

Black-capped Chickadee

Poecile atricapillus

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Sounds and Vocal Behavior

Audio Gallery, or see the full catalog of Black-capped Chickadee sound at Macaulay Library.

Vocalizations

Development

Most complete field studies to date are by Clemmons and Howitz (1990) and Baker et al. (2003). Nestlings give simple peeps the day they hatch. Gradually the calls become louder and more complex, but for the first 4–5 wk post-hatching (they fledge about day 15), the calls are primarily associated with obtaining food from their parents. Chick-a-dees develop gradually from the nestling peep and by 16–17 d approximate adult calls in temporal structure. By day 32 well formed dee syllables emerge and by day 40 the other three types of syllables in the chick-a-dee call emerge (Baker et al. 2003). Many adult vocalizations appear suddenly about day 30–36, including Fee-bees, Gargles and Tseets (Clemmons and Howitz 1990).

Gargles develop from subsong which emerges around 30 d; by 32–40 d gargles may have normal duration and general properties but syllables are still poorly formed when fledglings disperse (Baker et al. 2003). Young chickadees sing a variety of whistled notes soon after fledging, and later converge on the typical pattern. No information on sensitive periods. Vocal learning is understood to occur in the development of fee-bee (Shackleton and Ratcliffe 1993, Kroodsma et al. 1995). Chick-a-dee (Hughes et al. 1998) and Gargle calls (Baker and Gammon 1999). Kroodsma et al. (1995) has found that hand-reared Black-capped Chickadees learn to imitate whistled Carolina Chickadee vocalizations at least as readily as they do their own Fee-bee.

Vocal Array

The vocal behavior of Black-capped Chickadees is complex. Adults have at least 16 different kinds of vocalizations (Smith 1991): Fee-bee; Faint fee-bee; Gargle; Subsong; Chick-a-dee; Begging dee; Broken dee; Variable see; Hiss; Snarl; Twitter; High zee; the Contact note, or tseet (Ficken et al. 1978); as well as the Flight or Restless note (Odum 1942, Smith 1972), the Distress call (Odum 1942, Smith 1972, Clemmons and Howitz 1990), and the Squawk (Clemmons 1995a). Of these 16 vocalizations, three (Subsong, Begging dee and Distress call) are given only by young chickadees; the rest are given by adults. Females are the most likely to give Broken dee, Hiss, and perhaps Variable see vocalizations; males are the most likely to give Fee-bee, Gargle, Snarl, and perhaps High zee (Ficken et al. 1978).

Fee-bee. Typically 2 clear tones lasting approximately 1 second in total. The first note (Fee) higher in pitch than the second note (bee). The second note has a very short amplitude break in the middle which is audible at close range (i.e. bee-ee). Remarkable consistency over the entire geographic range, except for a few populations which show unusual variants, including birds in the Pacific Northwest, Fort Collins, Colorado, and Martha's Vineyard, Massachusetts (Kroodsma et al. 1999, Gammon et al. 2008). Black-capped Chickadees in Fort Collins, Colorado have small repertoires of 2–3 song types (Gammon and Baker, 2004). Fee-bees are given mostly by males, although not exclusively. Can be heard throughout the year, but are most commonly in late winter and spring (Avey et al. 2009). Males can transpose the two-note song across a frequency range of 860 Hz; they sing at one pitch for an average of 31–41 repeats before changing to a new pitch (Horn et al. 1992, Christie et al. 2004a).

The Fee-bee song serves to advertise territories and attract mates (Mennill and Otter 2007). Superficially simple in structure, this two-note song contains individually distinctive components (Christie et al. 2004b) that are important in species recognition (Shackleton et al. 1992) and individual recognition (Wilson and Mennill 2010). Songs are given in extended broadcast performances at dawn during the breeding period (i.e. the dawn chorus), and are also produced in aggressive exchanges during the daytime countersinging exchanges (Mennill and Otter 2007). High-ranking males sing more during the dawn chorus than low-ranking males (Otter et al. 1997); bachelor males sing more than paired males (Otter and Ratcliffe 1993); and birds provided with supplemental food sing more than non-supplemented birds (Grava et al. 2009). Both males and females listen to the singing exchanges that take place between males, and male performance during such exchanges influences female reproductive behavior and male territorial behavior (Mennill et al. 2002, 2003b, Mennill and Ratcliffe 2004a). Both frequency matching and song overlapping are important components of countersinging behavior (Mennill and Otter 2007, Foote et al. 2008a). Song-type matching occurs in the Fort Collins, Colorado population where males have song-type repertoires instead of the ability to change the frequency of the song (Gammon et al. 2008).

Faint Fee-bee. Resembles Fee-bee song in pattern, but is always much lower in amplitude and often shows higher patterns of variability than loud Fee-bees. Given by both sexes, during the breeding season, usually near the nest. Often given by one adult to its mate, especially when males bring food to females incubating or brooding inside the nest cavity (Ficken et al. 1978); also given by parents to fledged young (Dixon and Stefanski 1970).

