Vocal communication of Siberian crane *Grus leucogeranus*: it doesn't matter, who are you – your sex is important

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• Siberian crane is monomorphic species. Lack of olfactory and visual information may increase vocal dimorphism.

• Cranes lack of behavior dimorphism that assumes lack of vocal dimorphism.

• Siberian crane is one of endangered species. Vocal study is required for remote monitoring.

AIMS

- estimation of vocal repertoire diversity;
- estimation of sex and individual differences in calls;
- estimation of individual features stability.

PLAN OF THE PRESENTATION

1. There are 4 call types and 4 sequences of single calls.
2. Single calls have very high sex features.
3. One of sequences – duet call of a breeding pair – have very high interpair peculiarities.

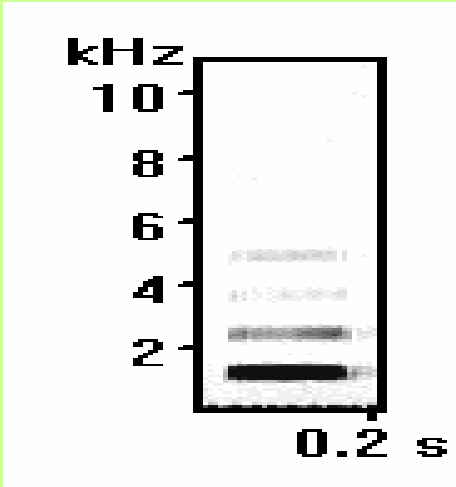
METHODS

- 10 Breeding captive pairs, 2003-2006
- 20 Calls of each type from every bird
- Avisoft-SASLab pro
- Measured parameters: initial, end, max and min, peak frequency, call duration and period of pulsation

RESULTS

- There are four single call types in Siberian crane’s vocal repertoire.
- In addition, there are four sequences - stable bouts of single calls.

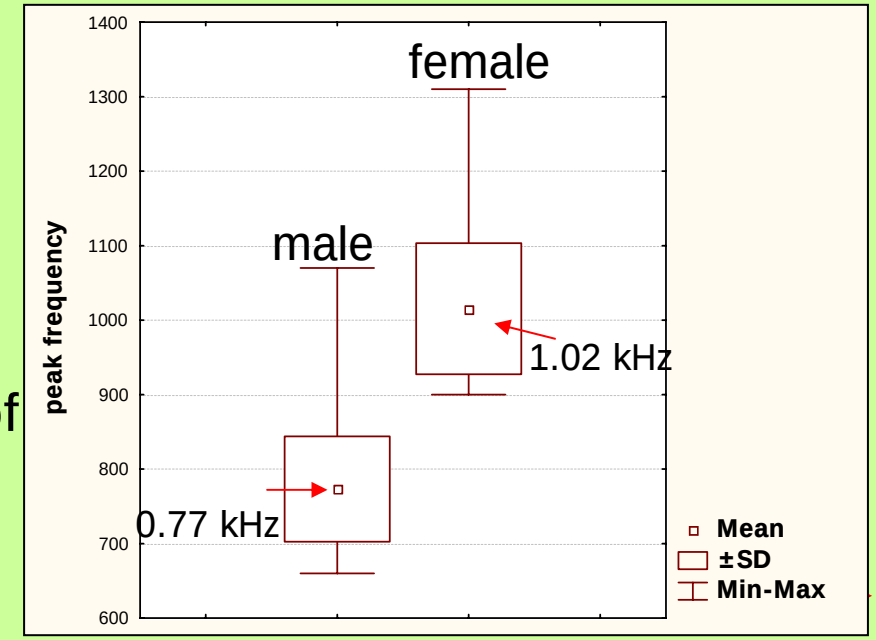
TONAL CALLS
Whine



- Males: F_0=0.77±0.07 kHz, females: F_0=1.02±0.09 kHz.

- Female F_0 is 32.5% higher than male one.

