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## **RED CROSSBILLS: BREEDING RECORDS AND CALL TYPES IN GEORGIA AND THE SOUTHEASTERN UNITED STATES**

**Ken Blankenship**

*2400 Barrett Creek Blvd #827, Marietta, GA 30066  
kenhblankenship@comcast.net*

**Matthew A. Young**

*Cornell Lab of Ornithology  
159 Sapsucker Woods Road, Ithaca, NY 14850  
May6@cornell.edu*

**Steve Holzman**

*349 Jefferson Rd, Bishop, GA 30621  
steve\_holzman@yahoo.com*

### **Introduction**

Crossbills are cardueline finches, and their name is derived from their distinction of being the only bird species in the world with a fully “crossed” bill – meaning that the tips of the upper and lower mandible do not meet in a point, but cross over one another, either to the right or left. The lower mandible is more curved from the midline than the upper mandible. This special adaptation allows these birds to access their primary food source: the seeds wedged deep between the scales of the cones of various coniferous tree species. This evolutionary specialization also has its downside – in years of major cone failures across large forested areas (hundreds of square kilometers), crossbills may suffer higher mortality rates than other cardueline finches because they are not as efficient at foraging on non-conifer seeds (Benkman 1988). However, recent observations suggest that when conifer seeds become scarce, crossbills will readily eat buds, tree seeds, and insects, particularly in spring (Kelsey 2008, Matt Young pers. observ.).

Different populations of Red Crossbills (*Loxia curvirostra*) around the world exhibit variability in physiological traits and foraging strategies, ranging from ecological associations, to bill size, to voice. Due to this variation, the species *curvirostra* is divided worldwide into as many as 20 or more different forms, subspecies, or “call types.” As many as 10 Red Crossbill call types can be found across North America (Groth 1993a, Benkman 1999, Benkman et al. 2009, Irwin 2010), each of which may represent a different species, or sibling species (Parchmen et al. 2006). There is much debate and discussion concerning the taxonomy of the species. Because there are diagnostic differences in vocalization and morphology, and the types appear to mainly mate with their own type (Groth 1993b, Summers et al. 2007, Benkman et al. 2009), it is believed by some researchers that these call types are in fact separate biological and phylogenetic species (Groth 1993a).

### **History of Occurrence in Georgia and the Southeast**

Red Crossbills have been known to occur in the southern Appalachians dating back to Griscom (1937), and a specific call-type is likely quasi-resident in the area. In Georgia, the Red Crossbill occurs erratically and can range from rare to uncommon, and there are strong historic indications of nesting in the state (Beaton et al. 2003). Most observations are those of birds seen visiting feeders near coniferous forests, and most reports come from the core range in the Appalachian Mountains during winter. There are also reports of sporadic sightings at feeders in the Appalachians in spring and summer, and birders and scientists have detected the species in the field in various seasons over many years (McNair 1988). On some occasions, the species has been found in the upper Piedmont or, rarely, at even lower elevations in Georgia, the Carolinas (Sykes 1967, McNair 1988), Alabama, and Mississippi.

During 1980-2010, there were 75-80 independent sightings of Red Crossbills in Alabama, Georgia, and South Carolina (Fig. 1). The likelihood of a quasi-resident population occupying a core zone within the Appalachian Mountains of the latter 2 states is strongly supported by these data. At least 65% of the sightings occurred in the limited geographical area of those states that lies within the Appalachians. The species was recorded on 18 of the 30 Christmas Bird Counts held during the period in the high elevations of the Cohutta Wilderness in Gilmer, Fannin, and Murray Counties, most involving multiple birds. In contrast, the remaining 35% of the sightings, considered to be on the periphery of the core range or extralimital in nature, were spread out over

a very wide geographical area, ranging from the foothills of the mountains to the Ridge and Valley, and even south to the Fall Line. Furthermore, the majority of those encounters occurred during winter and spring, when Red Crossbills are known to be much more nomadic as they search for large stands of mature conifers with cones that have not dropped their seeds.

