through learning interspecifically (Cody, Condor 71:222–239, 1969; Emlen et al. 1975; Brown, Can. J. Zool. 55:1523–1529, 1977).

In territorial species, song learning and matching of themes often follows intense intermale interaction (Bitterbaum and Baptista, Auk 96:462–474, 1979). Nice (Trans. Linn. Soc. 6:1–238, 1943) hand-raised 2 Song Sparrows which vied for dominance, each soon producing 6 identical themes. The closely related Lincoln Sparrow is also highly territorial and responds strongly to playback of conspecific song. We have several observations of the Lincoln Sparrow interacting aggressively with sympatric White-crowned Sparrows and vice-versa. Perhaps the Lincoln Sparrow learned the White-crowned Sparrow's song during such interspecific interaction.

Fieldwork was supported in part by National Science Foundation Grant DEB 77-12980 to Baptista and Morton.—LUIS F. BAPTISTA, MARTIN L. MORTON AND MARIA E. PEREYRA, *Dept. Biology, Occidental College, 1600 Campus Road, Los Angeles, California 90041.* (Present address LFB: *Dept. Birds and Mammals, California Academy of Sciences, San Francisco, California 94118.*) *Accepted 20 May 1980.*

Wilson Bull., 93(2), 1981, pp. 267–271

Notes on Purple Gallinules in Colombian ricefields.—Little has been reported on Purple Gallinules (*Porphyrula martinica*) in ricefields, despite the species' affinity for this habitat as a nesting site (Ensminger, La. Conserv. 11:19, 1959; Meanley, Auk 80:545–547, 1963). Descriptions of nests and food habits are few and limited to populations in naturally occurring marshes (e.g., Bent, U.S. Natl. Mus. Bull. 135, 1926; Gross and Van Tyne, Auk 46:431–446, 1929; Imhof, Alabama Birds, Univ. Alabama Press, University, Alabama, 1962). In certain Neotropical areas, Purple Gallinules are considered pests due to loss of harvestable rice incurred by bending rice (*Oryza sativa*) plants into nests and feeding platforms (Feakin, ed., Pest control in rice, PANS Manual No. 3, Tropical Pesticide Research and Information Unit, London, England, 1970). Gallinules are seasonally abundant in much of the extensive rice-producing region east of the Andes in northern South America, prompting experimentation with various control procedures. Endrin has been used as a control agent for gallinules in Surinam (Haverschmidt, Birds of Surinam, Livingston Publ. Co., Wynnewood, Pennsylvania, 1968) and is presently being used in Colombia, but few data are available on the effects of this practice. In this paper, I describe nest abandonment by Purple Gallinules in response to endrin applications, and report on nest construction and placement, observations of an unusual escape behavior, and food habits of the species in Colombian ricefields.

Study area and methods.—The Hacienda La Corocora (3°57′N, 73°24′W; elev. 310 m) is located in a large rice-growing zone in the tropical savanna of the Llanos Orientales in Meta, Colombia. Annual rainfall averages 2600 mm, with the rainy season occurring from April–October. Descriptions of climate and vegetation of the region were given by Bates (Geogr. Rev. 38:555–574, 1948) and Blydenstein (Ecology 48:1–15, 1967). Rice is grown year-round in 10–90 ha plots bordered by marshes and shrubby pastures. Ricefields in various stages of growth occupy a contiguous area of 600 ha with a mean water level of 13.5 cm in cultivated plots. Purple Gallinules migrate to the area in late March and nest from May at least through August. Gallinules are occasionally found in green ricefields, but usually do not enter fields until the "yellowing" or maturing stage, when rice grains are forming (about 10 weeks after germination). As water is drained from each plot prior to harvesting, gallinules move into nearby ricefields that are beginning to mature. Most gallinules leave the area at the end of the wet season, although small numbers remain all year in local marshes. Little is known regarding dispersal of the migrant population.

I estimated minimum density of gallinules in ricefields by averaging flush counts from parallel 300 × 40-m transects spaced 250 m apart. I sampled 3–5 transects per plot (depending on plot size) on different days to reduce bias associated with birds flushing from one transect to another and being counted twice. Density figures were obtained prior to and following aerial applications of 19.5% endrin (1 gal/ha or 3.79 l/ha) by the Hacienda in 1977 and 1978.