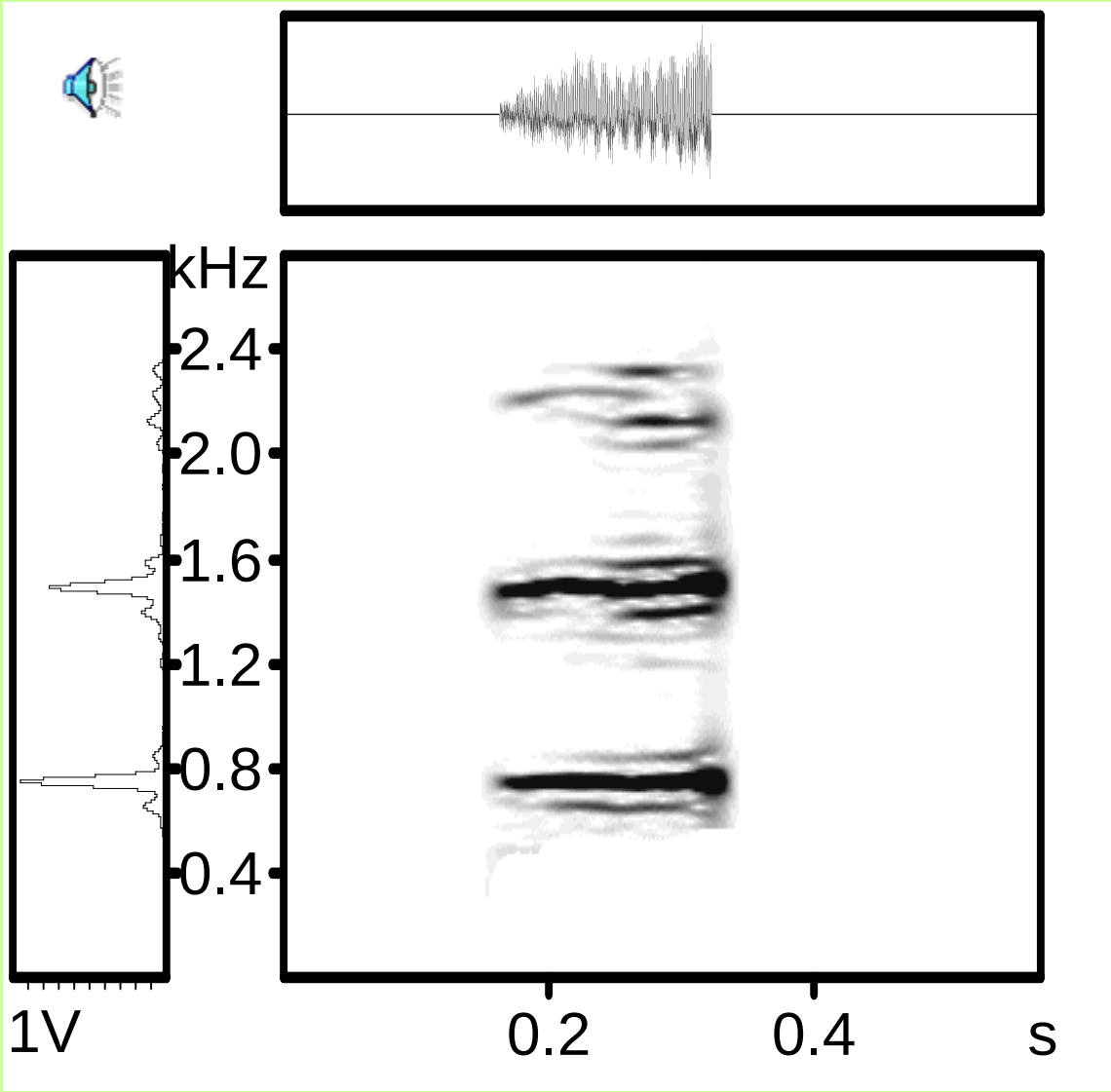
- Individual features: correctly classified 215 calls from 399, i.e. 53.9% (method of classification trees).



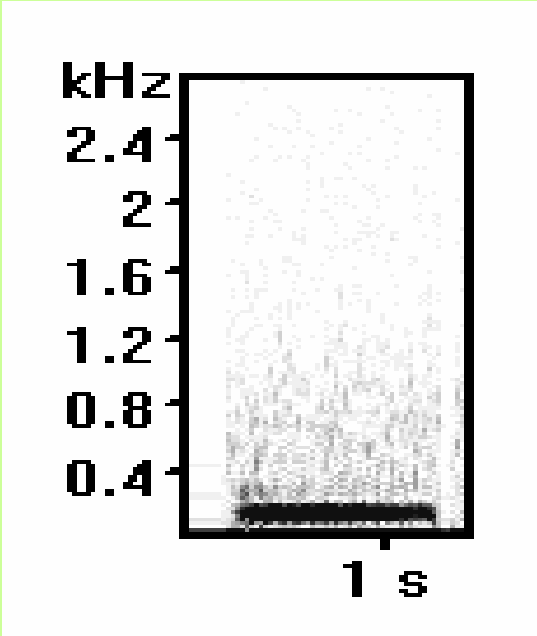
Snuffling whine is a variant of whine.

