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A note on the vocalizations of the Chinese Nuthatch.—Within the rather uniform genus *Sitta* there is a species group of four small conifer-dwelling nuthatches: Corsican Nuthatch (*Sitta whiteheadi*), Kabylie or Algerian Nuthatch (*S. ledanti*), Kruper's Nuthatch (*S. kruperi*) in Asia Minor, Chinese Nuthatch (*S. villosa*) in eastern Asia. These nuthatches have a highly disjunct distribution in the Palearctic region. Interest in this group has been stimulated by the recent discovery of *S. ledanti* (Vielliard 1976). Though some comparative information is available on the three Mediterranean species concerning voice, general behavior and details of plumage (Löhrl 1961, Ledant and Jacobs 1977, Ledant 1978, Vielliard 1978, van den Berg 1982), little is known about the Chinese Nuthatch (Löhrl 1988). This species is of particular interest as it is regarded as the most primitive member of the genus (Vielliard 1978). Here we describe vocalizations of the Chinese Nuthatch recorded in the province of Sichuan, China, and discuss the relationship with vocalizations of the Mediterranean nuthatch species.

Study area and methods.—Recordings were made by D. A. McCallum and S. L. L. Gaunt on 29–31 October 1989 and 10–14 May 1991, approximately 80 km N of Songpan, in the mountains of northwest Sichuan Province, People's Republic of China. The "main valley" was visited in both years, a tributary valley (Jiu Zhai Gou National Park) was visited in 1991 only. Both *S. villosa* and, for comparison, the sympatric Eurasian Nuthatch (*S. europaea*) were observed and recorded in conifer forests between 2300 and 2600 m in both valleys. *S. villosa* was also seen at about 2100 m in pine forest in both valleys. *S. europaea* also occurred in *Quercus-Betula* forest in the same elevational range. We recorded vocalizations of at least six *S. villosa* and, for comparison, five *S. europaea,* and heard several others. We did not detect either species at higher elevations in either year, despite approximately two weeks in the field at elevations of 2600–3500 m.

Recordings were made with a Sony TC-D5 Pro II cassette recorder and an Audio-Technica 815A directional microphone, using no parabola, at a tape speed of 4.75 cm/sec. High Bias, CrO_2 recording tape was used. The tapes reside in the collection of the Borror Laboratory of Bioacoustics, The Ohio State University. Recordings were analyzed on a Kay Elemetrics model 5500 digital (DSP) Sona-Graph at a transform size of 100 pts (600 Hz).

Description of vocalizations.—We discerned three basic note-types in recorded vocalizations of *S. villosa.* Type I: harsh, broad-band (3–6 kHz) vocalizations of varying duration (0.23–0.50 msec [N = 14]), repeated at irregular intervals of 0.3 to 1 sec (Fig. 1A, B). The sound is reminiscent of a common ("scold") call of *S. whiteheadi* (Matthysen and McCallum, pers. obs.). Type II: short-duration notes with few or no overtones (Fig. 1C–F); we recorded six variants (IIa–f). All type II notes were 40–65 msec in duration, but they varied in frequency range: 3.2–4.7 kHz (IIa), 2.3–5.3 kHz (IIb), 2.8–4.2 kHz (IIc and IIe), 3.3–4.2 kHz (IId), 3.2–4.2 kHz (IIf). All variants except IIf were recorded in both valleys. Type III: short-duration notes with complex overtones (Fig. 1G). The duration of these notes (mean = 93 msec) was about twice that of type II notes; the frequency range of 2.5–5 kHz was similar to that of the much simpler type IIb variant, but much greater than the other type II variants. Type III notes were recorded in both valleys and in both years.

Type I notes were not grouped in discrete series. Rather they were delivered singly or occurred repeatedly in bouts of vocalizing. They were given spontaneously on occasion (e.g., while a second bird was giving a long series of type II notes), but most type I notes we recorded were given after the observer had stimulated the birds by "squeaking" or "pishing." For example, two birds on 14 May 91 came down from high unseen perches to 2 m above the observer, where they were recorded as they flicked wings and tails while one gave type I notes repeatedly and the other gave "slow song" (see below).

