.6	25.0	4.1	2.7	T		
Nymphaea sp.	Waterlily					2.7	T		
Polygonum sp.	Smartweed	61.5	4.1	10.7	T	32.4	11.7	93.5	38.6
Leaves, Stems, Petals:									
Ceratophyllum demersum	Hornwort	3.8	1.6	3.6	2.9	2.7	2.7	19.3	6.0
Eichhornia crassipes	Water hyacinth	3.8	T	17.9	9.3			3.2	0.1
Hydrilla verticillata	Hydrilla	65.4	59.5	82.1	71.6	97.3	80.7	74.2	47.0
Limnobium spongia	Frog's-bit	7.7	7.7					6.5	2.1
Utricularia sp.	Bladderwort	3.8	T						
Animal									
Arthropods:									
Anisoptera	Dragonflies	3.8	1.0	3.6	0.2				
Chrysomelidae	Leaf beetles	7.7	5.1	25.0	2.0				
Curculionidae	Snout beetles			7.1	0.4	2.7	T		
Odonata	Dragonflies & damselflies	3.8	1.9						
Molluscs and Annelids:									
Oligochaete				3.6	0.3				
Planorbella spp.		3.8	3.8	42.9	4.6	37.8	3.6	6.5	0.8
Unknown:		23.1	4.4	17.9	3.8	5.4	0.2	12.9	4.8
Total:			99.9		99.8		99.8		99.9

[a] The number of birds that consume food item divided by number of birds in sample.
[b] The proportion of the jth food item in the ith bird averaged over all birds in sample.
[c] Food item occurred in trace amount (<0.1 ml).

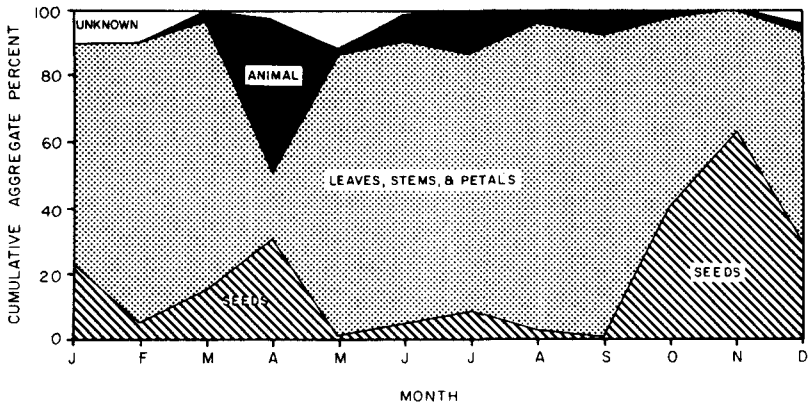

Figure 1. Monthly pattern in the use of major food types by 119 adult common moorhens from Orange Lake, Florida, 1981 and 1982.

cussion will therefore refer only to aggregate percent and not to both aggregate percent and aggregate volume.

The proportion by aggregate percent of total gizzard food volume that could be positively identified in each season averaged 97% for common moorhens (Table 1). Common moorhens consumed an average volume of 93% plant and 7% animal foods. This is comparable to 97% plant and 3% animal food reported by Wetmore (1916) from Puerto Rico.

In April, animal foods occurred in a greater proportion ($P < 0.05$) of the diet than during the rest of the year (Fig. 1). The animal foods consumed in the largest quantities were insects of the family Chrysomelidae and the order Odonata and *Planorbella* spp., snails common in the study area. The increased consumption of animal foods in April may be due to flush of insects during this time of year. The snails, *Planorbella* spp., were consumed in highest proportions in April and July. An increased amount of invertebrates in diets and its nutritional significance to waterfowl during the egg laying period has been discussed by Krapu and Swanson (1975). The increased consumption of *Planorbella* spp. may correspond to peaks in laying of the common moorhen on Orange Lake.