Most occurrences of Red Crossbills at lower elevations both at and away from feeders are in or adjacent to large, contiguous stands of mature loblolly pine (*Pinus taeda*) that also usually feature a smaller percentage of Virginia pine (*P. virginiana*) or shortleaf pine (*P. echinata*). A large flock was apparently resident from 1999-2004 at Pine Log Wildlife Management Area (WMA) in Bartow County, in the Cherokee Uplands region of the Piedmont (Beaton et al. 2003; Pierre Howard, pers. comm.). The conifers of that forest are primarily planted loblolly and Virginia pine. This flock was documented consistently for several years, including strong evidence of breeding such as a paired male and female in courtship displays, a female with an apparent brood patch, and streaky juvenile birds (Fig. 2; P. Howard, pers. comm.). Large-scale logging operations in the area may have contributed to the disappearance of this flock, as many mature trees of cone-bearing age were harvested during 2003-2006. Some birds may still be present, but concerted efforts to detect them in recent years have been unsuccessful.

Other areas at lower elevations where Red Crossbills have been observed on multiple occasions include Dawson Forest WMA, Dawson County, and Piedmont National Wildlife Refuge (NWR), Jones County. Both of these forests feature loblolly pine as the dominant conifer species. While Dawson Forest WMA is almost adjacent to the mountains, Piedmont NWR is a very unusual and seemingly unlikely place to find Red Crossbills because of its location in the lower Piedmont. In contrast, a resident breeding flock has been present continuously since 1998 in the Talladega National Forest in northeast Alabama (Summerour 2000), not contiguous with the mountains, but in uplands similar to Pine Log WMA. Both the latter location and the Alabama site are at considerably higher elevations than Piedmont NWR. Red Crossbills were also confirmed to be breeding in Mississippi in 1977 (Warren et al. 1977). Additionally, Red Crossbills have been observed several times since the late 1990s near Caesar's Head State Park in the Appalachians of South Carolina in mature white pine (*P. strobus*) – eastern hemlock (*Tsuga canadensis*) habitat (Andrew Farnsworth, pers. comm.). Records of the species breeding in the Caesar's Head area date back to at least 1988 (Pitts 1988).

## **Opportunistic Breeding Strategy**

Another unique trait of the Red Crossbill is that, unlike many songbirds, its breeding cycle is not primarily dictated by photoperiod and temperature; thus, it is considered to be an opportunistic versus seasonal breeder. In North America, eggs have been found in Red Crossbill nests from mid-December through early September (Adkisson 1996). It has long been postulated that food availability and related social cues, rather than season, are the primary factors triggering the physiological changes initiating breeding by Red Crossbills. Hence, reliable and abundant food likely trigger physical responses in Red Crossbills causing them to settle, begin courtship rituals, and breed, regardless of season.

This pattern of opportunistic breeding has been exemplified by observations of several flocks in Georgia and other parts of the southeastern United States. A male with a female showing an apparent brood patch were observed in courtship displays in February 2003, and a juvenile was observed in March 2004, both in Bartow County, Georgia (Fig. 2). A male was filmed feeding 2 fledglings in Rabun County, Georgia in April 2009 (Fig. 3). This video, a photo of an adult with a fledgling, and a sight report of adults feeding young from feeders in Floyd County in June 1991, represent the strongest evidence of breeding by the species yet documented in the state (Henson 1991; Jeff Sewell, pers. comm.). A very weak-flying fledgling or juvenile was found at feeders in Rabun County, Georgia in July 2008, and a male and female were participating in courtship rituals in White County in May 2009. Groups of adults with juveniles have been recorded in Georgia in every month from February through June (Beaton et al. 2003). A resident flock in the Talladega National Forest in Alabama has been documented nesting in December and March (Summerour 2000 and pers. comm.). Thus, evidence of Red Crossbills breeding in the Southeast (December-July) roughly matches the recorded egg dates for the species across North America with the exception of fall. There is no evidence yet of nesting crossbills in Georgia from August through November.