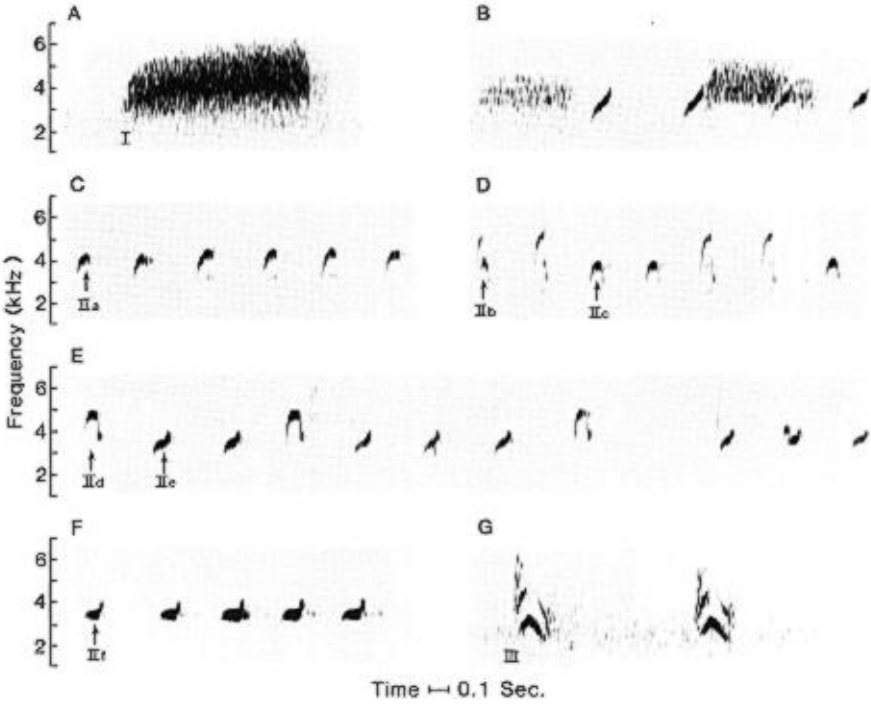

FIG. 1. Sonograms of call notes of the Chinese Nuthatch. A. Type I, single noted, harsh call from recording BLB #17563. B. Harsh call and call type IIe of a second individual, from recording BLB #17563. C–F. Call type II with note types a through f from recording BLB #17423. G. Call type III from recording BLB #17426.

In bouts of vocalizing type II and III notes were combined into multi-note series with patterns that suggest a very simple syntax, as follows: (1) Different note-types are not combined. (2) Variants of type II usually are not combined. (3) Frequency and duration of a given note type or variant does not change noticeably during a single series. (4) Individual series vary markedly in the number and duration of notes. The simplicity of this hypothesized syntax suggests that information is encoded primarily by note type and secondarily by the temporal grouping of notes of a particular type.

Bursts of 5–27 type II notes, separated by intervals of silence roughly equivalent in duration to the bursts were heard and recorded often in spring of 1991 but not at all in autumn of 1989 (Fig. 2). These vocalizations fit the usual conception of "song" (loud, distinct, delivered from high, conspicuous perch). These bursts all possessed an additional syntactical feature; amplitude of the notes increased progressively during at least the first third of the series (crescendo), then levelled off. Notes in "song" series typically were separated by about 100 msec of silence, but one individual increased this interval to 200 msec after coming down from the canopy when the observer "pished." Another individual produced four such "slow songs" of 7–11 type III notes, then gave a long unstructured series of type III notes (see below) before resuming short bursts of type IIe notes.

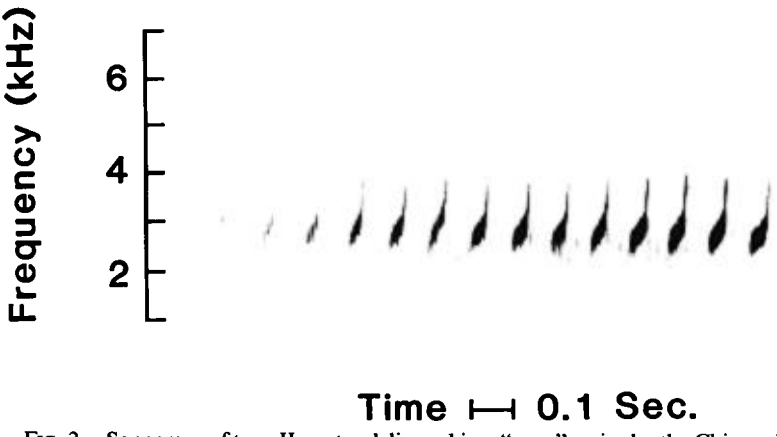

FIG. 2. Sonogram of type IIe notes delivered in a "song" series by the Chinese Nuthatch from recording BLB #17778.

Long series of dozens of type II or type III notes were recorded in spring and autumn. They varied from extremely rapid delivery (inter-note intervals < 100 msec) to irregularly spaced notes with no readily apparent organization. These series were sometimes delivered from treetops, with the bird flicking wings and tail. We detected no clear difference in the demeanor of birds giving these series and those delivering short bursts of notes.

S. europaea produced notes very similar in form to types II and III of *S. villosa* (Fig. 3). We did not detect variants of either type in our small sample. We neither heard nor recorded a type I note from *S. europaea*. *S. europaea*'s syntax appeared identical to *S. villosa*'s, with one additional detail in the case of the short song-like bursts of type II notes. The first note of such a burst was always lower in frequency than those following, and it was flat or rising while the others descended slightly in frequency. Like *S. villosa*, *S. europaea* produced long series of type II notes and series of widely spaced type III notes, as well as the bursts of "song."