Common moorhens ate significantly ($P < 0.05$) more plant than animal foods in all months except April. Leaves, stems, and petals were consumed in higher proportion than seeds (Fig. 1). Hydrilla made up a high proportion of the common moorhen diet throughout the year (Table 1). April was the only month when consumption of hydrilla declined. Montalbano et al. (1979) found a high utilization of hydrilla by ducks and coots in central Florida study sites and suggested the importance of hydrilla to waterfowl.

The high utilization of hydrilla by common moorhens offers further support to the hypothesis that hydrilla is important to waterfowl in Florida. Other plant species consumed were frog's-bit (*Limnobium spongia*), hornwort, and water hyacinth (Table 1). Seeds, particularly smartweed, became a large proportion of the diet in October and November (Fig. 1). Smartweed began blooming on Orange Lake in September, and the common moorhen was quite opportunistic in capitalizing on these abundant seeds.

The proportion by aggregate percent of total gizzard food volume that could be positively identified in each season averaged 91% for purple gallinules (Table 2). Purple gallinules consumed an average volume of 71% plant and 29% animal foods. These results are in contrast to 58% plant and 42% animal foods reported by Sprunt (1954). If the period April through June of the present study is considered, the average consumption calculated for purple gallinules would be 54% plant and 46% animal foods. Thus, Sprunt's data may have been collected only in the spring.

Animal foods contributed to the purple gallinule diet throughout the 8 months but began to decline in October and November (Fig. 2). Insects of family Chrysomelidae were the animal food consumed in the largest quantity. A noctuid moth larvae, *Bellura* sp. was common in June (Table 2). Because cowlily is the host plant for this larvae, purple gallinules may find them while consuming cowlily seeds.

Purple gallinules ate significantly ($P < 0.05$) greater amounts of plant foods in July, August, October, and November (Fig. 2) than in the other 4 months. In September, leaf beetles were consumed in a larger proportion in comparison to July, August, October, and November. Significantly ($P < 0.05$) less plant foods were consumed in June than in the other 7 months (Fig. 2). In contrast to common moorhens, leaves, stems, and petals made up a small proportion of the purple gallinule diet while seeds made up a large proportion (Fig. 2). The seeds consumed in the largest quantities were smartweed

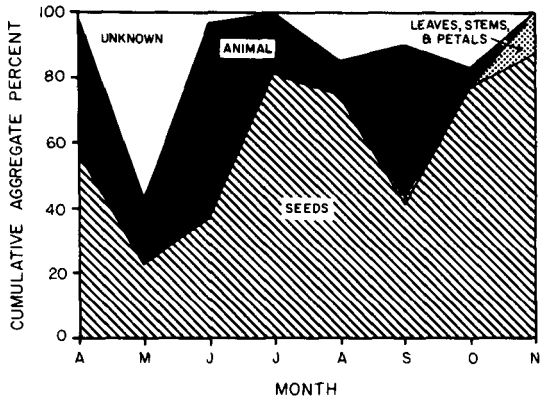

Figure 2. Monthly pattern in the use of major food types of 38 purple gallinules from Orange Lake, Florida, 1981 and 1982.

Table 2. Food Items from Gizzards of 38 Adult Purple Gallinules Collected from May 1981 to April 1982 on Orange Lake, Florida (Spring = April, Summer = May–July, Fall = August–October, Winter = November).

