ECOLOGICAL INVESTIGATION OF COMMON AND PURPLE GALLINULES ON LACASSINE NATIONAL WILDLIFE REFUGE, LOUISIANA[a]

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Abstract: Ecological observations of gallinules on Lacassine National Wildlife Refuge from 1 April 1975 through 28 February 1976 indicate common gallinules (*Gallinula chloropus*) arrive earlier and begin nesting before purple gallinules (*Porphyrula martinica*). Eleven nests of common gallinules, characteristically positioned low in the vegetation and constructed of bulltongue (*Saggitaria lancifolia*), contained an average of 8.1 eggs. The more elevated nest of the purple gallinule contained an average of 4.5 eggs, in a sample size of 12, and was constructed primarily of maidencane (*Panicum hemitomon*). Common gallinule chicks form a tight cluster or grouping and follow the parent bird(s) along linear feeding paths. The more precocial purple gallinule chicks form a more dispersed aggregation around the parent(s) which feed in circular patterns. Within the first 10 days of hatching mortality may be as high as 40% for common and 30% for purple gallinules. The total combined population of gallinules on Lacassine Pool is estimated to be 31,000 individuals in late summer.

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Gallinules occur in ponds, lakes, swamps, marshes, and rice fields of Louisiana, yet these game birds are virtually unknown to the majority of state residents. Local populations have traditionally received little shooting pressure by hunters who are generally unaware of the palatability of these birds. Perhaps it is because of this lack of interest that gallinules have not been studied by wildlife specialists as enthusiastically as other avian game species.

This investigation on common and purple gallinules on Lacassine National Wildlife Refuge was conducted in order to obtain additional ecological information. The primary objectives were to gather comparative data on nesting ecology, feeding behavior, mortality, predation, and population sizes.

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MATERIALS AND METHODS

Study Area

Lacassine National Wildlife Refuge, comprising 12,450 ha of freshwater marshland in Cameron Parish, was established in 1937 as a preserve for wintering waterfowl. A unique feature of the refuge is a shallow (about 1 m deep) 6,475 ha freshwater impoundment known as the Lacassine Pool which was constructed in 1943. During summer months the open water areas of the pool are almost completely covered by floating vegetation with watershield (*Brasenia schreberi*), big floatingheart (*Nymphoides aquatica*) and white waterlily (*N. odorata*) being most abundant. Emergents consist mainly of bulltongue (*Saggitaria lancifolia*) and maidencane (*Panicum hemitomon*), while nitella (*Nitella gracilis*) and bladderworts (*Utricularia* spp.) are the most important submergents. Water levels in the pool remained constant during the investigation except for minor changes due to rainfall and evaporation.

Methods

During the period 1 April 1975 through 28 February 1976 diurnal observations on behavior and ecology of both species of gallinules were made with the aid of a pair of 7 x 50 binoculars. The majority of observations were made during the months of May, June and July from a 10 m tower located within the pool and from an oilfield road which extends perperndicular from the pool's north levee into the approximate center of the impoundment.

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A small sample of 23 nests, located with the aid of a small aluminum boat and an airboat provided by refuge personnel, was selected for obtaining comparative data on nesting ecology. One of these nests was accidentally destroyed before complete data on its construction characteristics could be obtained. Gallinule broods were arbitrarily divided into 3 categories identfied on the basis of feathering and size: 1-10 days, 11-25 days, and 26-40 days. Only broods with both parents present were counted. Care was taken to identify and locate individual broods in order to minimize multiple recordings of the same brood within an age category.

A sample survey of common and purple gallinules within 6 belt transects predetermined by refuge personnel was conducted on 20 August, 17 September, 22 October, and 30 November 1975. Transects were 46 m wide and 23.1 km in length and were run only once during each sampling date. The total population of downy, subadult, and adult birds of each species was estimated for each survey date from the total counts made over the 6 transects (approximate combined total area of 106 ha).

Statistical procedures employed were obtained from Zar (1974). The mean heights of nests above water were compared between species and tested by a 2 sample t-test with pooled variance estimate. The Mann-Whitney 2 sample rank test was used to test the difference among clutch sizes because of unequal sample variances. For each species, the difference between mean clutch size and mean brood size for 1-10 day old chicks, and between mean brood sizes for successive age classes, was also tested for significance by the t-test.

RESULTS AND DISCUSSION

Nesting Ecology and Behavior

Common gallinules arrived earlier and began nesting before purple gallinules. Nest building by both species was observed during early April and continued into late July. With rare exceptions birds nested in mixed stands of maidencane and bulltongue. Males and females of both species participated in nest construction and incubation, but the proportion of time shared by the sexes for these activities was not measured.