- Biphonation call with “normal” F_0=0.8-1.0 kHz and G_0=0.07-0.08 kHz.

- Interaction of two frequency leads to sidebands.

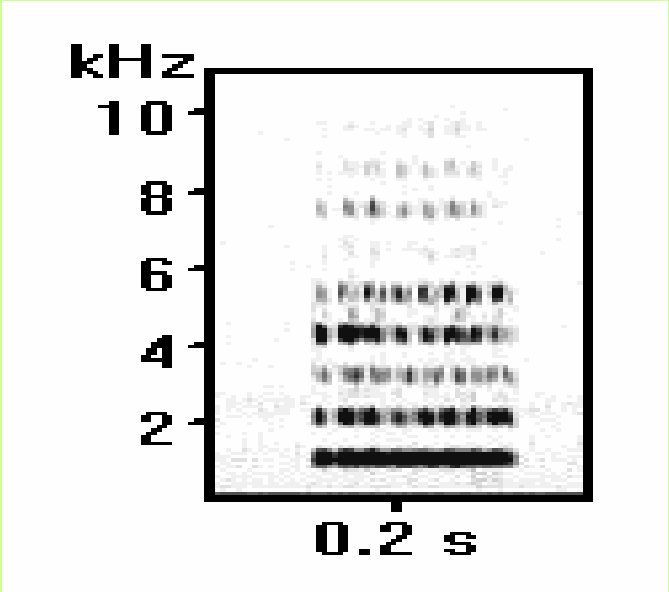


Buzzing - very low tonal call.
F_0=0.14±0.09 kHz



RHYTHMICAL CALLS

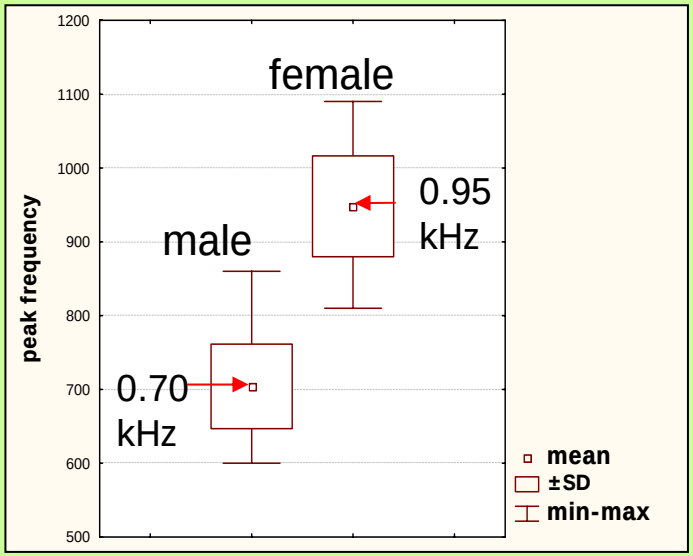