Food Item		Spring		Summer		Fall		Winter	
Latin Name	Common Name	% Occurrence[a] $n = 4$	Aggregate %[b] $n = 4$	% Occurrence $n = 12$	Aggregate % $n = 12$	% Occurrence $n = 18$	Aggregate % $n = 18$	% Occurrence $n = 4$	Aggregate % $n = 4$
Plant									
Seeds:									
Brasenia scherberi	Watershield					5.5	5.5		
Cladium jamaicense	Sawgrass	25.0	T[c]	46.1	4.5	22.2	0.2		
Hydrocotyle spp.	Pennywort			7.7	T	5.5	T		
Myrica cerifera	Waxmyrtle					16.7	0.5	50.0	T
Nuphar luteum	Cowlily	75.0	56.4	92.3	37.7	88.9	48.8	75.0	T
Panicum hemitomon	Maidencane			7.7	0.3	27.8			
Polygonum spp.	Smartweed			15.4	T	33.3	10.8	100.0	87.5
Scirpus validus	Bulrush			7.7	T				
Leaves, Stems, Petals:									
Hydrilla verticillata	Hydrilla					5.5	0.3	50.0	12.5
Animal									
Arthropods:									
Arachnida	Arachnids	25.0	1.0	7.7	T				
Chrysomelidae	Leaf beetles	75.0	40.5	76.9	16.7	72.2	18.7		
Curculionidae	Snout beetles			15.4	0.7	5.5	T		
Dytiscidae	Diving beetles			7.7	2.2				
Hydrophilidae	Water scavenger beetles			7.7	0.6				
Noctuidae	Noctuid moths			46.1	13.7	5.5	1.4		
Odonata	Dragonflies & damselflies	25.0	2.0						
Molluscs and Annelids:									
Planorbella spp.				7.7	T				
Unknown:		0.0	0.0	61.5	23.5	44.4	13.7	0.0	0.0
Total:			99.9		99.9		99.9		100.0

[a] The number of birds that consume food item divided by number of birds in sample.
[b] The proportion of the jth food item in the ith bird averaged over all birds in sample.
[c] Food item occurred in trace amount (<0.1 ml).

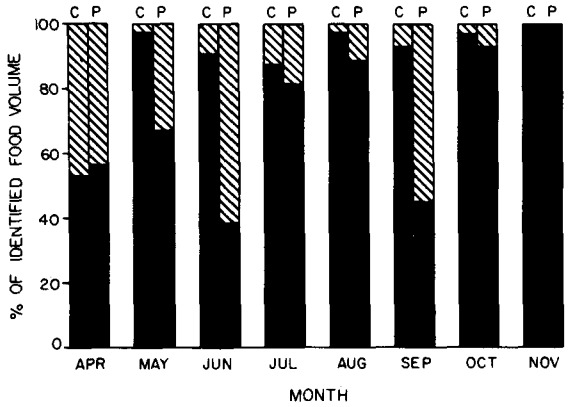

Figure 3. Proportions of plant and animal foods from gizzards of 119 adult common moorhens and 38 adult purple gallinules collected from Orange Lake, Florida, 1981 and 1982. ▨ = animal foods, ■ = plant foods. C = common moorhen, P = purple gallinule.

and cowlily. The only leaves consumed by purple gallinules were hydrilla in November (Table 2).

Comparison of the monthly samples when both bird species were present showed that common moorhens consumed more plant foods than purple gallinules in all months except April and November (Fig. 3). In contrast, purple gallinules consumed more animal foods than common moorhens in all months except April and November (Fig. 3). Both species consumed 100% plant food in November, and in April, both species consumed approximately 55% animal food (Fig. 3). Seeds, particularly of smartweed, were abundant in November while in April, insects and snails were abundant. Common moorhens rely on plant foods in all months while purple gallinules show an increased reliance of plant foods as the weather becomes cooler and insects become less abundant (Fig. 3).

The lists of foods identified from common moorhens and purple gallinules contained 21 and 17 food items, respectively (Tables 1, 2). The Sorenson similarity coefficients ranged from 22.2 in November to 72.7 in September for all foods. The diets of the 2 species were on the average 46% similar in terms of all foods found in the gizzards during the 8 months. Considering all plant foods, the diets were 49% similar, and considering all animal foods the diets were 35% similar. Similarity coefficients were also calculated for those foods which made up 5.0 or more aggregate percent of the diet thereby eliminating the foods which were consumed in only minor quantities. Dietary overlap was greatest in October, November, and April. In October and November, both bird species consumed hydrilla leaves and smartweed seeds. Competition for these food items would be minimal because they are very abundant, and few purple gallinules occur on the lake in October and November. In April, both bird species consumed a high proportion of leaf beetles. Competition for leaf beetles would be minor due to a suspected spring flush of insects on the lake.

