motory systems suggests that subtle differences among species' center of gravity may explain the adaptive significance of interspecific differences in head-scratching method.

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The usefulness of taped Spotless Crake calls as a census technique.—Playing taped calls of Spotless Crakes (*Porzana tabuensis*) has been used successfully to determine the presence of crakes and to identify the habitat they use in New Zealand (Ogle and Cheyne 1981). In this study, calls of Spotless Crakes were broadcast throughout the breeding season at given locations to evaluate the crake's consistency of reaction to taped calls. This study was conducted at Pukepuke Lagoon, an 86-ha management reserve of the New Zealand Wildlife Service in the Manawatu district of the North Island, New Zealand, latitude 40°20'S, lon-

TABLE 1
NUMBER OF MINUTES OF TAPE PLAYING UNTIL THE FIRST SPOTLESS CRAKE VOCALIZATION WAS HEARD

Time (min)	0–1	1–2	2–3	3–4	4–5	5–6	6–7
No. responses	42	31	26	23	22	11	38
% of total	22%	16%	13%	12%	11%	6%	20%

gitude 175°16′E. Dominant emergent plants within this marshland are raupo (*Typha orientalis*), flax (*Phormium tenax*), tussock sedge (*Carex secta*), and cabbage tree (*Cordyline australis*). The vegetation, climate, and history of the lagoon have been described by Ogden and Caithness (1982). Taped calls of Spotless Crakes were played for 6.5 min at slightly greater than normal amplitude at 45 stations from 14 September to 14 December 1982 for a total of 13 times. Maximum amplitude one m from the source was 90 db. The stations were approached carefully by walking on pathways or boardwalks about the swamp, and by rowing along the swamp edge of the lagoon. Tapes were played consecutively from stations 1 through 31 in the morning and usually in the evening (occasionally mornings) at stations 32 through 45. On land, I walked 5–7 m away from the tape recorder to listen; in the boat I turned down the amplitude of the tape recorder at frequent intervals to listen. This tape is listed in the N.Z. Wildlife Service sound library catalogue as checklist No. 136, reel No. 71, Spotless Crakes—Whangarei. The tape segment used consisted of five loud "purrs" in the first min, 35 soft "pips" the next 25 sec, followed by 279 moderately loud calls, mostly "pit-pits," during the following 5 min, and ended with a second series of loud "purrs." These descriptive terms of Spotless Crake vocalizations are from Hadden (1970) and Kaufmann and Lavers (1987). Tapes were played at the stations on the least windy day of each 7–10 day period.

The adjoining areas of marsh, especially raupo and tussock sedge, were searched for nests with the help of A. Grant, several members of the Faunal Survey crew, and my son Matthew. Active nests were checked regularly, and several were observed from a blind. In this way the extent of crake response could be correlated with the stage of their breeding cycle.

TABLE 2
LOUDNESS OF SPOTLESS CRAKE RESPONSES TO TAPED CALLS

Type of call	No. responses
Soft calls ("bubblings" and "murmurings")	65
Intermediate ("pit-pits" and whistles)	40
Intermediate and soft	32
Loud ("purrs")	15
Loud and soft	22
Loud and intermediate	7
Loud, soft, and intermediate	13

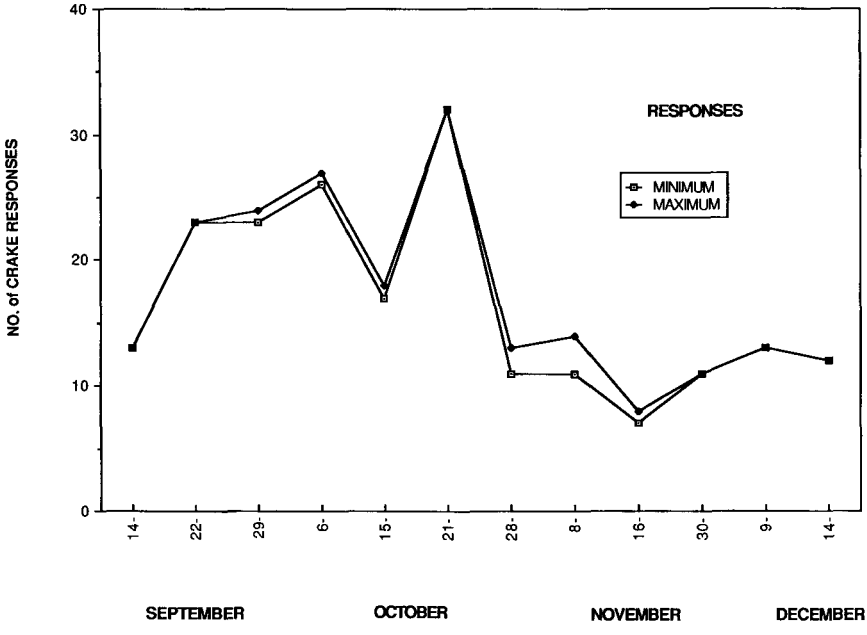

FIG. 1. Number of Spotless Crakes responding to taped Spotless Crake calls during the 1982 breeding season. Maximum = total number of calls heard. Minimum = probable number of birds responding, with 1–3 birds following the recorder from one station to the next.

Spotless Crakes varied in time to respond to taped calls, the kinds of calls given, their intensity, and their frequency. The initial response of the crakes was most frequently given during the first minute of tape playing (Table 1). Fewer responses were given as tape playing progressed, until the end, when nearly as many birds responded as during the first minute. In one instance the tapes were played continuously for 21 min before a response was given. At times, the tape did not elicit a response but appeared to make the crakes more sensitive to disturbance. For example, walking from station 15 to 16 required passing stations 12 and 13. Several times crakes called as I walked by these stations even though they had remained silent during the playing of tapes there.

