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NOTE
Notes on Nesting and Growth of Mariana Common Moorhens on Guam

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Abstract—A breeding pair of Mariana Common Moorhen, *Gallinula chloropus guami,* nested four times from May to October 1988 at the Barrigada ponding basin in central Guam, Mariana Islands. Two nests were successful, one was flooded, and the other was being incubated when the study ended. Renesting intervals varied considerably and were probably influenced by increased water levels and nest fate. Older offspring from the first clutch assisted the adults in rearing the hatchlings of the third clutch. Offspring from the first clutch, one of which remained at the ponding basin for the duration of this study, and hatchlings from the third clutch provided information that Mariana Common Moorhens pass through three developmental stages (chick, juvenile and subadult) during a 21-week period. Similarities exist between the Mariana Common Moorhen and other moorhen subspecies.

Introduction

The Mariana Common Moorhen, *Gallinula chloropus guami,* is a subspecies endemic to the Mariana Archipelago in the western Pacific Ocean and is endangered (U.S. Fish & Wildlife Service 1984). Its distribution, abundance and wetland use have been described (Ritter & Sweet 1993, Stinson et al. 1991, U.S. Fish & Wildlife Service 1992, Wiles & Ritter 1993), but aspects of reproduction, nesting and development of young have never been published. The recovery plan for this bird identifies the need for more life history information to aid in the achievement of recovery objectives (U.S. Fish & Wildlife Service 1992). This note provides information on nesting and development and reveals similarities among *G. c. guami* and other moorhen subspecies.

Study Area and Methods

Mariana Common Moorhens were viewed during 21 observation periods totaling 24.5 hr at the Barrigada Ponding Basin on Guam (13°28′N, 144°45′E)

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from 19 May to 25 October 1988. Major plant species in this small (0.6 ha) constructed wetland were *Spirodela* (80%) and *Panicum muticum* (20%). Two separate clumps of *Cyperus* sp., approximately 30–50 cm in height, also grew in the wetland. A buffer consisting primarily of *Colocasia esculenta, Bambusa vulgaris, Saccharum spontaneum* and *P. muticum* separated the wetland from adjacent homes, a gas station and a major road. Stinson et al. (1991), U.S Fish & Wildlife Service (1992), and Wiles & Ritter (1993) give additional information on the site and other wetlands on the island.

Observations on behavior and development were restricted to the only breeding pair of moorhens and their offspring in the wetland. Moorhens were viewed with a spotting scope and binoculars at distances of 10–50 m. Diurnal observations were divided about equally between mornings (0600–1200 hr; 57%) and afternoons (1200–1800 hr; 43%). Because Common Moorhens are not sexually dimorphic, sexes of individuals were determined during copulation when the male mounted the female. Nests were located by observing the movements of adult moorhens and by making two cursory searches of the wetland. Eggs were measured with dial calipers. Monthly rainfall data was obtained from the weather office at Naval headquarters on Nimitz Hill.

Results and Discussion

My observations of 11 precopulatory sequences, five of which resulted in copulation, generally agree with other descriptions of sexual displays in Common Moorhens (Howard 1940, Wood 1974). All precopulatory sequences lasted from 20–60 sec with the female initiating 40% of them. All sequences followed five steps: 1) the male and female approached each other with necks and heads lowered; 2) preening occurred and was sometimes extensive; 3) the male mounted the female; 4) copulation sometimes took place; and 5) additional preening and allopreening followed whether copulation occurred or not. Twice during mounting, the male grasped the nape of the female and once she put her head under water.

Table 1. Mean sizes of Common Moorhens at various locations.

Length (mm)	Width (mm)	Sample Size	Location	Source
44.1	31.5	114	Hawaii	Byrd & Zeillemaker (1981)
44.0	31.0	105	Florida	Bent (1926)
43.8	32.1	8	Saipan	Stinson (1993)
42.8	30.9	39	Russia	Dement'ev et al. (1969)
42.6	30.4	12	China	Cheng (1963)
41.9	30.6	12	Guam	This study
41.3	30.2	—	Louisiana	Audubon (1840)
40.4	31.4	29	Iowa	Fredrickson (1971)

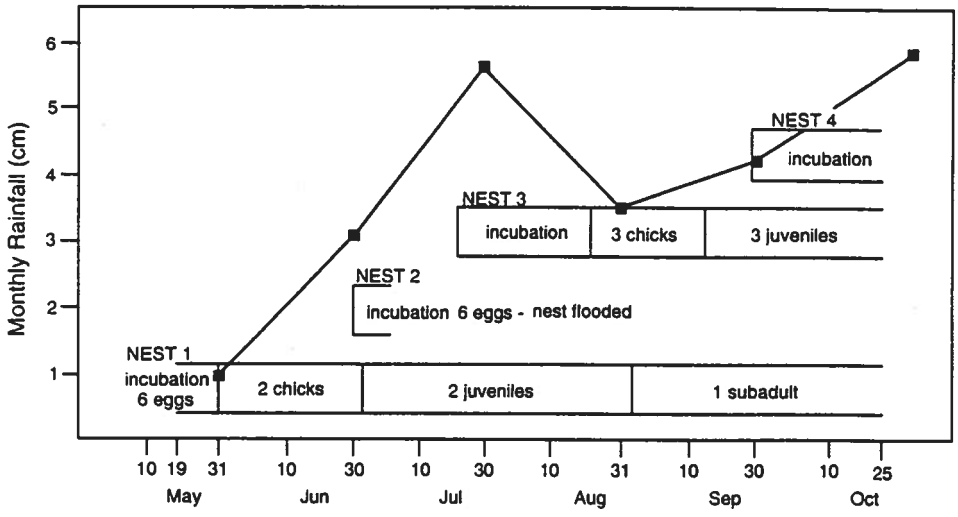

Figure 1. Renesting intervals and brood composition of Mariana Common Moorhens and monthly rainfall at the Barrigada ponding basin, Guam, from 19 May to 25 October 1988.