Gross and Van Tyne (1929) and Frederickson (1971) found nests with walkways or ramps commonplace in cattails, giant cutgrass, and sawgrass. However, although only 5 of the sample of 23 nests located in mixed maidencane and bulltongue had such structures, chicks easily ascended the leaves and stems of these plants in a ladder-climbing fashion. This observation suggests that gallinules may not construct walkways as frequently in vegetation like maidencane or bulltongue as they do in strongly vertical vegetation with thick stems and blades.

Species differences in nest construction reflected clear differences in agility and behavior between the 2 gallinules. The lighter, more rail-like purple gallinule constructed nests significantly ($P < .001$) higher above water than the slightly heavier and more coot-like common gallinule (Table 1). This observation supports the early report made by Quillin and Holleman (1918) for gallinules in Texas. Purple gallinules utilized the flexible leaves and stems of maidencane for nesting materials while the stronger, more

Table 1. Heights of common and purple gallinule nests above water on Lacassine National Wildlife Refuge, 1975-76.

Heights of Nests Above Water (cm)	
Common Gallinule (n)	*Purple Gallinule (n)*
26 (1)	48 (1)
18 (1)	43 (1)
13 (1)	38 (1)
10 (2)	36 (1)
8 (2)	30 (3)
5 (2)	28 (2)
3 (1)	26 (2)
	18 (1)
$\bar{x} = 10.6 \pm 6.9$	$\bar{x} = 31.8 \pm 8.2$

supportive stems of bulltongue were used by common gallinules. Such division or stratification of the nesting habitat results in reduced interspecific competition.

Common gallinule eggs were found in mid-April, but eggs of the purple gallinule were not discovered with regularity until late May. The Mann-Whitney 2 sample rank test indicated a highly significant ($P < .001$) difference in clutch sizes between 11 common ($\bar{x} = 8.1$, $s = 2.70$) and 12 purple gallinule nests ($\bar{x} = 4.5$, $s = 1.09$ observed until after chicks hatched. The largest clutch was 15 eggs for a common gallinule. Only 4 of 143 eggs found among the sample of 23 nests failed to hatch.

Incubating gallinules maintained the nest by reshaping vegetation and by bringing in materials for reinforcement and repair. On 1 occasion vegetation surrounding the nest of a purple gallinule was clipped to facilitate observations on incubating behavior. Shortly afterwards one parent returned and immediately began to pull surrounding strands of maidencane toward and around the nest. After some effort the bird succeeded in partially replacing vegetation over the clipped area.

Gallinules became reluctant to leave the nest as hatching time neared. Five different incubating purple gallinules pecked our hands during egg inspection. On a sixth inspection a purple gallinule was physically removed from its nest.

Both parents of both species brought food to the nest for 2 to 4 days after chicks hatched. Older chicks were led from the nest by one or both parents. In some cases adults alternatedin feeding the brood. In other instances, 1 parent fed part of the brood and the other fed the remainder.

No adult was observed to present plant material to a chick, although flowers of the white waterlily were consumed by adult birds without chicks. Parent birds of both species used their beaks to flip over pads of floating-leafed vegetation and pick up animal matter from beneath. No chick rejected a food item presented to it, and in many cases chicks pecked the yellow-tipped beak of the parent when no food was being offered. This observation indicates the red and yellow colored beak of adult gallinules may serve as the releaser for feeding behavior in chicks. Weidmann (1965) found that when common gallinule chicks were presented colored cards, they pecked red and yellow significantly more times than blue, white, or black cards.

Downy chicks of the 2 species varied in their feeding behavior. Common gallinules clustered behind the providing parent(s), while purple gallinule chicks formed a less organized, more dispersed group around the parent(s). The compact grouping by young common gallinules suggests they are highly dependent on the parents for feeding them. Since the average brood size is relatively large for this species, and therefore, competition among chicks for an available morsel of food may be great, the strategy of chicks following the parent in a tight cluster is advantageous. In contrast, the smaller brood size for purple gallinules results in reduced competition among chicks and allows each individual more time to explore and sample the range of food sources available to it. These differences in feeding strategy suggest that purple gallinules are more precocial and begin feeding themselves before common gallinules.

Common gallinules, with and without chicks, fed in linear routes, in deeper water, and over greater areas than purple gallinules. The latter fed in smaller circular routes near the periphery of emergent communities. Both species foraged actively throughout the day except during periods of heavy rains, strong winds and intense heat. During these conditions birds sought protection in dense stands of vegetation.

Mortality and Predation

Broods decreased in size as chicks became older, more active and independent of their parents (Table 2). Mean brood size recorded for the youngest age category was much less than mean clutch size for both gallinules (Table 3). Since hatching success among nests sampled was high, this reduction is attributed to high chick mortality during the first few days of age. During this critical period chicks are vulnerable to predation and adverse weather. Two downy chicks were found dead in a nest following a heavy late afternoon rain shower.

The proportional reduction between mean brood size for 1-10 and 11-25 day old chicks is likewise attributed to mortality. However, small brood sizes recorded for 26-40 day old birds may, in addition to mortality, reflect reduced group integrity and greater independence among individuals.

