Predator Alarm Calls of Young Black-capped Chickadees

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Avian alarm calls are of special interest because of their acoustic structure (e.g. Marler 1955, Nature 176: 6) and the evolutionary forces that have shaped them (e.g. Charnov and Krebs 1975, Amer. Natur. 109: 107). As far as we know, there are no studies of the development of "alarm calls" in young birds. Adult Black-capped Chickadees (*Parus atricapillus*) emit high-pitched calls (High Zees) in response to a variety of potential predators, both avian and mammalian, moving and stationary (Ficken and Witkin 1977, Auk 94: 156). In this paper we discuss certain aspects of the High Zees of young birds.

Four chickadees were removed from a nest at the University of Wisconsin–Milwaukee Field Station, Saukville, Ozaukee County, Wisconsin at the age of about 15 days. The birds fledged the next day; normal fledging age is 16 days (Weise pers. comm.). The birds were housed indoors, and, while they could hear each other, they were never exposed to adult High Zees after we obtained them. We recorded their vocalizations with a Nagra 4.2 tape recorder at 9.5 c.p.s. and a Sennheiser 104 microphone and analyzed them with a Kay 6061 B Sona-graph on intermediate band setting (150 Hz).

When the birds were 18 days of age, the first High Zees were given, apparently elicited by sudden movements of a hand about 0.5 m from the cage. The birds also gave the calls to flowers moving in a breeze and to a large wasp about 4 m from their cage. When the cage was placed near a window, High Zees were given in response to birds flying, including Barn Swallows (*Hirundo rustica*), Red-winged Blackbirds (*Agelaius phoeniceus*), Common Grackles (*Quiscalus quiscula*), and Crows (*Corvus brachyrhynchos*). More rarely the birds gave the calls when they were being fed, a time of excited movements and frequent begging calls. The response to High Zees was usually immobility and cessation of other calls, which is also the usual adult response to these calls. While initially the calls were given at sudden movements, within a few days the birds responded primarily to moving birds.

The calls differed from those of free-living adults chiefly in consisting of a tone with an overtone rather than of a single tone, although this difference could be due to different recording conditions. The mean midpoint frequency of the higher tone is 9.95 kHz ($\pm$0.38, n = 20), of the lower tone 8.73 ($\pm$0.44, n = 20), the latter tone corresponding well to the adult High Zee (8.87 $\pm$ 0.2) (Ficken and Witkin 1977, Auk 94: 156). In our sample size of 20 calls, all four birds called, but we could not always be certain which bird was calling.

Some other calls of the chickadee develop slowly (e.g. the Chick-a-dee call), but High Zees are like those of adults within a few days of their first being uttered. In fact, these calls, along with the hiss, are the first adult vocalizations to appear in development. In the wild, these calls would first be given shortly after leaving the nest while the siblings are still on the parental territory. The selection pressures for early development may be that these calls could function to warn kin such as siblings or possibly parents. Perhaps High Zees may have evolved through kin selection for use by the young, but other selection pressures may be responsible for their retention in adults in winter flocks that are composed of unrelated birds (Witkin and Ficken 1979, Anim. Behav. 27: 1275).

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