The pair of moorhens constructed four nests during the 160 days. Two nests, each containing six eggs, were found during cursory surveys and two more were identified when the adults were incubating. The contents of these two nests were not examined. Nests were built over water approximately 50 cm deep and 3–4 m from the shoreline. They were anchored to and partially shaded by emergent vegetation. Two nests were made in *P. muticum* and the other two were in *Cyperus* sp. The outside dimensions of one circular nest measured 25 cm. The average egg size at the ponding basin was within the range of sizes reported for other subspecies of Common moorhens (Table 1).

Only the first and third nests produced chicks. The first nest had six eggs but only two chicks were observed. Clutch size of the third nest was not determined, but at least three chicks hatched. Brood sizes suggest that high egg loss or chick mortality occurred during incubation or shortly after hatching. Similarly, Bell (1976) reported a 40% reduction from mean clutch size to mean brood size in 1–10 day old moorhens. The second nest was lost to flooding, which was a major cause of egg loss in other studies (Wood 1974, Brackney 1979). The fourth nest was being incubated when the study ended.

Intervals between hatching of successive clutches in common moorhens ranged between 42 days in South Africa (Siegfried & Frost 1975) to 60 days in Great Britain (Gibbons 1987). Incubation requires 22 days (Byrd and Zeillemaker 1981). Renesting intervals in this study varied considerably and were probably influenced by rising and high water levels associated with the wet season (Figure 1). Incubation of the second nest began approximately 30 days after the hatch of the first nest. Therefore, had the second nest been successful, hatching would

Table 2. Developmental stages of Mariana Common Moorhen on Guam.

Developmental stage	Developmental period	Legs	Bill	Plumage
Chick	0–4 weeks	Black	A thin black band separates a red upper mandible from a yellow-green tip.	Black natal down
Juvenile	5–13 weeks	Brownish-green developing to dirty yellow-green with faint orange band above the knee.	Brownish-orange with yellow-green tip. Frontal shield begins to grow upward to the forehead at 12–13 weeks.	Various shades of light and dark brown. Back and wing coverts begin to take on olivaceous-brown cast.
Subadult*	14–21 weeks	Yellow-green developing to green with reddish-orange band above the knee. Band becomes red.	Deep, dark red towards the forehead becoming reddish-orange near the tip. Tip is bright green.	Brownish-gray developing to black with grayish cast to feather tips. Olivaceous-brown back and wings. Entire plumage lacks sheen.

* Subadults are nearly identical to adults at 22 weeks, but their frontal shields still lack the "fullness" of adults in the forehead region. Plumage on the head and neck continues to lack sheen.

have occurred on approximately 22 July, 52 days after the first nest hatched. Incubation at nest #3 began ten days after the loss of the second nest. This suggests that the renesting interval is much shorter after a nest has been lost during the incubation period. In a study by Wood (1974) in Great Britain, renesting occurred an average of 10 days after nests were lost to predation in the first half of incubation. In Hawaii, renesting occurred 15 days after a nest was lost to unknown causes (Nagata 1983). The long renesting interval between the third and fourth nest was probably related to the lack of emergent vegetation caused by rising water levels after heavy rainfall during July to September. The fourth nest was eventually built on a floating board with *Cyperus* sp. growing on it.

Older offspring from the first clutch remained at the wetland and assisted the adults in rearing the hatchlings of the third clutch. Only feeding by the juveniles was observed, but assistance may also involve brooding (Guam Division of Aquatic & Wildlife Resources, unpubl. field notes; Robertson 1964) and territorial and predator defense (Gibbons 1987).

The plumage and bare parts of chicks, juveniles, and adult moorhens are well known, but little information is available on the duration of each developmental stage. Fredrickson (1971), Karhu (1973), Krauth (1972), and Wood (1974) recorded anatomical or plumage changes of young moorhens but did not divide the growth into developmental stages. I recorded regular, but rudimentary

descriptions in the changes in plumage, and leg and bill coloration of moorhens to document the development chicks into adults. A hatchling from the first nest remained at the wetland for the duration of the study and three hatchlings from the third nest provided additional development information. I found Mariana Common Moorhens to pass through three developmental phases (chick, juvenile and subadult) during a 21-week period (Table 2).

This note identifies some similarities between Mariana Common Moorhen and other moorhen subspecies. Recovery programs could be implemented using data from studies of other subspecies to supplement those aspects of the biology and ecology of *G. c. guami* that are not well known. Concurrently, ecological studies of Mariana Common Moorhens should be made to identify any unique characteristics that may affect the recovery of this endangered subspecies.

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