

TULLETT, S. G., AND R. G. BOARD. 1977. Determinants of avian eggshell porosity. *J. Zool. (London)* 183:203-211.

WHITTOW, G. C. 1984. Physiological ecology of incubation in tropical sea birds. *Studies in Avian Biology*, No. 8.

———, G. S. GRANT, AND E. N. FLINT. 1985. Egg water loss, shell water-vapor conductance and the incubation period of the Gray-backed Tern (*Sterna lunata*). *Condor*. 87:269-272.

T. N. PETTIT AND G. C. WHITTOW, *Department of Physiology, John A. Burns School of Medicine, University of Hawaii, Honolulu, Hawaii 96822*. Received 20 Aug. 1984; accepted 17 Apr. 1985.

Responses of Neighboring Conspecifics to Typical and Atypical Songs of a Rufous-sided Towhee.—The songs of passerines may communicate several kinds of information including sex, reproductive status, and species of the singer. Specific recognition depends on song features that are relatively constant among individuals of a species. Occasionally, however, individuals of species not normally considered mimics may imitate the song of another species. Such apparent mistakes in song learning have been reported for a number of species, including the Rufous-sided Towhee (*Pipilo erythrophthalmus*) (Borror, *Wilson Bull.* 73:57-78, 1961; Borror, *Wilson Bull.* 89:477-480, 1977; Richards, *Auk* 96:688-693, 1979). The atypical songs that result from mistakes in song learning may not possess those features necessary for specific recognition and, therefore, conspecifics may not respond to them. If, however, conspecifics learn to associate these imitations with the

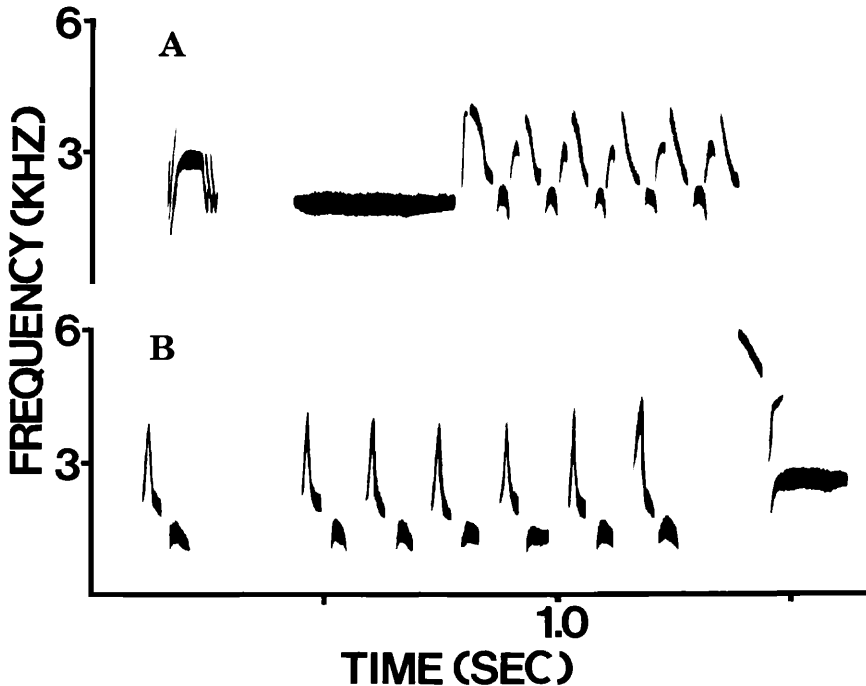


FIGURE 1. (A) Typical and (B) atypical songs of a Rufous-sided Towhee.

TABLE 1. Responses of Rufous-sided Towhees to the typical and atypical songs of a neighboring male.^a

	Approach distance (m)	Songs	Flights	Calls	Time to 1st song
Typical songs					
Pre-playback period (PPP)	21.8	2.6	1.9	0.7	—
Playback period (PP)	4.7	5.2	8.0	19.4	2.08
PPP vs. PP	*	NS	*	NS	—
Atypical songs					
Pre-playback period (PPP)	25.6	3.0	1.4	1.4	—
Playback period (PP)	20.9	0	1.8	4.6	—
PPP vs. PP	NS	NS	NS	NS	—

^a Values for responses are averages for all tests; the significance levels are according to *t*-tests; *n* = 5.

* = $P < .05$, NS = not significant.

conspecific individual, then more typical responses may result (Richards 1979). In this note I examine the responses of Rufous-sided Towhees to typical and atypical songs of a neighboring conspecific.

On 27 May 1983 I discovered a male Rufous-sided Towhee 17 km southeast of Richmond, Madison Co., Kentucky singing atypical songs. I was in this area almost daily throughout the spring of 1983. Thus, I believe that the towhee with the atypical song had just arrived in the area. Observations over the next 2 days revealed that this towhee also sang typical towhee songs. On 31 May and 1 June, I recorded both the typical and atypical songs (Fig. 1). This towhee was gone by 4 June. Experiments with playbacks of recordings were designed to determine if the atypical songs would elicit the same response from a territorial male towhee that a typical song would. Songs were recorded on a Uher Report Monitor tape recorder using a Dan Gibson parabola and microphone. I subsequently made 3-min playback tapes from these recordings. For playback a loudspeaker was placed 2 to 3 m above ground in a bush or tree located within the subject's territory. Five male towhees with territories adjacent to the atypical male were used as test birds.