Gause's principle (1943) states that 2 species with identical ecological requirements cannot occupy the same niche. Although common moorhens and purple gallinules often occur together in the same habitat, they make differential use of the habitat. Bell (1976) and Reagan (1977) found that common moorhens had a greater tendency than purple gallinules to feed in open areas of water whereas purple gallinules tended to feed in areas of floating leaved plants. Purple gallinules consume seeds and insects while common moorhens consume leaves and stems of aquatic plants. These dietary differences reflect differences in microhabitat selection. The purple gallinule feeds while standing on floating leaved plants. Here, seeds on plants and insects are readily available. The common moorhen feeds while in open water areas. Here, aquatic vegetation as opposed to seeds are readily available. Both bird species seem to be opportunistic in their food habits and consume items which are in abundant supply on Orange Lake.

Literature Cited

Anon. 1981. National Wetlands Reconnaissance Survey. Gainesville, Florida. USDI Fish and Wildl. Serv. (Map).

Bell, G. 1976. Ecological observations of common (*Gallinula chloropus*) and purple gallinules (*Porphyrula martinica*) on Lacassine National Wildlife Refuge, Cameron Parish, Louisiana, M.S. thesis. Univ. Southwest, La. 59pp.

Dillery, D. G. 1965. Post-mortem digestion of stomach contents in the Savannah sparrow. Auk 82:281.

Gause, G. F. 1943. The struggle for existence. Williams & Wilkins, Baltimore, MD. 163pp.

Greig-Smith, P. 1964. Quantitative plant ecology, 2nd ed. Butterworth's & Co., Ltd., London. 256pp.

Holliman, D. C. 1980. Purple gallinule (*Porphyrula martinica*). Pages 105–109 *in* G. C. Sanderson, ed. Management of migratory shore and upland game birds in North America. Int. Assoc. Fish and Wildl. Agencies, Washington, D.C.

Korschgen, L. J. 1980. Procedures for food-habits analyses. Pages 223–250 *in* S. D. Schemnitz, ed. Wildlife management techniques manual. The Wildl. Soc., Washington, D.C.

Krapu, G. L., and G. A. Swanson. 1975. Some nutritional aspects of reproduction in prairie nesting pintails. J. Wildl. Manage. 39:156–162.

Martin, A. C., and W. D. Barkley. 1961. Seed identification manual. Univ. Calif. Press, Berkeley and Los Angeles. 221pp.

Merritt, R. W., and K. W. Cummins, eds. 1978. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing 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.

Reagan, W. 1977. Resource partitioning of North American gallinules in southern Texas. M.S. thesis. Utah State Univ., Logan. 72pp.

Shireman, J. V., and W. T. Haller. 1979. The ecological impact of integrated chemical and biological aquatic weed control. Annu. Rep. Aug. 1, 1978–July 31, 1979 to Environ. Protection Agency, Inst. Food and Agric. Sci., Aquatic Weed Center, U. of Fla., Gainesville. 238pp.

Simpson, T. W. 1939. The feeding habits of the coot, Florida gallinule, and least bittern on Reelfoot Lake. J. Tenn. Acad. Sci. 14:110–115.

Snedecor, G. W., and W. G. Cochran. 1980. Statistical methods, 7th ed. Iowa State Univ. Press, Ames. 507pp.

Sprunt, A., Jr. 1954. Florida bird life. Coward-McCann, Inc., N.Y. and Nat. Audubon Soc. 527pp.

Strohmeyer, D. L. 1980. Common gallinule (*Gallinula chloropus*). Pages 110–117 *in* G. C. Sanderson, ed. Management of migratory shore and upland game birds in North America. Int. Assoc. Fish and Wildl. Agencies, Washington, D.C.

Swanson, G. A., and J. C. Bartonek. 1970. Bias associated with food analysis in gizzards of blue-winged teal. J. Wildl. Manage. 34:739–746.

Swanson, G. A., G. L. Krapu, J. C. Bartonek, J. R. Serie, and D. H. Johnson. 1974. Advantages in mathematically weighting waterfowl food habits data. J. Wildl. Manage. 38:302–307.

Wetmore, A. 1916. Birds of Puerto Rico. USDA Bull. 326.