Nests were located by systematically searching ricefields and nearby marshes on repeated occasions during May–July 1977 and 1978. For each nest I recorded height of nest rim above water, greatest diameter of nest, outside depth, bowl depth, estimated percent of nest surface covered when viewed from directly above, size and placement of runway (Gross and Van Tyne 1929) and number and sizes of eggs. I investigated correlates of nest placement in ricefields by recording water depth, height of rice above water and distance to nearest ricefield border at nest-sites and comparing these values with similar data obtained at an equal number of ricefield locations determined from a table of random numbers. I recorded data only from nests known to be active, i.e., containing eggs, since unfinished nests are frequently found near active nests (Bent 1926).

I collected 48 adult-plumaged gallinules in ricefields during May–June 1977 and 1978. Food items removed from the esophagus, proventriculus and gizzard were preserved in 8% formaldehyde (Martin, Procedures in Wildlife Food Studies, USFWS Wildlife Leaflet 325, 1949) and subsequently identified. Aggregate volume of each item was determined by water displacement. Six birds with empty digestive tracts or extensively digested stomach contents were excluded. The remaining sample contained 14 males, 14 females and 14 birds of unknown sex whose digestive tracts had been removed by farm workers before the gonads could be examined.

Gallinule densities and response to endrin applications.—In 1977, migrant gallinules first appeared in marshes on the study area during the last week of March. Numbers increased through April and scattered individuals were observed in the earliest maturing ricefields (an area of 50 ha) during the second week of May. Gallinules became abundant in these plots during the third week of May with a minimum density of 21/ha. This density indicated a large influx of migrants, since the number of birds in the marshes did not appear to decrease. Egg-laying began on 17–18 May. On 2 June, endrin was applied to plots with nesting gallinules. By 3 June, all nests (N = 11) had been abandoned and minimum density of birds had decreased to 2/ha. Many gallinules had apparently moved and begun to nest in untreated plots (area 22 ha) which were beginning to mature. Minimum density in the second plots was 27/ha on 15 June. Endrin was then applied to all untreated plots on 1 July, after which the new nests (N = 18) were abandoned and virtually all gallinules left the Hacienda's ricefields. No dead birds were found following either application. Where the gallinules went is unknown.

In 1978, gallinules appeared in the earliest maturing ricefields during the first week of May, but the large influx of migrants did not occur until the first week of June. Minimum density was 20/ha by 7 June. Endrin was applied to all plots during 9–20 June, after which most gallinules left the area without initiating nests. I found 5 dead gallinules after the 1978 pesticide applications. The birds presumably died from pesticide poisoning, but facilities for analysis were not available. Although gallinules remained in ricefields at low densities (7/ha) until I left the study area in mid-August, I found only 1 nest in 1978, which was abandoned by 1 July.

Nests and eggs.—All ricefield nests (N = 30) were constructed entirely of leaves and panicles of growing rice plants wound into a roughly circular cup supported by rice stems.

Platforms were numerous in the vicinity of nests, but nests were not located on these structures. Nests had a mean diameter of 21.8 ± 0.4 (SE) cm (range 16–28 cm), outside depth of 10.0 ± 0.5 cm (6–16 cm), bowl depth of 5.2 ± 0.4 cm (2–9 cm), and were placed 29.8 ± 1.0 cm (21–42 cm) above the water. Most nests were partially covered by leaves and panicles bent over into a high arch 25 cm or more above the nest rim. Surface areas of 3 nests were covered 50% or more, 10 nests were 25–50% covered, 7 were 10–25% covered, 6 were 1–10% covered and 4 were not covered to any extent. Most nests had an entrance indicated by a low section of the rim adjacent to a runway of bent leaves which often led to feeding platforms. Runways were approximately 15 cm wide, 20 cm–1+ m long and either led directly to the entrance or were built tangentially to it, apparently allowing the birds to enter the nest from 2 directions. Several runways were poorly-defined, and 3 nests lacked evidence of runways or entrances.

