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NOTES ON THE NESTING OF THE COMMON MOORHEN AND PURPLE GALLINULE IN SOUTHWESTERN LOUISIANA

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Abstract.—Selected aspects of the breeding biology of the Common Moorhen and Purple Gallinule were compared in coastal marshes and rice fields of Louisiana during two breeding seasons. Both species constructed trial-nests, egg-nests, and elevated platforms in marsh and rice fields. Nests were constructed over water out of plant parts available near the nest site. The interiors of Common Moorhen nests were significantly larger, but external dimensions were similar for both species. The mean height above water level of Purple Gallinule nests was significantly greater than for nests of the Common Moorhen. Purple Gallinules had a 78.6% nesting success rate, while 63.3% of Common Moorhen nests were successful. Success for both species was distributed uniformly over the range of nest heights. Average clutch sizes for Common Moorhen were 6.7 in the marsh and 8.6 in rice fields. Common Moorhen and Purple Gallinule both produced significantly larger clutches in rice fields than in marshes.

NOTAS SOBRE EL ANIDAMIENTO DE *GALLINULA CHLOROPUS* Y *PORPHYRULA MARTINICA* EN EL SUROESTE DE LUISIANA, E.U.A.

Sinopsis.—Durante dos periodos reproductivos, aspectos particulares de la biología reproductiva de *G. chloropus* y *P. martinica,* fueron comparados en cienagas y sembrados de arroz de Luisiana. Se encontró que ambas especies construyen nidos de práctica, nidos para poner, nidos para resguardar sus pichones durante la noche y plataformas elevadas tanto en cienagas como en campos de arroz. Los nidos se construyeron, sobre el agua, de partes de plantas disponibles cerca del lugar de anidamiento. Las dimensiones externas de los nidos resultaron ser similares en ambas especies, aunque el interior resultó ser significativamente mayor en *P. martinica.* La altura de los nidos sobre el nivel del agua resultó ser significativamente mayor en *P. martinica* que en *G. chloropus.* Se encontró un éxito de anidamiento de 78.6% y de 63.3% en *P. martinica* y *G. chloropus,* respectivamente; este fue uniforme para ambas especies a diferentes alturas de los nidos. La camada promedio para *G. chloropus* resultó ser de 6.7 en cienagas y 8.8 en arrozales. *P. martinica* produjo un promedio de 5.8 huevos en las cienagas y 8.6 en arrozales. Las camadas de ambas especies resultaron ser significativamente mayor en arrozales que en cienagas.

The Common Moorhen (*Gallinula chloropus*) and Purple Gallinule (*Porphyrula martinica*) nest sympatrically in coastal marshes and rice fields along the Gulf of Mexico. Information relating to the breeding biology of these birds in sympatry is restricted to unpublished M.S. theses (Bell 1976, Helm 1982, Reagan 1977) and a reference to late nesting in south Texas (Cottam and Glazener 1959). We present results of a study of nest characteristics, clutch size, and hatching success of these birds in coastal marshes and rice fields in southwestern Louisiana.

STUDY AREA AND METHODS

Nesting observations were made on three Louisiana sites during the 1977 and 1978 breeding seasons. Two sites were located on or near the Rockefeller Wildlife Refuge, Cameron Parish, in "coastal deep fresh marsh" (Shaw and Fredine 1956). The third site was in rice fields on the Louisiana State University Rice Experiment Station in Acadia Parish, approximately 70 km northeast of the Rockefeller marsh sites.

Rice field nests were found each year in thorough searches conducted in early June and mid-July. There was no evidence that any nesting had been completed before the first search. Nests in the marsh sites were located initially in roadside canals during weekly searches from April through August. The composition, size and placement of all nests were recorded. Active nests were checked at five-day intervals and the number of eggs noted until clutches were completed (i.e., when a nest with an adult bird in attendance did not contain additional eggs on two successive visits).

Date of initiation of laying of incomplete clutches was derived by subtracting one day for each egg present on the day of discovery. For clutches completed before discovery, date of initiation was estimated by subtracting 26 d from hatching date. These estimates were based on observations (Krauth 1972) that the birds lay one egg per day, begin incubation on the fifth day, and incubate for approximately 21 d before hatching begins.

Nests were considered successful if there was evidence that at least one egg hatched. When eggs disappeared, either the presence of numerous small egg shell fragments amid the nesting material (Oney 1954) or ready separation of the vitelline membrane from the shell (Rearden 1951) provided evidence that eggs had hatched and had not been lost to predation.

RESULTS

Both Purple Gallinule and Common Moorhen constructed trial-nests, egg-nests (often with associated ramps), brood-nests, and elevated platforms in marsh and rice fields. Both sexes participated in construction and maintenance of these structures.