## **Breeding in Relation to Conifer Reproductive Phenology and Diversity**

The most important habitat factor for ensuring the presence of crossbills is the availability of large stands of mature, cone-bearing conifers that include sufficient species diversity to cover a wide range of cone ripening phenologies. Coniferous trees – and even entire forests – may not produce reliable, abundant

cone crops annually. Abundant or very poor cone crops typically develop in a quasi-cyclical nature every 3-4 years, with average or near average crops occurring in the intervening years (Koenig and Knopps 2000). Thus, in years with very poor cone crops, the birds are essentially forced to wander over great distances in search of a productive foraging area full of cones. It is during such major cone crop failures that southward irruptions of some types of Red Crossbills can occur.

Cone ripening phenologies vary among conifer species. Both loblolly and eastern white pine develop immature cones (i.e., green cones in loblolly pine and conelets in white pine) during May and June that do not mature until the following year in September and October. In spruces, larches, and hemlocks (all soft-coned conifers), the cone crop develops in May and June, and matures the same year from July through September. Because of their dependence on these conifer cones, Red Crossbills in Georgia are generally associated with areas high in conifer abundance and/or diversity. In such areas, eastern white pine and, to a lesser extent, Carolina hemlock (*Tsuga caroliniana*) and eastern hemlock are found. Not surprisingly, these are the predominant conifers in the forests at the southern terminus of the Appalachian Mountains in north Georgia where most of the state's Red Crossbills appear to occur.

### **Recent Evidence of Breeding in Georgia**

Given the irregular history of crossbill sightings in Georgia, usually only a small number annually, a series of sightings in spring and summer 2008 were significant and deserved detailed documentation. Given the irregular history of crossbill sightings in Georgia, usually only a small number annually, a series of sightings in spring and summer 2008 were significant and deserved detailed documentation (Oriole Vol. 73:64, 74). Two flocks, first noted in early summer 2008 in Rabun and White Counties, were monitored sporadically and were present continuously for at least one year. During spring and summer 2008, several reports of Red Crossbills were noted across the northern third of Georgia. These sightings were unusual both in the large number of reports overall, as well as the geographic area over which the reports were distributed. Interestingly, one of the largest southern irruptions on record of Red-breasted Nuthatches (*Sitta canadensis*) had occurred the previous winter, and significant movements of some Red Crossbill types (perhaps because both species rely on conifer cones) occasionally correlate with incursions of the former species (Dunne 2006). Of the 2008 crossbill reports (totaling nearly 20

separate encounters), 2 occurred at feeders in Rabun and White Counties in the mountains, where sporadic visits over the following months showed that these flocks were resident for at least one year. This setting provided opportunities to study the birds at leisure, including the acquisition of many photographs by various observers, as well as audio and video recordings.

On 28 May 2008, a group of Red Crossbills was re-located in Dawson Forest, where the species had first been observed the previous winter. Audio recordings were obtained the next day (Grant McCreary, pers. comm.); though faint, the recordings contained both the male primary song and some call-like notes. Audiospectrographic analysis revealed that these were Type 1 birds, but many of the calls were associated with singing, introducing uncertainty to the results (Fig. 4g; Groth, pers. comm.; see discussion about call types below). Males were observed singing and chasing other crossbills, and both behaviors are probable indicators of breeding but are not definitive. On 25 April 2009, a visit to the residence in Rabun County where Red Crossbills were reported was particularly productive and surprising. During a 2-h observation, at least 12 Red Crossbills of various ages were observed at or near feeders and in numerous mature white pines in the area, including an adult female accompanied by a juvenile bird. A female was observed feeding a juvenile, which was displaying wing-flicking behavior. During the same observation, a male Type 1 Red Crossbill was observed in a bare persimmon tree (*Diospyros virginiana*) feeding 2 very recently-fledged birds, whose plumage was streaky and whose bills had not yet fully crossed (Fig. 3).