Thrill



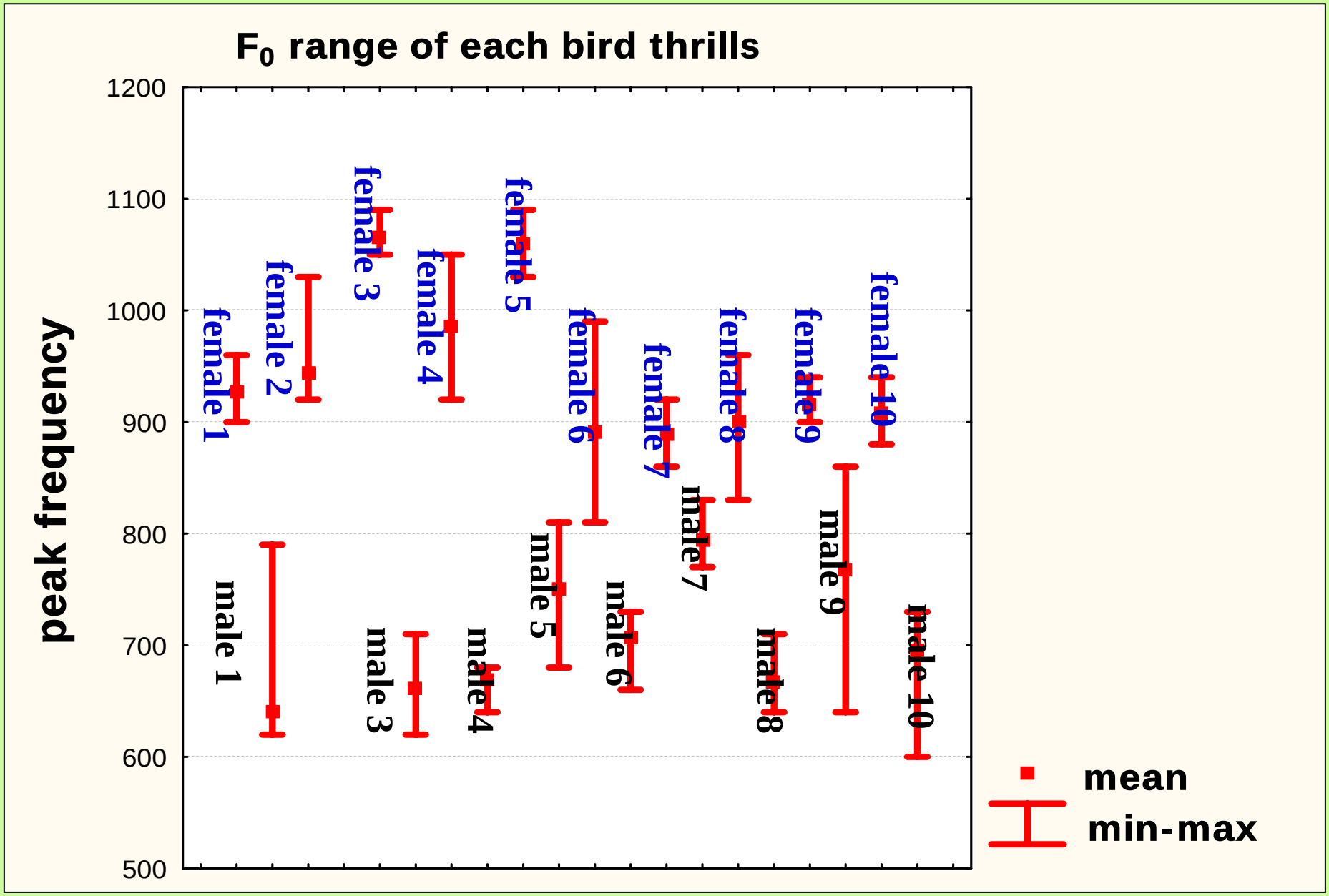
- Males: F_0=0.70±0.06 kHz
Females: 0.95±0.07 kHz.

- Female frequency is 37% higher than male one.

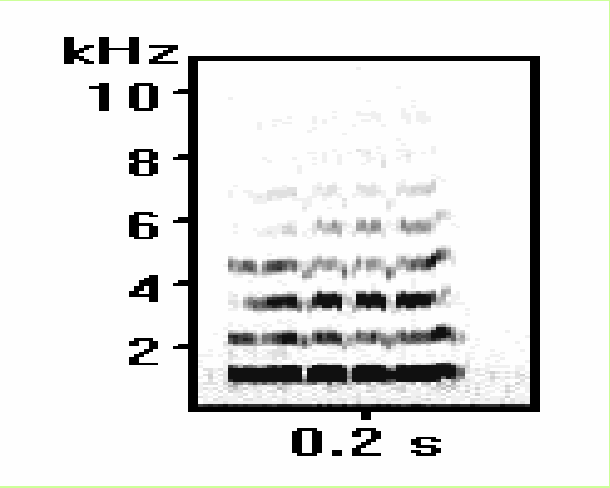
- Individual features: correctly classified 212 calls from 365, that is 58.1%.