Discussion.—The most striking element in the Chinese Nuthatch's vocal repertoire is the harsh type I note. Similar "scold" calls have been reported in all three Mediterranean nuthatches (Löhrl 1961, Chappuis 1976, Vielliard 1978, Ledant 1978), but not in other nuthatch species, including the superficially similar Red-breasted Nuthatch (*S. canadensis*) of North America (pers. obs.). Our recordings documenting the existence of this call in *S. villosa* provide further evidence for the close phylogenetic relationship of the four species (Voous and van Marle 1953, Vielliard 1978).

Although the harsh "scold" call is the most frequent vocalization, after "song" and low-intensity single "contact" notes, in *S. whiteheadi* (Matthysen, pers. obs.) and *S. ledanti* (Vielliard 1978), this is not the case in *S. villosa*. Chinese Nuthatches used both type II and type III notes in the same contexts as the harsh type I notes. Only type I ("scold") notes have been reported in these contexts for the other three Mediterranean species.

All vocalizations of *S. villosa* resemble those of most other nuthatch species in that they consist of simple notes repeated in series that vary greatly in length and internote intervals (Löhrl 1988). The short bursts of type II notes given by *S. villosa* are similar to the "song" of the Corsican Nuthatch (Matthysen, pers. obs., sonograms in Löhrl 1961 and Chappuis

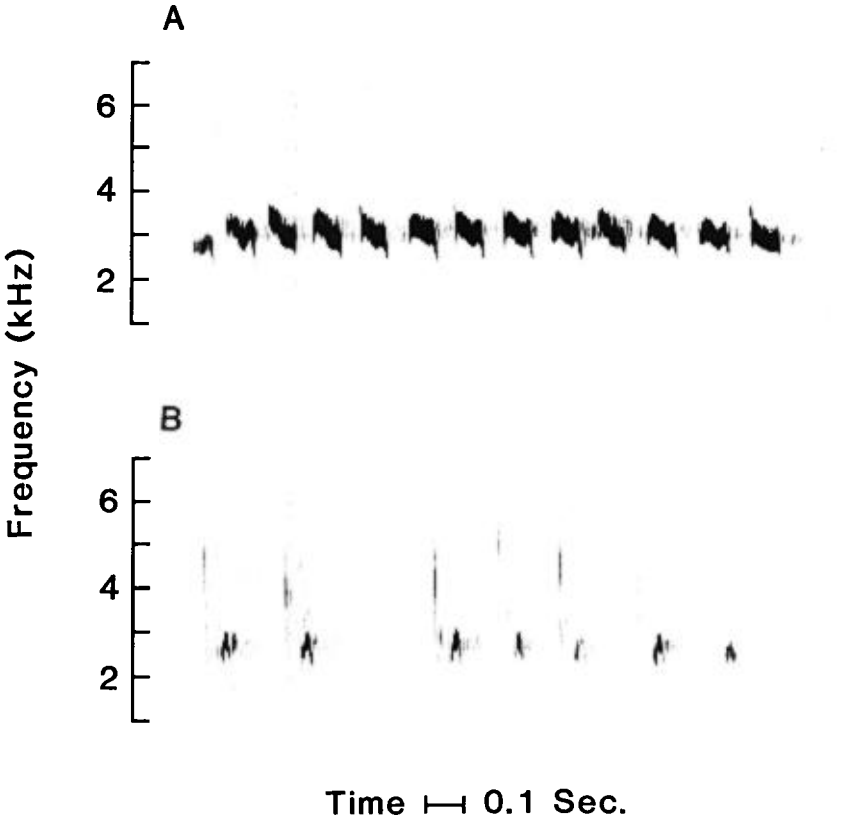

FIG. 3. Sonogram of vocalizations recorded from the Eurasian Nuthatch A. Note type II delivered in "song" series. B. Note type III in call series. Both from recording BLB #17671.

1976) but differ markedly from the "songs" of *S. ledanti* and *S. kruperi* as described by Vielliard (1978).

The Chinese Nuthatch therefore has a full complement of typical *Sitta* vocalizations, as well as the unusual harsh call shared with the Mediterranean group. Vielliard (1978) has interpreted this call as a primitive trait inherited from *Parus*-like ancestors. If that is true, it may be that the typical type II and type III calls (not "songs") have been lost or greatly modified in the Mediterranean species, with the harsh call becoming the most commonly used call. This interpretation is consistent with Vielliard's (1978) contention that the Chinese Nuthatch, with its unique redundancy of call types, is the most primitive member of the genus *Sitta*.

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ERIK MATTHYSEN, *Dept. of Biology, Univ. of Antwerp, B-2610 Wilrijk, Belgium,* SANDRA L. L. GAUNT, *Borror Laboratory of Bioacoustics, Dept. of Zoology, 1735 Neil Ave., The Ohio State Univ., Columbus, Ohio 43210-1293,* AND D. ARCHIBALD MCCALLUM, *Dept. of Biology, College of Charleston, Charleston, South Carolina 29424.* *Received 11 Feb. 1991, accepted 4 Aug. 1991.*