# The long-term stability of pair-specific duet structures in the red-crowned crane *Grus japonensis* can be used for the vocal-based monitoring of territorial pairs through the years

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INTRODUCTION The vocal-based monitoring has proved its use in many bird species and is promising for the red-crowned crane (*Grus japonensis*). This species counts in the wild hardly over 2000 birds and is Endangered in the IUCN Red List status. Loud duets of nesting pairs can be recorded properly from a distance 800 m in nature and are potentially appropriate for the monitoring, however their use in conservation is prevented in the absence of knowledge if the duets are pair-specific and stable through the years.

Figure 1. Spectrogram of the red-crowned crane duet
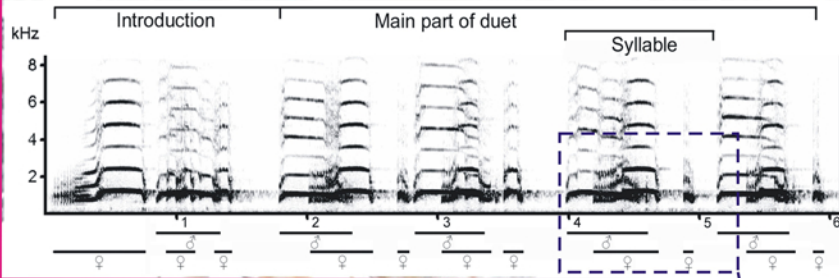
Duet structure

All duets contained introduction and main part. The introduction is an unordered alternation of pair mate calls. The main part is a regular sequence of syllables. Each syllable contains 1-2 male and 1-4 female calls (Figure 1).
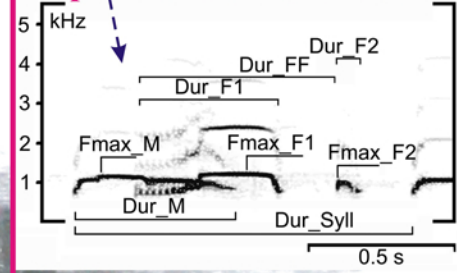
SITES OF RECORDING

In 2003-2006, we recorded 343 duets from 8 captive and 2 wild pairs. The duets of five captive pairs were recorded at Oka Crane Breeding Centre of Oka Biosphere State Nature Reserve (Ryazan region, Russia) in 2003-2006, of three other captive pairs - at Rare Bird Reintroduction Station of Khingansky State Nature Reserve (Amur region, Russia) in 2005-2006, of the wild pair 9 - at Muraviyev Park of Sustainable Development (Amur region), and of the wild pair 10 - at Khingansky State Nature Reserve.

Interpair differences

To test interpair differences in red-crowned crane duets we select 88 duets of good quality (5-10 duets per pair, overall 10 pairs). We measured 8 frequency and temporal parameters from duet syllables (Figure 2) with Avisoft-SASLab Pro. The discriminant analysis standard procedure showed 97.7% correct assignment to pair, significantly higher the value expected by chance. The most important parameters to discrimination are the maximum fundamental frequency of first female call ($Fmax\_F1$), the maximum fundamental frequency of male call ($Fmax\_M$) and the duration of male call (Dur_M).
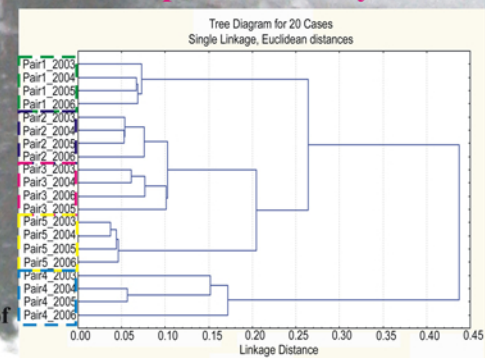
### Figure 2. Measured syllable parameters within duet

Percentages of different syllables

We estimated percentages of syllables with different numbers of female calls per male call in 343 duets of 10 pairs. Syllables with one or two female calls per male call were the most widespread. However preferences of particular sets of syllable types were pair-specific (Figure 3).

Stability of pair identity

For five captive pairs, we examined stability of duet structures throughout four years, 2003-2006. We took 4 - 20 duets per pair per year, 272 duets in total. We measured the same 8 temporal-frequency parameters per duet syllable (Figure 2). MANOVA showed that the effect of pair identity on the syllable parameters was always stronger than the effect of the year of recording. Discriminant analysis standard procedure showed high percentages of correct classification to pair, varying from 98.2 to 100% between years. Cross-validation of duets from the test sets (represented by samples of 2004, 2005 and 2006) with discriminant functions derived from the training duet sets (represented respectively by pooled samples of 2003, 2003-2004, and 2003-2005) showed comparable high percentages of correct classification to pair, varying from 91.2 to 95.4% between analyses (Figure 4).

Reliability of identification for 5 examined pairs was very high both within- and between years. For pairs 1, 4 and 5, the correct assignment of duets to pair was always 100%, whereas mistaken assignment occurred between pairs 2 and 3 (from 1 to 5 of their duets were incorrectly classified in different years). However, these two pairs did differ strongly by percentages of syllables, containing one or two female calls per male call in their duets (Figure 3).

Figure 4. Similarity in duets of five pairs in four years

Figure 3. Percentages of five syllable types within duets.
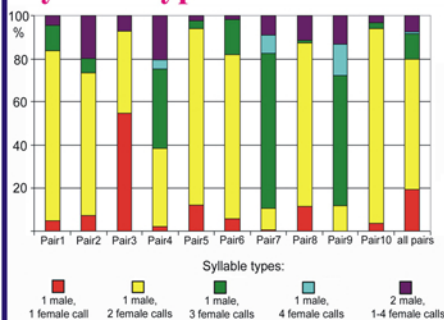
Conclusion Red-crowned crane pairs could be reliable identified by 8 time-frequency parameters of their duets. Combining the quantitative and qualitative indicators has allowed to enhance the reliability of pair identification to 100% for all examined pairs.

Thank you for your interest!