The interiors of Common Moorhen egg-nests were larger than those of Purple Gallinule, in terms of both mean bowl depth (4.5 cm vs. 3.6 cm, $t = 3.6$, df $= 13$, $P < 0.05$) and bowl diameter (12.1 cm vs. 10.8 cm, $t = 3.4$, df $= 13$, $P < 0.05$). External nest diameter ($\bar{x} = 24.1$ cm, Common Moorhen; $\bar{x} = 21.7$ cm, Purple Gallinule) and external nest height ($\bar{x} = 12.0$ cm, Common Moorhen; $\bar{x} = 10.9$ cm, Purple Gallinule) did not differ between species ($t = 1.07$, $P > 0.05$; $t = 0.63$, $P > 0.05$).

All nests except for 3 Common Moorhen nests were built over water. There were no differences ($t = 0.19$, $P > 0.05$) in the depth of water over which nests were built ($\bar{x} = 61.2$, Common Moorhen; $\bar{x} = 62.9$, Purple Gallinule). However, Purple Gallinule nests were located under significantly denser cover than were Common Moorhen nests (Mann-Whitney U-test, $Z = -4.29$, $P < 0.05$). Heights of nests above water were grouped into 10 cm intervals for analysis. The mean height category for Purple Gallinule nests (40–50 cm) was greater ($\chi^2 = 76.6$, df $= 9$, $P < 0.05$) than for that of the Common Moorhen (20–30 cm).

Egg nests of both species were constructed either on floating or in emergent vegetation. Floating nests, found only in marsh sites, were constructed on water hyacinth (*Eichhornia crassipes*), alligator weed (*Alternanthera philoxeroides*), and pennywort (*Hydrocotyle* spp.). Stems of bulltongue (*Sagittaria lancifolia*) and southern bulrush (*Scirpus californicus*) were incorporated into their bases. These nests were often located near the centers of canals with little overhead cover. On three occasions, floating nests drifted approximately 75 m during strong winds and were then abandoned. The disappearance of six others was accompanied by a wide swath through the vegetation indicative of alligator (*Alligator mississippiensis*) predation.

Nests in emergent marsh vegetation were typically anchored in southern bulrush, bulltongue or giant cutgrass (*Zizaniopsis miliacea*). Leaf blades were bent over in a criss-cross pattern to form the base, and leaf portions were molded to form the nest cup. Growing leaves were bent over nests during incubation, thereby increasing overhead cover. Extensive ramps were commonly associated with higher marsh and maturing rice field nests. Nests in lower emergents tended to be susceptible to flooding.

Nests were built out of readily available plant material. In rice fields, nests were built out of rice foliage. In the marsh, 78% of Common Moorhen nests ($n = 97$) and 93% of Purple Gallinule nests ($n = 28$) were built from plants found within 1 m of the nest site. In only one instance, a floating Common Moorhen nest built on water hyacinth, was a nest constructed entirely of plant parts not found within 1 m.

One unusual Common Moorhen nest was built in a black willow (*Salix nigra*) overhanging a roadside canal, and two others were constructed atop abandoned Boat-tailed Grackle (*Quiscalus major*) nests. Three cases of egg-dumping by other species into Common Moorhen nests included one by a Least Bittern (*Ixobrychus exilis*) into a marsh nest subsequently lost to predation, and two by Fulvous Whistling-Ducks (*Dendrocygna bicolor*) into nests that were abandoned shortly thereafter.

In the marsh, Common Moorhen initiated clutch production from the first week of April until early August, a total of 122 d in 1977 and 131 d in 1978. Marsh-nesting Purple Gallinules began laying in May and ceased clutch-initiation in early August, a total of 95 d in 1977 and 72 d in 1978. Neither species could begin nesting in rice fields until mid-May, when the rice had grown to a height of 80-90 cm. Harvest began

TABLE 1. Nesting success of Common Moorhen and Purple Gallinule in coastal marsh and rice fields of southwestern Louisiana, 1977 and 1978 combined.

	Marsh		Rice fields	
	Unsuccessful	Successful	Unsuccessful	Successful
Common Moorhen	48 (45%)	59 (55%)	10 (20%)	41 (80%)
Purple Gallinule	15 (32%)	32 (68%)	10 (14%)	60 (86%)

on 3 August 1977 and 31 July 1978 and limited nesting in rice fields to approximately 70 d.

Clutch size was determined for 100 Common Moorhen and 92 Purple Gallinule nests. Egg numbers were determined for completed clutches only. No differences were noted between marsh sites in 1977 (Common Moorhen, $t = 0.65$, df = 47, $P > 0.05$; Purple Gallinule, $t = 1.05$, df = 22, $P > 0.05$) or between marsh sites in 1977 and 1978 (Common Moorhen, $t = 0.85$, df = 57, $P > 0.05$; Purple Gallinule, $t = 0.48$, df = 29, $P > 0.05$), so data were combined. Average clutch sizes for Common Moorhen were 6.7 in the marsh ($n = 59$) and 8.8 in rice fields ($n = 41$). The Purple Gallinules laid an average of 5.8 eggs in the marsh ($n = 32$) and 8.6 in rice fields ($n = 60$). Both species produced larger clutches in rice fields than in marshes (Common Moorhen, $t = 5.3$, df = 98, $P < 0.05$; Purple Gallinule, $t = 7.9$, df = 90, $P < 0.05$). A regression of clutch size by 10-d periods over time for each species in each habitat revealed that no trends exist ($P > 0.05$) (Common Moorhen in marsh, $F = 0.19$; in rice, $F = 0.87$; Purple Gallinule in marsh, $F = 0.56$; in rice, $F = 0.06$).

