Feeding of Brown-headed Cowbird (*Molothrus ater*) Fledglings by More Than One "Host" Species

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In North America 216 species of birds are known as hosts of the Brown-headed Cowbird (*Molothrus ater*) (Friedmann 1929, 1963, 1966, 1971; Friedmann et al. 1977). Identification of species and individuals as cowbird hosts helps to clarify the behavioral and ecological effects of parasitism on hosts. Status as a host usually is based on records of cowbird eggs or nestlings in host species' nests. However, five species (Brown Creeper, *Certhia americana*; Townsend's Warbler, *Dendroica townsendi*; Hermit Warbler, *Dendroica occidentalis*; Seaside Sparrow, *Ammodramus maritimus*; Evening Grosbeak, *Coccothraustes vespertinus*) and seven subspecies are considered to be hosts even though nests containing cowbird eggs or nestlings have not been reported for them (Friedmann 1929, 1963, 1971; Friedmann et al. 1977). Host status for these species and subspecies has been based solely on an observation of adults feeding cowbird fledglings whose foster-parental history was unknown (Friedmann 1929, 1963, 1971; Friedmann et al. 1977).

We report here four observations of individual fledgling cowbirds fed sequentially by adults of two different species. These observations led us to doubt the validity of host status for species that have merely been observed to feed fledgling cowbirds. We found only one similar report, namely, a cowbird known to have been raised by "vireos" that was fed by "redstarts" (Friedmann 1929). On 13 July 1976, in riparian habitat (primarily *Salix*) along the lower Bill Williams River in western Arizona, K.V.R. observed a fledgling Brown-headed Cowbird repeatedly fed by a Song Sparrow (*Melospiza melodia saltonis*) and fed once by a Lucy's Warbler (*Vermivora luciae*). No interactions between the two adult birds were observed.

On three separate occasions in July 1978, in disturbed riparian habitat bordering the Bitterroot River in western Montana, N.K.K. observed a Brown-headed Cowbird fledgling sitting in an alder (*Alnus tenuifolia*) and calling loudly. On each occasion the fledgling was repeatedly fed by adults of different species. It is unknown whether or not it was the same individual fledgling in all three cases. On 19 July, a male American Redstart (*Setophaga ruticilla*) in adult plumage and a female Yellow Warbler (*Dendroica petechia*) alternated several feedings of a cowbird during a 5-min period. On 25 July, a cowbird was fed several times each by a Red-eyed Vireo (*Vireo olivaceus*) and a Willow Flycatcher (*Empidonax traillii*). Also on 25 July, a female American Redstart and a Red-eyed Vireo each fed a cowbird twice within 3 min; in the subsequent 2 min the redstart alone fed it several times.

We do not know the true foster-parentage of any of these cowbirds, nor whether any of the feeding adults had themselves been parasitized [although all these species are known parasite hosts (Friedmann 1963)]. Woodward (1983) described several instances of adults feeding cowbird fledglings that they had not raised. In all cases, the adults were conspecific with the foster parents of the fledgling, and had themselves been parasitized. He never observed nonparasitized birds feeding cowbirds, nor any feedings of the same individual by more than one species. He suggests that loud and persistent begging behaviors may adapt cowbird fledglings for brood parasitism, although indiscriminate begging by cowbirds may sometimes be deleterious (Ficken 1967).

Our observations, which involved six potential host genera, indicate that feeding of Brown-headed Cowbird fledglings by individuals that are not actual foster parents might be more frequent than previously recognized. Also, the feeding of cowbird fledglings is not conclusive evidence that a species or particular individual is a cowbird host.

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The Influence of Human Disturbance on Tufted Puffin Breeding Success

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Burrow-nesting alcids are vulnerable to human disturbance (Amaral 1977, Manuwal 1978), but little quantitative information exists on the impact of researcher disturbance on estimates of alcid breeding success. We estimated our influence on Tufted Puffin (*Fratercula cirrhata*) reproductive success as part of a larger study of seabird ecology on the Barren Islands, Alaska (Manuwal and Boersma 1977).

The Barren Islands (58°55'N, 152°10'W) are located at the entrance to Cook Inlet in the Gulf of Alaska. The seven islands range in size from 60 to 17,000 ha. We studied the Tufted Puffin colony on East Amatuli Island from May through August 1978. Vegetation on East Amatuli is dominated by beach rye (*Elymus arenarius*), sedge (*Carex* sp. and *Honckenya peploides*), and cow parsnip (*Heraculum lanatum*) at lower elevations and alpine tundra plants (e.g. *Empetrum, Vaccinium, Lupinus, Potentilla*) at upper elevations. The island is treeless. The vegetation, climate, and breeding seabirds on the island were described by Bailey (1976), Manuwal and Boersma (1977), Manuwal (1979), and Simons (1980). The 1.5-ha study site was located above a rocky border along the island's eastern coast. Burrow density was estimated at approximately 830 active burrows/ha. Active burrows were defined as burrows in which Tufted Puffins laid eggs. We divided the puffin colony into three similar areas that received different levels of disturbance. Every effort was made to minimize unnecessary disturbance. Generally, only one of us visited the colony, and our activities usually flushed most of the breeding adult puffins from the vicinity. Approximately 2 h were spent collecting data during each visit, and adult birds generally did not return to their burrows until after our departure. We visited Area 1 every 5 days from late May to early June to determine egg-laying dates. We dug access holes to the nest chambers of longer burrows and covered the holes with weighted squares of plywood. Burrows that contained warm eggs were not checked again for approximately 45 days; they were then checked every 5 days to determine hatching dates, and every 3 days thereafter to collect chick growth data. Burrows in Area 2 were not checked until most eggs in Area 1 had hatched; nestlings were then weighed and measured every 3 days. Burrows in Area 3 were visited only once, 17 August, when nestlings in the other two areas were close to fledging. Burrow occupancy rates and chick sizes and weights were determined during this visit and compared with data from chicks in Areas 1 and 2. All chicks were weighed and measured using 100, 500, or 1,000-g Pesola spring scales and steel caliper. Statistical tests were taken from Dixon and Massey (1969) and Helwig and Council (1979), and significance was assumed at an alpha level of 0.05.

Reproductive success was significantly lower on heavily disturbed Area 1 (6 chicks fledged from 78 total burrows checked, including both active and inactive burrows) than in undisturbed Area 3 (15 chicks fledged from 32 total burrows checked; Chi-square test, $P < 0.001$; Table 1). Assuming that approximately 50% of all Tufted Puffin burrows on the Barren Islands have eggs laid in them (Amaral 1977, Manuwal and Boersma 1977), we estimate that our activities on the colony reduced fledging success from an undisturbed rate of 94% (15 chicks fledged/16 eggs laid; Area 3) to 18% (6 chicks fledged/34 eggs laid; Area 1) in the heavily disturbed area ($\chi^2 = 22.84$, $P < 0.001$).

It is also clear that the development of chicks in the most disturbed area was retarded. Even though logistic growth-rate constants (K values; Ricklefs 1967, 1968) of the nestlings in Areas 1 and 2 were similar, chicks from Area 1 were significantly lighter and had shorter wings than chicks from the less disturbed areas (ANOVA, $P < 0.001$; Table 1). Chicks were also significantly younger in Area 1 than in Area 2. Age

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