Distribution of frequency values for each bird separately; mates of each pair are located together



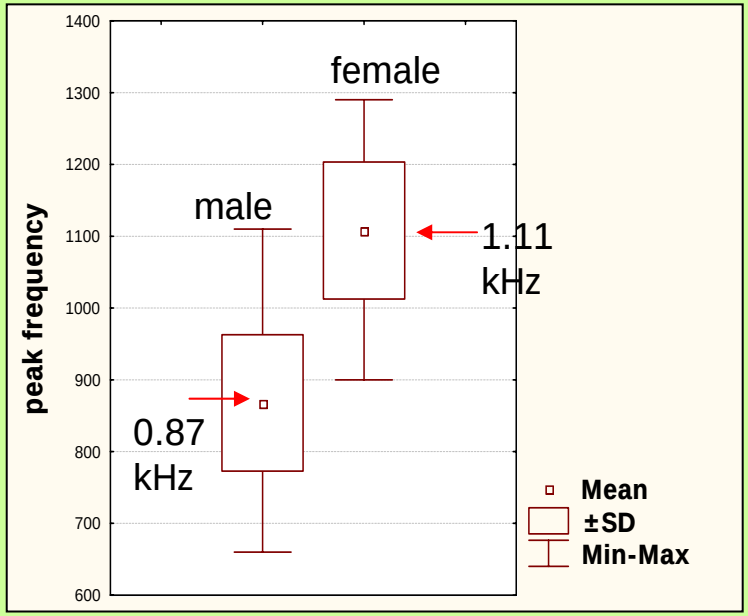
Bleat, or guard call



- Period of pulsation is twice as much as thrill one's.

- Males: F_0=0.87±0.10 kHz, females: F_0=1.11±0.09 kHz.

- Individual features:152 calls of 12 birds from total amount of 200 calls, that is 76%, correctly classified.



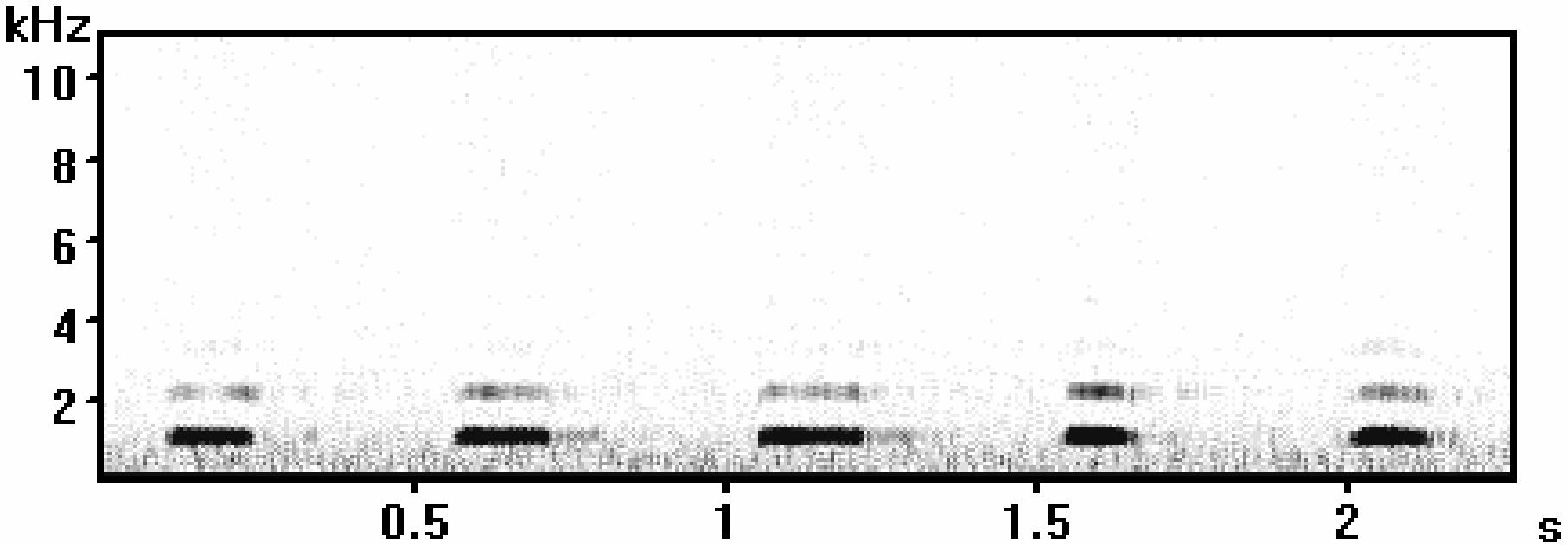
Sequences of single calls - settled bouts with determined functions.