Each experiment consisted of two 3-min segments (pre-test period and playback period). Each experimental bird was tested with both the typical and atypical songs. Different trials with the same bird were at least 24 h apart. All trials were conducted between 1 and 9 June.

The following features of response were used to ascertain a bird's reaction to playback: number of songs, number of calls, number of flights, distance of closest approach to the speaker, and latency to the first song. Songs included any part of a song. Flights of less than 50 cm were not counted.

The results of the playback experiments are summarized in Table 1. These experiments revealed that whereas neighboring males responded in a significant manner to the typical songs, there was little or no response to the atypical songs. In response to playback of the typical songs, males typically approached the speaker, made several flights in the vicinity of the speaker, and vocalized (both calls and songs).

Richards (1979) reported observations similar to those described here. He reported towhees singing imitations of songs of Carolina Wrens (*Thryothorus ludovicianus*). Further, playback experiments revealed that whereas neighboring male conspecifics responded as strongly to the atypical songs as to typical songs, more distant conspecifics responded only weakly to the atypical songs. Such responses suggest that neighboring males learned to associate the atypical songs with their conspecific rival male. These results differ from those noted in the present study. This difference may be due to changes in towhee behavior during the breeding season. Richards (1979) noted that towhees only interact with neigh-

boring males in the early spring. During this time, males could learn to associate atypical songs with a rival male. Later in the season, countersinging with males occurs at a distance and interactions with neighbors are infrequent. Thus, at this time (e.g., late May and early June) there would be fewer opportunities to form the association between an atypical song and a rival male. Such an association still may develop over a period of time; however, the atypical male in the present study only remained in the area for 9 or 10 days. This apparently was insufficient time for associative learning to occur.—GARY RITCHISON, *Department of Biological Sciences, Eastern Kentucky University, Richmond, Kentucky 40475*. Received 25 Sept. 1984; accepted 10 May 1985.

Replacement Clutches in the Red-throated Loon.—Although replacement clutches have been reported for Red-throated Loons (*Gavia stellata*; Keith 1937, Cyrus 1975, Bundy 1976), those findings were based upon observations of unmarked birds. Replacement clutches are suspected for Common Loons (*Gavia immer*) (McIntyre 1977, Titus and VanDruff 1981) and Arctic Loons (*Gavia arctica*) (Sjolander, pers. comm.). We report here an experiment performed to find out whether replacement clutches are laid by Red-throated Loons.

This study was conducted at Cape Espenberg (66°30'N, 163°30'W), the northernmost cape on the Seward Peninsula in Western Alaska. The Cape is a series of sand dune beach ridges interspersed with numerous shallow ponds and marshes. These ponds supported a dense population of Red-throated Loons (7 pairs/km²). We conducted the experiment in 1979 and made supplemental observations in 1976–1978.

Four pairs of loons were marked at their original nests between 5 and 7 June with green (alkali green), orange (tropaeolin 002), red (rhodamine B), or black (nyanzol D) dyes. Saturated solutions of green, orange, and red dyes were prepared using distilled water. Before these dyes were used, they were diluted by 30% using 95% ethanol to increase penetration of the dye into the feathers. Black dye was prepared according to directions in Melchior and Iwen (1965). Dyes were soaked into absorbent cotton, which was attached to a 10 cm section of clothes hanger, which served as an anchor. These dyed cotton balls were anchored to the inner rim of the nest bowl. Eggs were removed 2 days after placement of the dye, after at least one bird of each pair was confirmed dyed and the other bird should have been exposed to the dye during incubation bouts. Embryos in the removed eggs were estimated by visual inspection to have developed for 5 days or less. We checked ponds at 1–3-day intervals to search for dyed birds and newly laid eggs. We feared that more frequent harassment of the loons might cause them to desert the area.

Both members of each of the 4 pairs were successfully dye-marked. Three of the 4 experimental pairs of loons remained territorial on their original ponds and produced a second clutch of eggs. Distances between first and second nests were approximately 2.5, 6, and 35 m. In all 3 cases where we found replacement clutches, the original pairs remained intact. The fourth pair disappeared from its original pond within one week after destruction of the original clutch. Neither member of this pair was subsequently resighted within a .5 km radius of the original pond. The dye used on these birds (orange) proved difficult to distinguish from naturally acquired stains caused by the mineral-rich ponds, however, and either or both birds could have been present without our detection. No loons established a territory on the deserted pond, however. Time between the destruction of the original clutch and the deposition of the first egg in the second clutch was 12, 13, and 14–15 days.

The time between successive clutches is long, compared to the 30-day nest initiation period at Cape Espenberg. This comparison is significant because each of the 3 successfully re-nesting pairs showed social behavior that minimally delayed production of a second clutch: retention of their original mate and their original territory. Thus, intervals between clutches may have been determined only by nutritional and physiological constraints.

The ability to produce replacement clutches should be a valuable adaptation to occasional high rates of egg predation. During two summers when arctic foxes (*Alopex lagopus*) and red foxes (*Vulpes vulpes*) were active in our area, 83% (n = 6) and 72% (n = 32) of