Gargle. One of the two most complex and highly variable vocalizations given by this species. Given primarily by males throughout the year (Avey et al. 2008). At least 23 syllable types are described; each individual chickadee uses 3–18 (mean 7–8, Baker et al. 2000) which are given in various combinations, which have been suggested to constitute a call repertoire (Baker and Gammon 2006). Typical gargles vary in total number of syllables from 2 to at least 13 (Ficken and Popp 1992), uttered very rapidly, typically lasting only 0.5 seconds in total (Baker and Gammon 2007). Gargles vary with location (Miyasato and Baker 1999) and also from year to year (Baker and Gammon 2007), however some Gargle types show long term cultural transmission (Ficken and Popp 1995, Baker and Gammon 2008). Gargles usually indicate a high level of aggression and often accompany physically aggressive interactions in winter flocks (Dixon and Stefanski 1970, Ficken et al. 1978). Gargles can also be given in a sexual context, sometimes during a male's dawn chorus performance; such Gargles are not associated with aggression, but are often associated with variable sees and copulation (Dixon et al. 1970; Gammon 2004). Both Fee-bees and Gargles have been argued to serve some of the standard functions of song (Dixon and Stefanski 1970, Ficken 1981b, Hailman 1989).

Subsong. Given only by young chickadees, especially dependent or newly independent fledglings in the period after fledging. Frequently contains elements of other, adult vocalizations interspersed with many tonal elements that are most similar to Fee-bee songs. Typically quite faint; often long and sometimes quite musical. Assumed to be important in vocal development, not communication.

Chick-a-dee. The namesake vocalization of the genus is a highly complex and variable vocalization with multiple functions. Given by both sexes. Given throughout the year, although especially common in fall and winter (Avey et al. 2008). Comprised of 4 possible note types, arranged in many combinations with variable numbers of repeats (Ficken et al. 1978, Nowicki 1989, Charrier et al. 2004, Lucas and Freeberg 2007). The recombinant system of note types, permitting an open-ended variety of Chick-a-dee call types, has been likened to human language (Hailman et al. 1987). Certain aspects of the harmonic-rich dee notes contain information on flock identity; captive chickadees held in artificial "flocks" show convergence in the structure of their dee notes over time (Mammen and Nowicki 1981, Nowicki 1983, 1989).

The Chick-a-dee call functions in many different contexts: given by a bird when separated from mate and/or flock; given when mobbing a predator, often involving a particularly long string of dee notes (Odum 1942); given, especially by high-ranking chickadees, as an "all-clear" signal after a predator (which has startled a flock) has apparently left (Ficken and Witkin 1977); given by a chickadee discovering a new food source, such as a newly filled feeder (Ficken 1981a). Studies of a captive flock show that birds add more dee notes to the call when presented with smaller, more threatening predators, and respond to playback of such calls with a more intense response (Templeton et al. 2005). Perhaps one thing common to all these situations is a "come here" message, but more work remains to be done on this call (Smith 1991).

Begging Dee. Given only by young, usually fledging, chickadees. Serves to demand food and possibly as a signal of location (Ficken et al. 1978). Typically directed toward the caller's parents, although not exclusively.

Broken Dee. Given only by females during the early part of the breeding season; usually associated with courtship feeding. Experimental food supplementation reveals that female solicitation calling is dependent on hunger levels (Otter et al. 2007a).

Variable See. Given only during the nesting season. Most common before and during copulation, often in combination with Gargle calls (Gammon 2004). Can be given in other contexts, such as when both members of a pair suddenly meet close to their nest. Given by both sexes; perhaps more often by females. Usually accompanied by wing quivering behavior that intensifies as birds approach their copulation partner. Evidently some microgeographic variation in this call (Ficken et al. 1985).

Hiss. A forced exhalation, typically given when a chickadee is startled while in an enclosed space such as a nest hole. Most commonly given during the breeding season. Widespread among parids; has been called the "snake display" (Smith 1972). May be accompanied by slapping wings against the nest cavity walls, such that the sound involves both a vocal and a mechanical component.

Snarl. A rare, intensely agonistic call, usually given by Black-capped Chickadees only during contact fights. May form a graded series with the hiss (Ficken et al. 1978).

Twitter. Another rare call, most likely to be given in sudden unexpected confrontations with other chickadees. May inhibit attack (Ficken et al. 1978). May also be used when male approaches brooding female, and while giving her food (Clemmons et al. 1995a).

High Zee. The high intensity alarm note, given particularly when a fast-approaching predator is detected. Evidently given more frequently by males (Ficken and Witkin 1977). Chickadees hearing High Zees typically freeze, holding their position until they hear a Chick-a-dee call, "all-clear" signal (see above). May vary with kind of predator (Ficken and Witkin 1977). Has a directional radiation pattern, such that it can be directed toward the caller's mate, and/or away from the predator (Witkin and Ficken 1979).

Contact call (tseet). Given almost incessantly by undisturbed chickadees of both sexes at all times of year. A soft call, probably serving primarily to signal the caller's location to individuals who are nearby immediately. May also serve in agonistic encounters (Ficken et al. 1978, Smith 1991).

Flight or restless note (tsleet). Very similar to the contact call, but seems louder; more notes/s than the contact call. Given primarily when a chickadee pair or flock is about to move off (Odum 1942, Smith 1972). May be a variant of the Contact Call (tseet).