- **Breeding sequence**

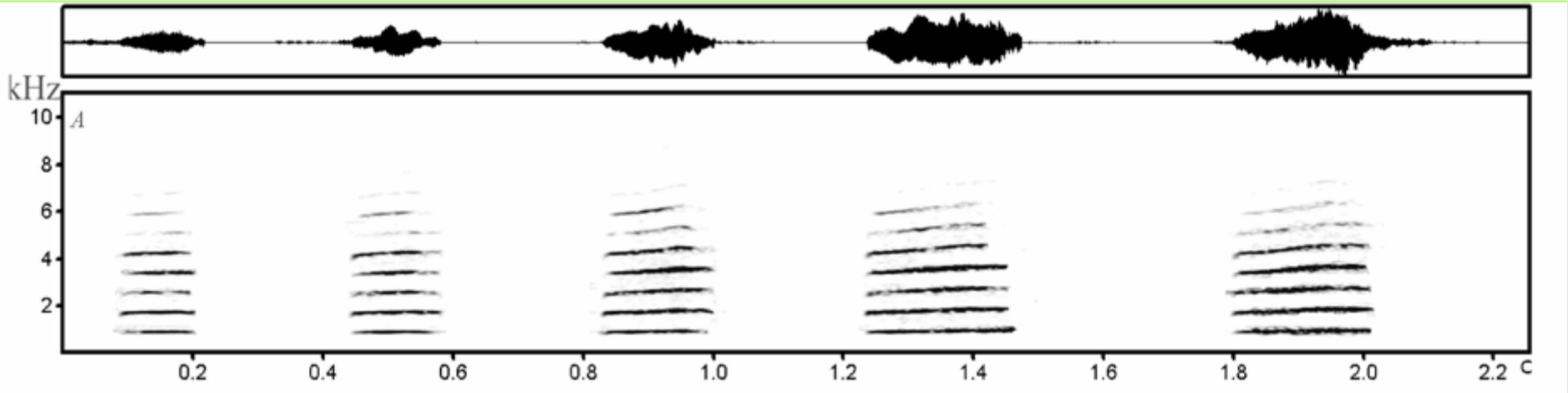
  - produced before copulation by a male or a female;

  - consists of non-modulated whines;

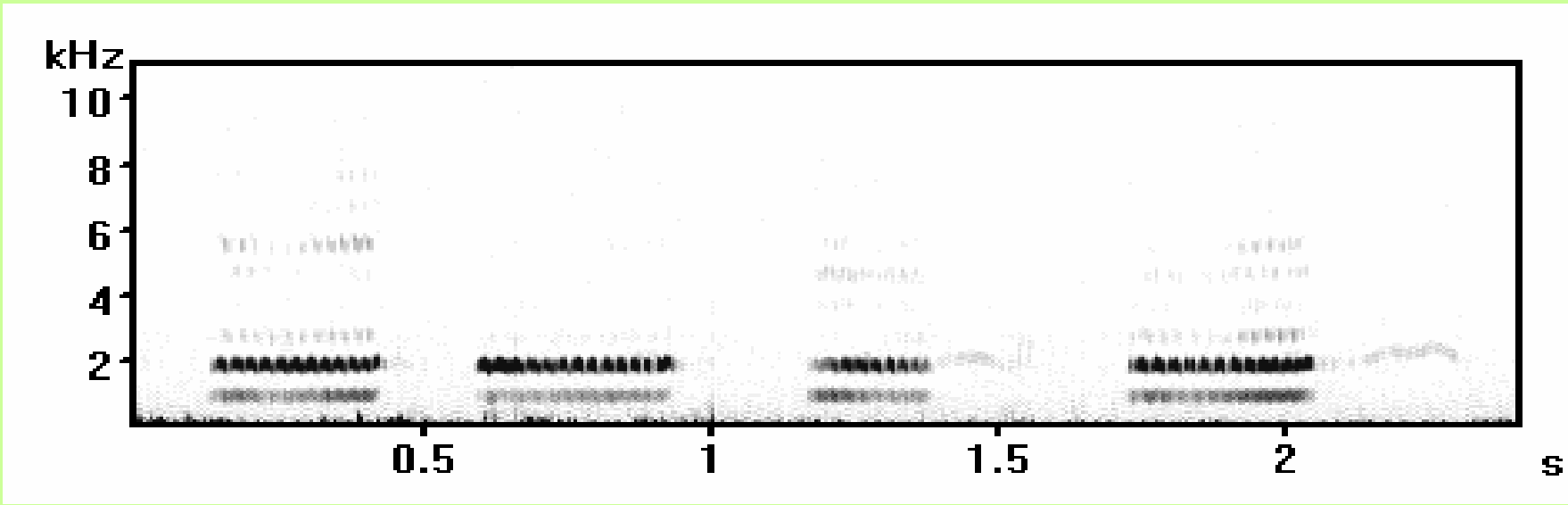
  - very equal duration of whines and intervals.