Nest-site means for water depth (14.7 ± 0.8 cm, range 6–26 cm), rice height (65 ± 1.3 cm, 55–85 cm) and distance to nearest border (108 ± 16.7 m, 29–200 m) did not differ from those for 30 random points ($t = <1.7$), indicating that gallinules nested randomly with respect to these factors. Data regarding nest spacing are incomplete, since more nests would probably have been initiated if endrin had not been applied. Observed inter-nest distance was usually 40 m or more, although 2 nests were located only 11 m apart.

Clutches contained up to 7 eggs, but many nests were obviously abandoned before clutches were complete (13 nests contained 1–2 eggs). Fifty-three eggs averaged 41.0 ± 0.3 × 29.3 ± 0.2 mm. Eggs within clutches varied by as much as 5.5 mm in length and 2.5 mm in width. Weights of 2 eggs of unknown age were 15.2 g and 14.8 g.

Seven additional nests were found in dense growths of "platanillo" (*Thalia geniculata*) in narrow strips of marsh habitat (<0.5 ha) along streams and drainage canals. Nests were constructed of *T. geniculata* leaves and differed from ricefield nests by being placed at greater heights above the water ($\bar{x} = 56.7 \pm 5.0$ cm, $t = 2.80$, $P < 0.01$), and having greater outside depths ($\bar{x} = 15.6 \pm 1.9$ cm, $t = 2.77$, $P < 0.01$). No more than 1 nest was found in each area of marsh.

Escape behavior.—When approached, gallinules usually flushed, although they frequently remained on the ground and moved away through the vegetation. On several occasions, I closely pursued running gallinules whose locations were apparent from movements of the rice plants. After running several meters, the birds that did not flush lowered their bodies 2–3 cm under the water, flattened out and remained completely submerged with eyes closed. I captured by hand male and female birds in this submerged posture. Local farm workers often use this technique to catch gallinules for food. To my knowledge, this unusual escape behavior has not been reported for the species.

Food habits.—Rice grains constituted 68% of the food by volume, occurring in all but 1 of the stomachs examined (Table 1). The remainder comprised ricefield weed seeds (5%) and animal matter (27%), the most frequent being borer moth (Noctuidae) pupae and larvae, dragonfly (Odonata) adults and nymphs, and various beetles (Coleoptera). An unusual item was a 2.6-cm section of the unfeathered crus and knee of an adult-sized Purple Gallinule, found in the gizzard of a female collected 26 June 1977. This was presumably taken from a dead bird, implying that gallinules occasionally will feed on carrion. On 2 occasions, I found partially-eaten sections of 10-cm fish (Cichlidae) on feeding platforms. Grit, obtained from adjacent gravel access roads, was present in all stomachs examined.

Purple Gallinules are known to feed largely on seeds and fruit of aquatic plants supplemented by small invertebrates (Gross and Van Tyne 1929; Imhof 1962; Krekorian, Condor 80:382–390, 1978), although feeding on flower blossoms (Crosby, Florida Nat. 42:171, 1969), tree fruit (Meanley 1963) and opportunistic predation on eggs and young of other birds (Bailey, Auk 44:560, 1927; McIlhenny, Auk 53:327–328, 1936; Beadel, Auk 63:87–88, 1946) have also

TABLE 1

ESOPHAGEAL AND STOMACH CONTENTS OF 42 PURPLE GALLINULES COLLECTED IN COLOMBIAN RICEFIELDS MAY–JUNE 1977 AND 1978

	Percentage	
Food item	Volume	Occurrence
Plant (seeds)		
Rice, *Oryza sativa*	68	98
Cyperaceae spp.	2	19
Paspalum notatum	1	5
Thalia geniculata	trace	5
Panicum sp.	trace	2
Echinochloa colonum	trace	5
Scleria pterota	trace	2
Polygonum sp.	trace	7
Gramineae sp.	trace	2
Scirpus sp.	trace	7
Croton tinctoria	trace	2
Paspalum virgatum	trace	7
Total plant	73[a]	98
Animal		
Noctuidae pupae and larvae	14	12
Odonata adults and nymphs	6	12
Coleoptera (undetermined)	1	10
Curculionidae	1	7
Tenebrionidae	trace	5
Hemiptera (undetermined)	trace	2
Pentatomidae	trace	2
Corydalidae larvae	trace	2
Cyclorrhapha pupae	trace	2
Hymenoptera	trace	2
Other insect (undetermined fragments)	4	26
Arachnida	trace	5
Gastropoda	trace	2
Crus-knee segment (gallinule)	1	2
Total animal	27[a]	43

[a] Totals include trace (>0.5%) items.

been reported. This study demonstrates that gallinules nesting in ricefields feed mostly on rice, but take a variety of other items when available.