### Likely Call Types in Georgia and the Southeastern United States

Morphological features such as bill size, with bill depth appearing to be the most heritable (Benkman 1993), are thought to be the reason certain crossbill call types are associated with particular conifer species. This association with certain conifers is one reason specific crossbill call types are thought to inhabit core zones or particular areas of North America. The Red Crossbill call types typically found in the southern Appalachian Mountains are the large-billed Type 2, the third largest form in North America, and the medium-billed and smaller Type 1 (Groth 1988). Overall, the Type 1 flight call is a quicker, dryer, and sharper flight call: “*chewt-chewt-chewt*” (Young 2008a). Type 2 flight calls are a bit more powerful and huskier than those of Type 1 (Young 2008a). The initial upward component found in the Type 1 is absent, and the downward component of the spectrogram is more gradual (Fig. 4b). Additionally, the call

(as it appears on the spectrogram) will often level out a bit before continuing its downward trend (Fig. 4b). Occasionally, Type 2 birds can also produce a “kinked” type spectrogram (Pieplow 2007) in which there is a strong down-up component before leveling and decreasing (Fig. 4c); however, the kinked type appears to be much more common in the West. The Type 2 flight call can be transcribed as “*cheewp-cheewp-cheewp*” (Young 2008a). Both types can have secondary ending components, but this is much more common and prominent in Type 1 birds (Figs. 4a, b, c, d).

Both Type 2 and Type 1 will readily forage on eastern white pine, but due to their larger bill, Type 2 birds can feed on a greater diversity of conifers, particularly hard-coned varieties. Type 1 is more efficient at feeding on the small cones of hemlocks, which in Georgia are only found in considerable abundance in the mountains. Crossbill researchers have speculated that the most likely Red Crossbill encountered in southeastern forests would be the large-billed Type 2. Indeed, Type 2 birds can occasionally be fairly common in parts of the southern Appalachians (Groth 1988, Groth 1993c). Though Type 2 birds are typically found in greatest abundance in western forests consisting primarily of ponderosa pine (*P. ponderosa*), a hard-coned species (Benkman 1993), they are also the most eclectic in habitat and diet preference, and are therefore the most widespread crossbill call type in North America (Groth 1993c). Although Type 2 Red Crossbills almost certainly occur in Georgia, no recent audio recordings are known to exist for analysis and verification.

Prior to recent work, there was only one previous definitive record of Type 1 Red Crossbills in Georgia – a bird found in a mature second growth, white pine-hemlock forest on Burrells Ford Road in Rabun County (Oberle and Forsythe 1995). Since 2008, all recordings from Georgia (and North Carolina) have been Type 1, which strongly suggests that call Type 1 is likely more common than Type 2 in Georgia, at least in the Appalachian Mountains. Groth (1988) found Type 1 birds to be fairly common and resident in the Appalachians of Virginia and North Carolina. He hypothesized that Type 1 was an Appalachian endemic, but later, after recording a few Type 1 birds in British Columbia, retracted this statement (Groth 1993c). Recent evidence suggests that various call types might indeed occupy a “core range” (Dickermen 1987, Knox 1992, Kelsey 2008, Young 2010). Current research (Young, unpubl. manuscript) strongly supports Groth’s original claim that the Type 1 Red Crossbill is closely associated with the Appalachians.

Unlike Type 2 birds, Type 1 Red Crossbills are not known to use hard-coned pines (loblolly, pitch, table mountain, etc.) as readily; thus, call types

found away from the mountains in the Southeast (and, therefore, away from soft-coned white pines and hemlocks) may be Type 2. However, confirmed audio recordings of Type 1 birds from the loblolly-dominated Dawson Forest in Georgia raise the possibility that Type 1 birds may be more generalized in diet than most of the other types. This assertion is supported by research indicating that Type 1 individuals may nest in several different species of conifers (i.e., perhaps as many as 10 species), with eastern white pine (Groth 1993b), red spruce (*Picea rubens*; Groth 1993b), white spruce (*Picea glauca*; Groth pers. comm.), and eastern hemlock (Douglas Gross, pers. comm.) playing a major role in eastern North America.

Type 3 birds have occurred at least once in Virginia (Adkisson 1996), and Type 10 has been detected in Maryland (Cornell catalog #94205); thus, these call types should not be ruled out in Georgia, though they would be exceedingly rare at best. Another call type that could potentially occur in the southern Appalachians is Type 4, but to date the closest occurrences recorded were in Ohio (Borror catalog #10428) and New York (Young 2008b). A Type 5 bird has been recorded east of the Rocky Mountains only once, in New York in 2006 (Young 2010).