• **Flight sequence** - whines of increasing intensity. At the end of a sequence a bird usually flies up.

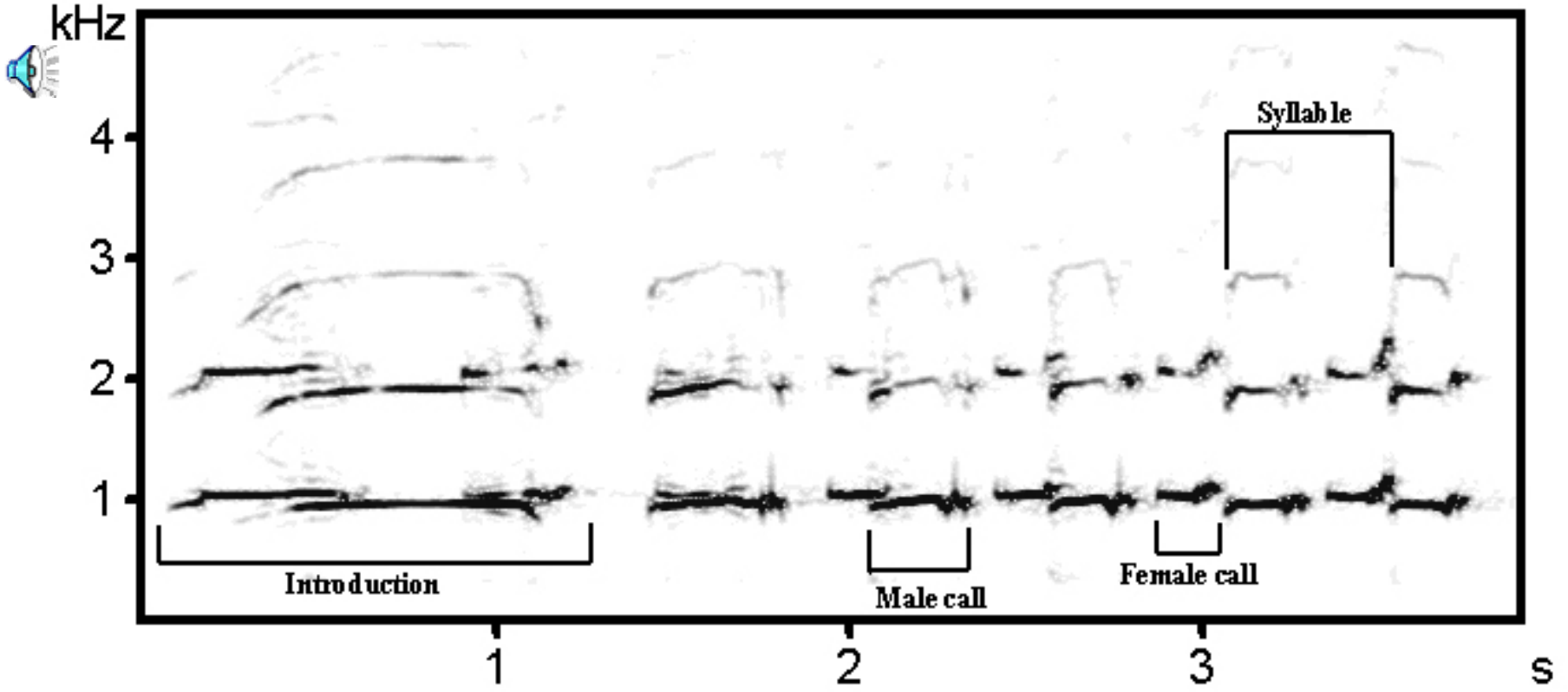


• **Nesting sequence** is a bout of thrills. It's produced during chick hatching, turning nest materials etc.



- **Duet call**

- sequence of male and female calls;
- frequency-modulated whines;
- alternation of male and female calls forms a lot of possibility for individual pattern.