The Spotless Crakes usually responded with calls of low amplitude; "bubblings" and "murmurings" were soft and low, "pit-pits" and short whistles were intermediate, and "purrs" were loud. The main exception were the "purrs," which became more variable in form and amplitude toward the end of the study. Less than one-third of the responses contained loud calls (Table 2). For this reason, the broadcasting of calls was restricted to calm days.

While some birds called as they were approaching the recorder, others did not respond until after they had approached the edge of the swamp vegetation. Some birds, which were responding close to the recorder, appeared to return to the center of their territory before giving loud "purrs." Some of the birds which interacted with the tapes during the "pit-pits" appeared intimidated by the second series of loud "purrs" and ceased calling. However, the

large number of responses during the first minute and after the last minute of taped calls coincided with the "purrs" on the tape recording.

Stage of breeding cycle was the most significant cause of variation in responding to tapes. Nesting pairs responded quickly, vigorously, and continuously to calls broadcast during the two weeks prior to egg laying. Once incubation began they did not call, although several times splashings were heard. After their eggs hatched, they answered the calls sporadically, with soft or intermediate calls of short duration. One pair of crakes never responded to tapes. The behavior of this pair suggests crakes may not respond during renesting, since two months prior to finding their active nest, I located two empty nests nearby. The large number of responses obtained from the 22 September to 27 October indicate this is the major pre-incubation period at Pukepuke Lagoon (Fig. 1). In contrast, the response rate of Soras (*P. carolina*) to recordings played weekly peaked at the beginning of egg laying and steadily diminished thereafter (Johnson and Dinsmore 1986).

Water levels may influence the concentration of crakes and thereby affect their response to tape recordings. A large number of Spotless Crakes responded to taped calls 21 October when the water level in the lagoon was at its lowest. Multiple responses, often resulting in interactions between birds, were most frequent that day, and the largest number of birds appeared at the edge along the lagoon.

The full roles of the sexes in calling has yet to be determined. I assumed that soft calls, such as "bubblings," "murmurings" and whistles performed by two birds close together, often in a duet, were made by members of a pair. I assumed that loud calls, such as "cracks" and "purrings," were performed by males, as these were followed by chasing and fighting when two birds were close together.

One or two Marsh Crakes (*P. pusilla*) responded to tapes of Spotless Crakes at two stations on four occasions. Marsh Crake calls were broadcast on the dark, calm evenings of 22 September and 26 October and the morning of 25 October. No Marsh Crakes responded and only two (possibly five?) Spotless Crakes responded weakly at the cessation of the Marsh Crake tape broadcast. The Spotless Crakes appeared unstimulated, if not intimidated, by the Marsh Crake calls. In contrast, Glahn (1974) found that Virginia Rails (*Rallus limicola*) and Soras responded equally well to conspecific and interspecific calls during the breeding season in the western U.S. However, Johnson and Dinsmore (1986) found that the Sora's call could be used to count both species during the prelaying season in central U.S., but during the postlaying season best results were achieved by alternating broadcast calls of the two species. Virginia Rails respond as readily to broadcast calls of the other species as well as their own (Glahn 1974). Griese et al. (1980) used a sequence of alternating calls of both species, incorporating 1 min listening periods between calls, to census rails in Colorado. The difference in responses to taped calls between Spotless and Marsh crakes may have been caused by the low population density of Marsh Crakes at Pukepuke Lagoon.

To standardize census methods I suggest: (1) the use of the same recording having a variety of calls including several bursts of purrs; (2) playing recording for 5 min; (3) using a slightly above-normal amplitude; (4) using 1 min breaks during the recording as silent listening periods; (5) playing recordings on calm mornings; (6) playing during the peak of the breeding season, mid-September to mid-October; and (7) only one person should make each census to avoid frightening crakes.

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Notes on Hooded Merganser nests in the coastal plain of South Carolina.—Densities of breeding Hooded Mergansers (*Lophodytes cucullatus*) in the southeastern United States are low (Bellrose 1980), and information on their breeding biology is limited. We document the frequency of nesting at a site located in the coastal plain of South Carolina, examine the relationship between fresh egg mass and duckling mass, and report sex ratios of hatching broods. We also report changes in body mass of two female Hooded Mergansers during incubation.

Study area and methods.—Nest boxes were erected for Wood Ducks (*Aix sponsa*) in the mid-1970s on the Department of Energy's Savannah River Plant (SRP) in west-central South Carolina. Twenty-six nest boxes were placed along a 2.5-km portion of Upper Three Runs Creek, a mixed-hardwood swamp forest typical of the southeastern coastal plain (Sharitz et al. 1974). Nest boxes (N = 41–47) also were available in Steel Creek, a section of the Savannah River swamp recovering after the termination of thermal stress from nuclear reactor effluent (McCort 1987). Additional nest boxes (N = 30–59) were located in Carolina bays (see Richardson et al. 1981). Variation in the number of available boxes was due to additions and removals. From 1982–1988, all nest boxes were checked weekly from late January to early July. Length (mm) and breadth (mm) of Hooded Merganser eggs were noted. Fresh egg mass (nearest 0.1 g) of unincubated eggs was recorded with a digital balance. Nesting females were captured, banded, and body mass was recorded during early incubation. Eggs were candled to determine incubation stage and nest initiation date. Females were recaptured when eggs were pipping to measure body mass. Ducklings were web-tagged in pipping eggs (Alliston 1975) to examine the relationship between egg mass and duckling mass. Duckling mass was recorded before the protective keratin sheath on most feather tracts had been preened off. Ducklings were sexed by cloacal examination.

Linear regression of egg dimensions on fresh egg mass was performed with the Statistical