The higher mortality of common gallinules (Table 3) may have resulted from their habit of feeding over larger areas and in deeper water than purple gallinules. This behavior exposes young chicks to a greater variety of aquatic predators. Five largemouth

Table 2. Observed brood sizes for 3 age categories for common and purple gallinules on Lacassine National Wildlife Refuge, 1975-76.

Common Gallinule			*Purple Gallinule*		
1-10 days (n)	*11-25 days (n)*	*26-40 days (n)*	*1-10 days (n)*	*11-25 days (n)*	*26-40 days (n)*
8 (1)	6 (1)	5 (1)	5 (2)	4 (3)	3 (2)
6 (1)	5 (1)	4 (3)	4 (5)	3 (2)	2 (3)
5 (4)	4 (4)	3 (4)	3 (4)	2 (5)	1 (4)
4 (3)	3 (2)	2 (7)	2 (4)	1 (2)	
3 (2)	1 (1)		1 (1)		
$\bar{x}$ = 4.7 ± 1.4	3.3 ± 1.4	2.6 ± 1.0	$\bar{x}$ = 3.2 ± 1.2	2.5 ± 1.1	1.8 ± 0.8

Table 3. Proportional decrease in mean brood size for early age periods for common and purple gallinules on Lacassine National Wildlife Refuge, 1975-76.

Age Period	*Percentage Decrease in Brood Size*[a]	
	Common Gallinule	*Purple Gallinule*
Egg to 1-10 days	40[b]	30[b]
1-10 to 11-25 days	30[c]	20
11-25 to 26-40 days	20	30

[a]Values rounded to nearest 10%.

[b]$P < 0.01$.

[c]$P < 0.05$.

bass (*Micropterus salmoides*) weighing 2 to 3 kg each and taken from Lacassine Pool during the study contained young gallinules. Personal communication with fishermen in the area indicated they frequently found gallinule remains in the stomachs of this game fish. During brood observations a bass captured a common gallinule chick and several others struck at chicks.

The reactions of a feeding gallinule family to a fish predator were observed on 3 separate occasions. In each case the fish predator (species unknown) struck at, but missed, a young common gallinule. In each instance one parent, emitting loud clucking sounds, immediately rushed the swirl left by the fish by flapping its wings and running on top of the water. The bird then typically situated itself between the attack site and the retreating brood which followed the other parent into emergent vegetation. The defending bird then followed its mate into the vegetation. In all cases, feeding activity resumed shortly thereafter.

Although the largemouth bass is an important predator on young gallinules on Lacassine Pool, alligators (*Alligator mississippiensis*) 1 to 2 m in length stalked and attacked both young and adult birds on several occasions. No alligator, however, was observed to capture a gallinule. Other predators include the bowfin (*Amia calva*), gars (*Lepisosteus* spp.) and snapping turtle (*Chelydra serpentina*).

Earlier arriving common gallinules outnumbered purple gallinules 5 to 1 in April, but by late May relative densities for the 2 species were more nearly equal. Refuge personnel estimated the total pool population of adult birds to number less than 10,000 at this time. Estimates based on monthly surveys conducted from August through November indicated a peak population of over 31,000 birds (adult and young) in late August (Table 4).

By this time common gallinules have completed nesting. Purple gallinules, however, nested into September.

Table 4. Population estimates for three classes of common and purple gallinules on the 6,475 ha impoundment area on Lacassine National Wildlife Refuge for four census dates during 1975.

Species and Age Class	*Number of gallinules*			
	20 August	*17 October*	*22 October*	*30 November*
Common Adult	7,625	6,625	5,938	438
Immature	9,250	7,563	7,000	563
Downy	1,125	0	0	0
Subtotals	18,000	14,188	12,938	1,001
Purple Adult	5,250	2,625	125	0
Immature	6,688	4,938	875	0
Downy	1,125	500	0	0
Subtotals	13,063	8,063	1,000	0
Totals	31,163	22,251	13,938	1,001

Lower overall population estimates for each species after August reflected emigration of birds from the impoundment area. By the end of November, purple gallinules have left Lacassine. Common gallinules, however, remain in the area in small numbers throughout the winter.

LITERATURE CITED

Frederickson, L. H. 1971. Common gallinule breeding biology and development. Auk 88:914-917.

Gross, A. O., and J. Van Tyne. 1927). The purple gallinules of Barro Colorado Island (Canal Zone). Auk. 46:431-466.

Quillin, R. W., and R. Holleman. 1918. The breeding birds of Bexar County, Texas. Condor 20:37.44.

Weidmann, U. 1965. Colour preference and pecking response in young *Gallinula chloropus*. Ibis 107:108-110.

Zar, J. H. 1974. Biostatistical analysis. Prentice-Hall, Inc. Englewood Cliff, New Jersey. 620 pp.