### Research and the Future

The preservation of diverse conifer forests will ensure the Red Crossbill's future in Georgia and the southeastern United States. A recent threat to conifers on which Red Crossbills depend is the hemlock woolly adelgid (*Adelges tsugae*), which threatens to remove eastern hemlock from the southern Appalachians (Tingley et al. 2002). Though it is unknown how the loss of the eastern hemlock would affect the Red Crossbill, one would expect that it would be detrimental to their survival, particularly for Type 1 birds. There is a need for additional research on Red Crossbills across their range, particularly in the Southeast, where they occur erratically and can be quite difficult to locate and study in detail. Based on the findings presented here, is it possible that Type 1 birds are the most common form in Georgia, at least in the mountains? If Red Crossbills will readily forage in large stands of mature loblolly pines in the Piedmont, should a more concerted effort be made to detect them in such forests if public access is available? At least one thing is certain: birders in Georgia should turn on their "crossbill radar" any time they are in the mountains, as well as while birding in popular conifer-dominated Piedmont sites – even if it might seem unlikely for the species to occur in those areas. Furthermore, when Red



Crossbills are encountered anywhere, an attempt to record their flight calls using any available means, including video recorders or even cellular phones with microphones, may lead to a better understanding of the true distribution of call types in Georgia and the Southeast.

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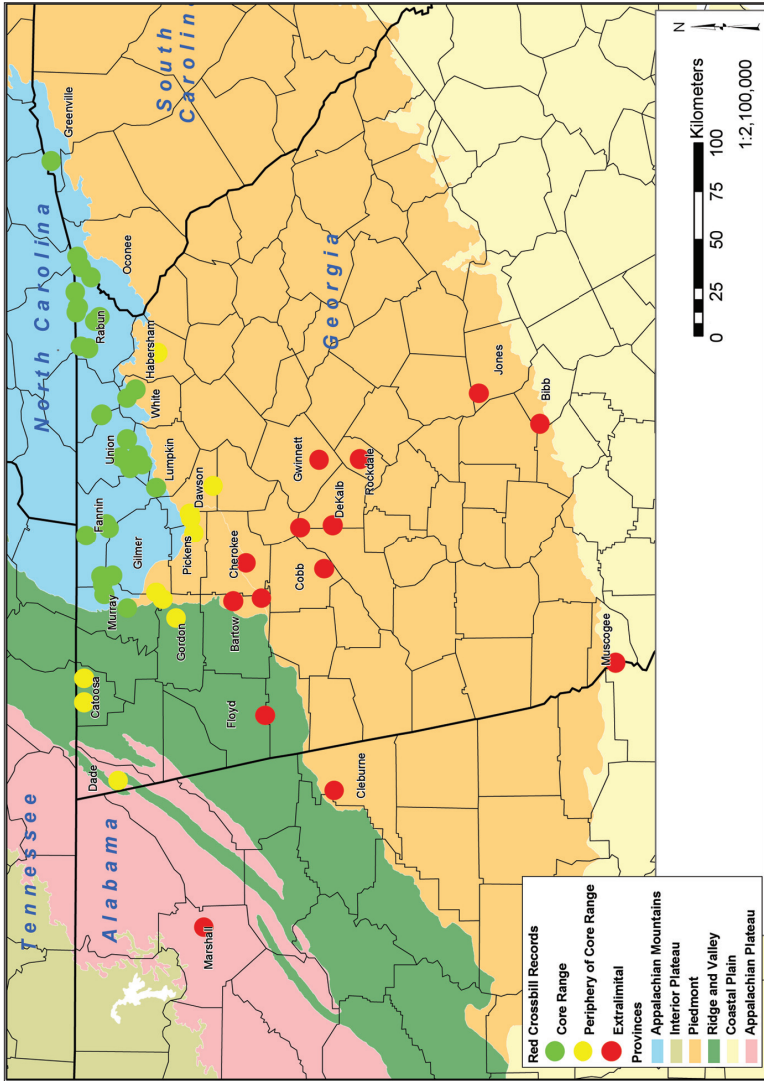


Figure 1. Red Crossbill records in Georgia, Alabama, and South Carolina, 1980-2010. Map by Steve Holzman.