Over the two years, Purple Gallinule had a success rate of 78.6% compared to 63.3% for Common Moorhen (Table 1). There was no relationship for either species between success rate and height above water level (Common Moorhen, $t = 0.71$, $P > 0.05$; Purple Gallinule, $t = 0.43$, $P > 0.05$).

Of 25 unsuccessful Purple Gallinule nests, 20 (80%) were lost to predators, one (4%) was abandoned after floating away, and four (16%) were abandoned for unknown reasons. Of 58 unsuccessful Common Moorhen nests, 37 (64%) were lost to predators, 10 (17%) destroyed by weather or high water, two (3%) were abandoned after floating away, and nine (16%) were vacated for unknown reasons.

DISCUSSION

We noted similarities and differences between selected aspects of Common Moorhen and Purple Gallinule breeding biology along the upper Gulf Coast. No differences were noted in nest composition; both species used parts of those plants growing near the site. Bowl depth and diameter of Common Moorhen nests were greater, perhaps reflecting their greater weight (Ripley 1977), but there were no differences in external nest

TABLE 2. Clutch sizes reported for the Purple Gallinule and Common Moorhen.

Area	Mean	*n*	Range	Source
		Purple Gallinule		
Panama	4	1	4	Gross and Van Tyne 1929
Louisiana	4.5	12	3–6	Bell 1976
South Texas	6.5	87	4–12	Cottam and Glazener 1959
Louisiana	6.7	38	4–10	Causey et al. 1968
Louisiana				
Marsh	5.8	32	3–8	this study
Rice field	8.6	60	2–13	this study
		Common Moorhen		
Iowa	7.1	13	5–10	Fredrickson 1971
Ohio	8.0	55	3–15	Brackney and Bookhout 1982
Louisiana	8.1	11	5–15	Bell 1976
Wisconsin	8.1	18	5–12	Krauth 1972
Louisiana	8.6	35	6–16	Causey et al. 1968
South Texas	9.1	142	4–17	Cottam and Glazener 1959
Pennsylvania	10.0	2	10	Miller 1910
Pennsylania and New Jersey	10.0	26	6–14	Harlow 1918
Louisiana				
Marsh	6.7	59	3–10	this study
Rice field	8.8	41	5–10	this study

dimensions. Both species nested most often over water and water depth under nests did not differ between them. Yet, Purple Gallinules built nests higher above the water surface under thicker cover and had greater nesting success.

Clutch sizes reported for the Common Moorhen in the New World ($\bar{x} = 8.8$, recalculated from original data; range 3–17) are similar to those that we observed in rice fields (Table 2). Reported clutch sizes ($\bar{x} = 6.4$; range 3–12) for Purple Gallinule fall between our marsh and rice field averages (Table 2).

Interspecific differences in clutch size within each habitat were less than intraspecific differences between habitats. Common Moorhens laid a mean of 0.9 more eggs in marsh and 0.2 more eggs in rice fields than Purple Gallinules. These differences are well below those reported by other researchers: Common Moorhens average 2.6 more eggs than Purple Gallinules in southern Texas (Cottam and Glazener 1959), and 3.6 more eggs from a small sample of nests in an earlier Louisiana study (Bell 1976).

Possible explanations for the significant habitat differences in clutch size that we observed include: (1) a sampling artifact, (2) divergent evolution in isolated populations, or (3) differences in resources available for egg production and/or the successful rearing of chicks.

The differences could be spurious if large mean marsh clutches represent an averaging of very large early clutches with smaller later clutches that are not different in size from clutches laid at the same time in rice where early nesting is precluded by a lack of vegetation. Indeed, observations of juvenile Common Moorhens associated with adults nesting late in the season in the marsh is evidence that second broods are produced in that habitat. However, a regression analysis of each species in each habitat revealed no change over time. Therefore, we think the results are not due to a sampling artifact.

Noordwijk et al. (1981) commented that differences of a few eggs in clutch size of Great Tits (*Parus major*) could evolve in a matter of decades. Rice and marsh populations of both species would have to exhibit very little interbreeding for the differences to be genetically based. However, there are no apparent geographic barriers across the 70 km of apparently suitable habitat that separates the study sites. Also, banding data show that there is at least occasional mixing of birds between marsh and rice production areas. Thus, significant genetic divergence does not appear likely.

There may be differences in the types of resources available between the sites. Both species are omnivorous (Reagan 1977), but they may be more insectivorous in rice fields where plant parts they normally consume (Howell 1932, Miller 1946, Simpson 1939) are generally not available (Harmon et al. 1960). A comparative study of food habits in the two habitats could help determine the correlation of available resources with egg production and/or the successful rearing of chicks.

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