Distress call. Loud squeals, given only by young chickadees captured soon after leaving the nest (Odum 1942, Clemmons and Howitz 1990). May serve both to startle predators and to warn other fledglings of danger. At least two other, undescribed, vocalizations may also be given by adults close to their nest (Clemmons and Howitz 1990; see also Smith 1991).

Squawk. A recently-described call (Clemmons 1995a) associated with parental provisioning. Apparently produced by parents at the nest, stimulating gaping from the nestlings; nestlings respond with increasingly selective response to the Squawk as they mature (Clemmons 1995b).

At least one other poorly-understood vocalization may also be given by adults (the high-low call; Haftorn et al. 1998; see also Clemmons and Howitz 1990, Smith 1991).

Nonvocal Sounds

The snake display, which involves the hiss sound mentioned above, may also include sudden spreading of the wings such that they hit the walls of the nest cavity, making a sharp noise (Smith 1972).

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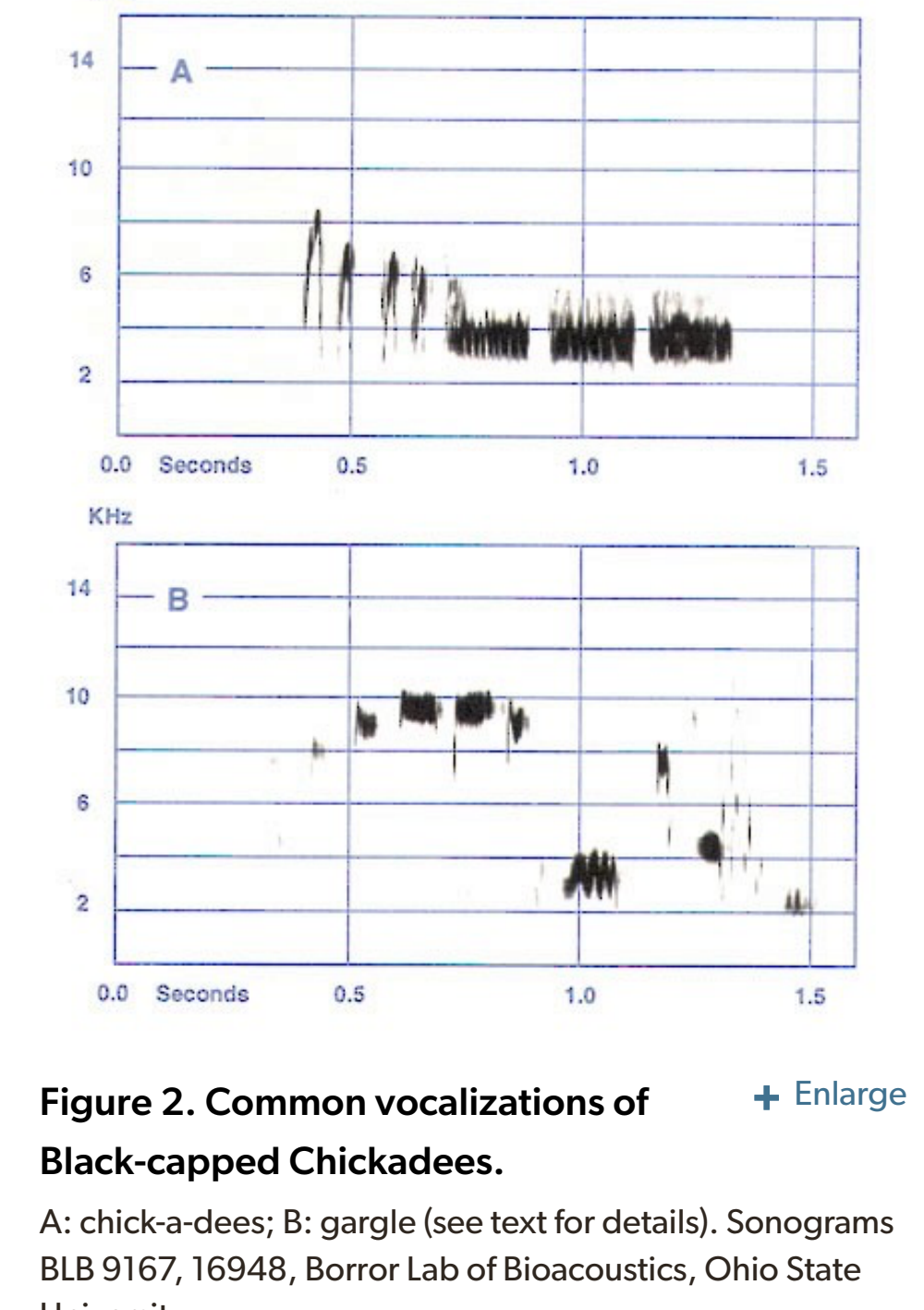


Figure 2. Common vocalizations of Black-capped Chickadees.
A: chick-a-dees; B: gargle (see text for details). Sonograms BLB 9167, 16948, Borror Lab of Bioacoustics, Ohio State University.