Figure 2. A female Red Crossbill (left) with an apparent brood patch, 8 February 2003; a juvenile Red Crossbill (right) foraging on Virginia Pine, 27 March 2004. Photos by Pierre Howard, Pine Log Wildlife Management Area, Bartow County, Georgia.



Figure 3. A male Red Crossbill (left) with fledgling (head visible); the same male (right) feeding a different fledgling, 25 April 2009. Photos by Ken Blankenship, Rabun County, Georgia.

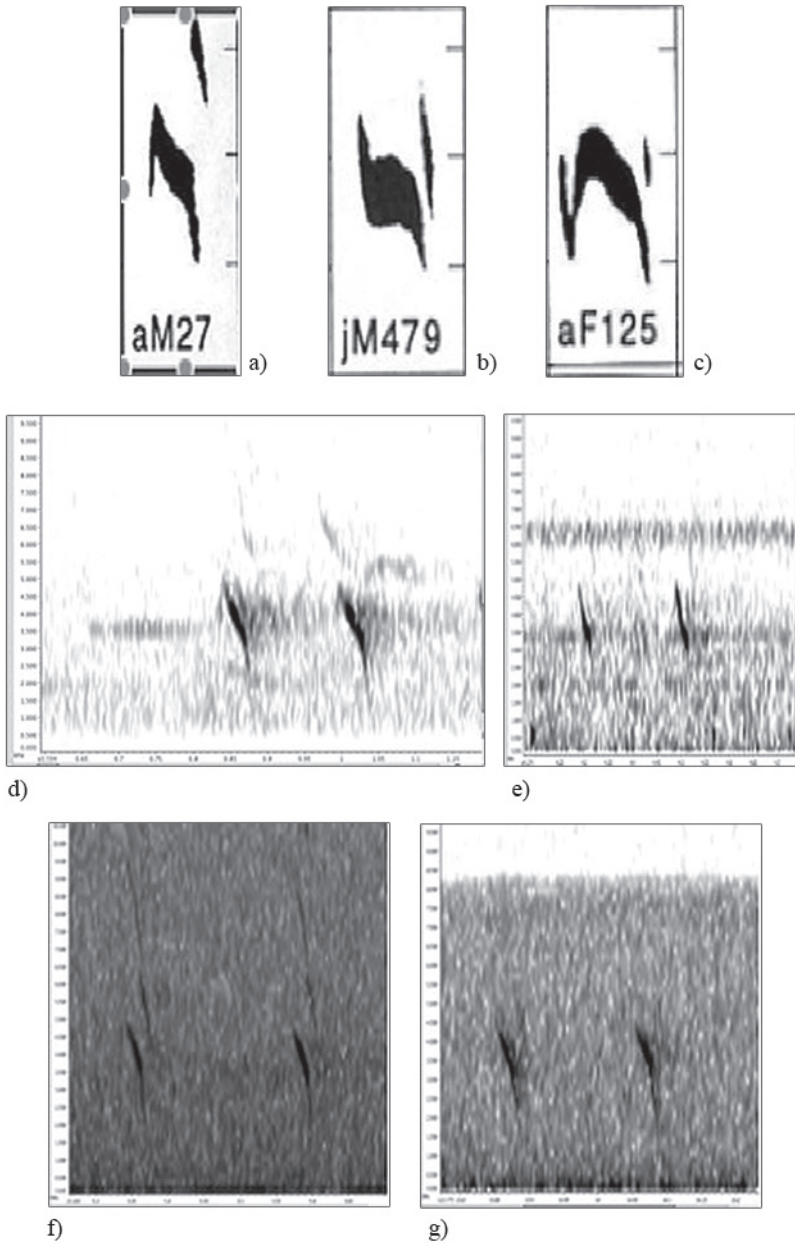


Figure 4. Spectrograms showing (a) a typical Type 1; (b) a typical Type 2; and (c) a “kinked” Type 2. Figures used and adapted with approval from Groth (1993). Spectrograms showing diagnostic flight calls of Type 1 Red Crossbills: (d) 25 April 2009, Rabun County; (e, f) 30 May 2009, White County; and (g) 29 May 2008, Dawson County. Recordings by Ken Blankenship (d, e, f) and Grant McCreary (g); spectrograms by Matt Young.