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Automatic Measuring of Sex-specific Visiting Rates to Nests in Hole-breeding Avian Species

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Feeding rates in birds are often used to estimate parental effort. Measurements of sex-specific feeding rates are sometimes required to answer important questions in behavioral ecology. For example, researchers interested in the reaction of males to cuckoldry in terms of paternal care need a sex-specific measure of parental care (e.g. Møller 1988, 1991, Burke et al. 1989, Hatchwell and Davies 1992).

The common method of measuring feeding rates by observation is very time consuming. For this reason, data collection is usually restricted to short-term observations or a small number of long-term observations. Also, diurnal shifts in parental care may invalidate data (e.g. Kluijver 1950, Gibb 1955) and, as an additional difficulty, sexes may not be easy to distinguish from greater distances. In view of these problems, we have developed a device to count nest visits of hole breeders automatically and for the sexes separately.

The device, that is based on an original idea of Winkel (1977), consists mainly of three subunits: (1) two light barriers that enable one to count every nest visit regardless of sex; (2) a metal detector that counts only visits of one parent previously banded; (3) two registration modules that store the number of visits detected by each of the above mentioned subunits up to a maximum of 99,999 counts. The light barriers and the metal detector are placed in the entrance of the nest box, while the registration modules and a 12-V power supply are placed in a separate box below (Fig. 1). The registration modules must be read from time to time by looking at the digital displays and then reset to zero.

For a parent entering the nest, the first light barrier is near the outside of the nest box, while the second one is at the inner side. Both registration modules count only visits that first trigger the outside light barrier and then the inner one. No counts are added

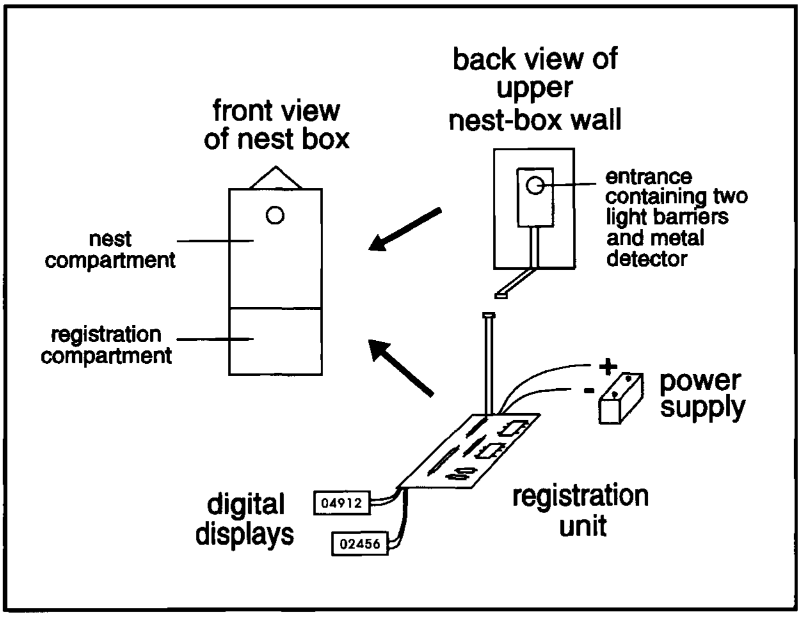

Fig. 1. Sketch of nest box with two compartments. Upper one (12 cm × 13 cm × 22 cm) contains nest, while lower one (12 cm × 13 cm × 16 cm) contains registration unit and power supply. Front lids of both parts of nest box are detachable and, therefore, exchangeable. Thus, not all nest boxes in study area must contain the full electronic equipment. It is sufficient if one changes the front of the upper compartment one or two days before measuring feeding rates.

if the light barriers are triggered in the reverse. Thus, parents leaving the nest are not recorded. Also disturbances due to young, that look out of the nest box shortly before fledging, are restricted to a minimal level.

The metal detector works the following way. When a previously banded individual enters the nest box, the band disturbs the electromagnetic field of a coil and, thereby, induces an electrical potential in a second coil. This potential difference leads to a count on the second registration module. The bands used by us in studies of Great Tits (*Parus major*) were of aluminum and had a mass of approximately 0.25 g.

Sex-specific feeding rates could be determined for the banded sex by the absolute number of visits counted by the metal detector, and for the other sex by calculating the difference between the values of the registration modules of the light barriers and the metal detector. The device has been operated during breeding seasons from 1990 to 1992. Corroboration of the results by simultaneous observation revealed a high level of concordance of recorded visits. For those who are interested in our device, we can provide circuit diagrams and some instructions for installation and adjustments.

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Erratum: Whittingham et al. (1992)

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In a recent note I and coauthors (Whittingham et al. 1992) presented sonagrams of female Red-winged Blackbird (*Agelaius phoeniceus*) songs from North America and Cuba. However, there was an error in our sonagrams of females from North America (fig. 1), which also is reflected in data in table 2. Here we reanalyze our data with the correct female songs from North America and show that our results remain unchanged. Songs of female Cuban Red-winged Blackbirds had greater maximum frequency, lower minimum frequency, and a greater frequency range than North American female songs (see below and Whittingham et al. 1992: table 2). In addition, songs of Cuban females were shorter in duration than female North American type 1 songs.

Figure 1E in Whittingham et al. (1992) is not a female Red-winged Blackbird song, and figure 1F is a female type 1 song from North America, not a type 2 song as labeled. To clarify the comparison between songs of female North American and Cuban Red-winged Blackbirds (table 2) here, we present song parameters ($\bar{x} \pm$ SE) of both type 1 and type 2 songs (as described in Beletsky 1983) from new recordings of North American female Red-winged Blackbirds (recorded in Ontario Canada, 1993). Sonagrams were analyzed as in Whittingham et al. (1993). Type 1 song characteristics ($n = 10$ females): song duration 1.10 ± 0.1 s, maximum frequency 5,020 ± 103 Hz, minimum frequency 2,839 ± 148 Hz, frequency range 2,178 ± 165 Hz. Type 2 song characteristics ($n = 9$ females):