Sexes did not differ in amounts of rice or plant material eaten, but females consumed greater volumes of animal matter ($\bar{x}$ = 1.9 ml for females vs <0.1 ml for males, t = 2.42, $P < 0.05$) and total food ($\bar{x}$ = 6.2 ml vs 3.6 ml, t = 2.07, $P < 0.05$). Mean weights of males (213.4 ± 5.1 g) and females (223.6 ± 15.6 g) were not significantly different (t-test, NS). Sexual differences in food habits may correspond to selection by females for more animal matter during the nesting season. For birds in general, egg production requires more protein than does sperm production (King, pp.79–107 *in* Breeding Biology of Birds, Farner, ed., Natl. Acad. Sci., Washington, D.C., 1973). Krekorian (1978) assumed that the heavier bird in each pair was male; the lack of significant sexual dimorphism in the weight of breeding Purple Gallinules in this study suggests that this may not be a reliable criterion for sexing the birds.

In eastern Colombia the amount of land converted to rice culture is steadily increasing. Ricefields present an advantageous nesting habitat for Purple Gallinules by affording an abundant food supply and stable water levels. Some of the insects consumed by gallinules are serious pests in rice (notably the noctuid caterpillars), indicating that food habits of this species are to some extent beneficial. I was informed by local farmers that endrin is used against gallinules in varying quantities and apparently with no established guidelines. Little is known regarding the effect of pesticides of gallinule population dynamics. In view of the potential for crop and environmental contamination, studies integrating damage analysis with feeding habits are needed to assess accurately the impact of Purple Gallinules in tropical ricefields.

This study was sponsored by the Instituto Colombiano Agropecuario. I am grateful for the assistance of Danilo Valencia, Ernesto Barriga, Dario Leal and La Corocora Ltda.; I especially thank Patricia Chacón for identifying insects. E. E. Good, Thomas Lemke, Jeffrey Jorgenson and Clait Braun offered valuable advice on drafts of this manuscript.—WALLACE D. MCKAY (deceased), *Smithsonian-Peace Corps Environmental Program, U.S. Embassy, Bogotá, Colombia.* (Corresponding address: Douglas McKay, *17 Hamilton Ave., Wheeling, West Virginia 26003*). *Accepted 20 Mar. 1980.*

Wilson Bull., 93(2), 1981, pp. 271–274

Agonistic behavior of the White-breasted Nuthatch.—My studies of agonistic behavior of White-breasted Nuthatches (*Sitta carolinensis*) were begun in Bethesda, Maryland, in 1953, but generally undertaken in Lyme, New Hampshire, between 1961 and 1973. Previous detailed reports of agonistic behavior of the White-breasted Nuthatch are lacking, although Tyler (Wilson Bull. 28:18–25, 1916), Butts (Bird-Banding 2:1–26, 59–76, 1931), Bent (U.S. Natl. Mus. Bull. 195, 1948) and Brackbill (Maryland Birdlife 25:87–91, 1969) have been helpful.

Agonistic displays.—Included are a spectrum of displays which, as noted for the European Nuthatch (*S. europaea*) (Löhrl, Z. Tierpsychol. 15:191–252, 1958), may merge confusingly. Displays most discernible are:

(1) Tail-fanning. Here the tail is raised and fanned, displaying the black and white markings. It is given frequently by the female when her mate comes close to the nest where she is dominant, as well as in conflicts with rival pairs.

(2) Wing-flicking. This action, combined with raising the tail, was used chiefly against predators.

(3) Threat display. Usually the bill is raised, wings are down and tail is cocked up as shown in Fig. 1 and by Löhrl (1958) for the European Nuthatch. The pose is assumed by a subordinate when threatened by a dominant bird of the same or a different species.

(4) Aggressive threat display. It resembles (3), except for a raising of the back feathers and a pointing downward of head and bill (Fig. 2). It is given in severe conflicts.

(5) Raising back feathers with wings and tail in normal position. This display (Fig. 3) is