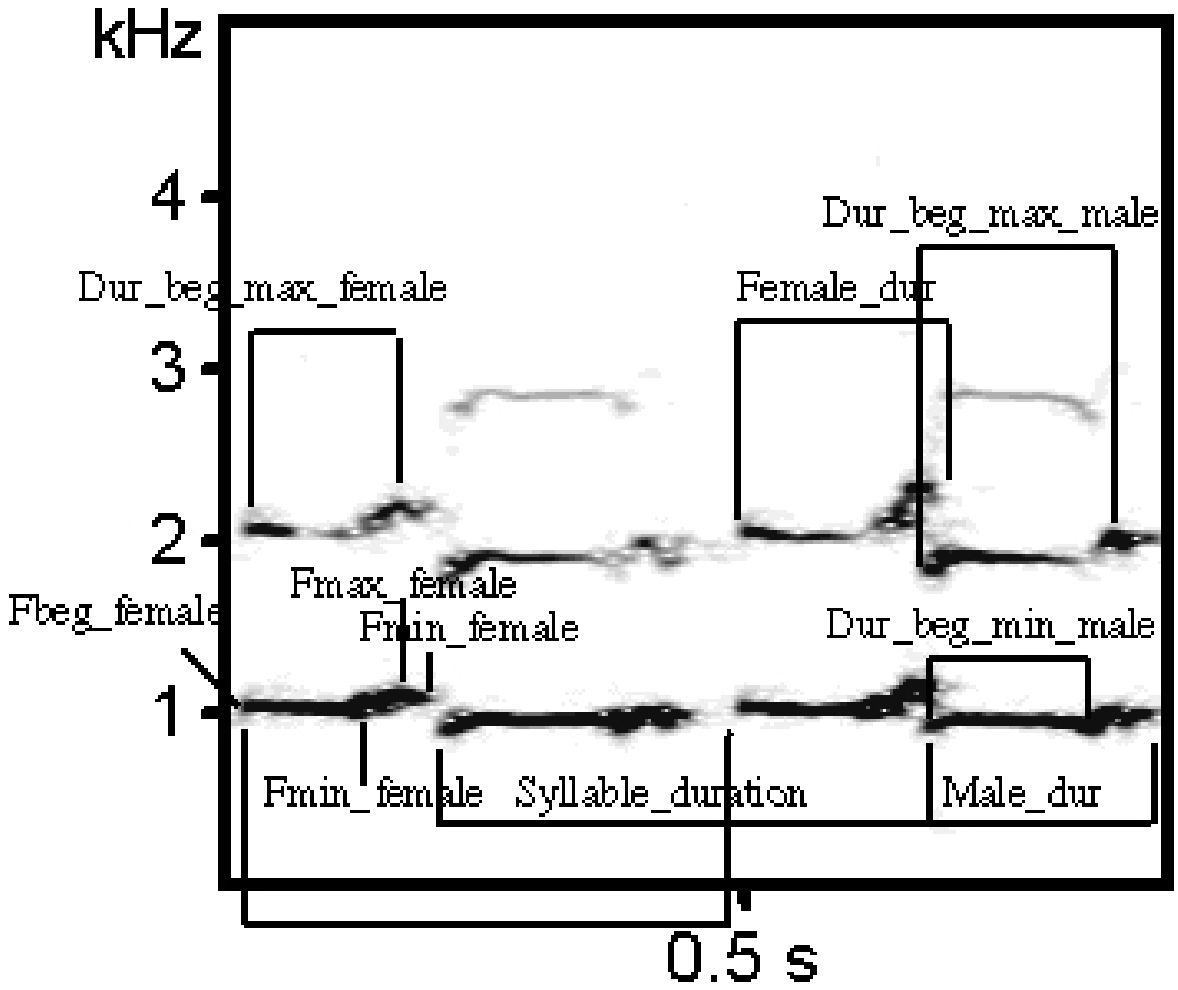
Interpair variability and temporal stability of duets

Method

- 375 Duets from 10 pairs from 3 years: 100 duets from 7 pairs in 2003, 95 duets from 9 pairs in 2004, 180 duets from 10 pairs in 2006.

- 10 Syllables of good quality per one duet.

Measured parameters
Fpeak_female,
Fpeak_male,
Fmax_male,
Fmax_female, Fmin_male,
Fmin_female,
Fbeg_male, Fbeg_female,
Fend_male, Fend_female;
Male_dur - duration of male call,
Fem_dur - duration of female call,
Syllable_duration_m/f - duration from male/female call beginning to male call of next syllable beginning,
Dur_beg_min_m/f –duration from beginning to minimum frequency of male/female,
Dur_beg_max_m/f – duration from beginning to maximum frequency of male/female,
Dur_male_female - duration from beginning of male call to beginning of female call.



Interpair variability and temporal stability of duets

Statistical treatment

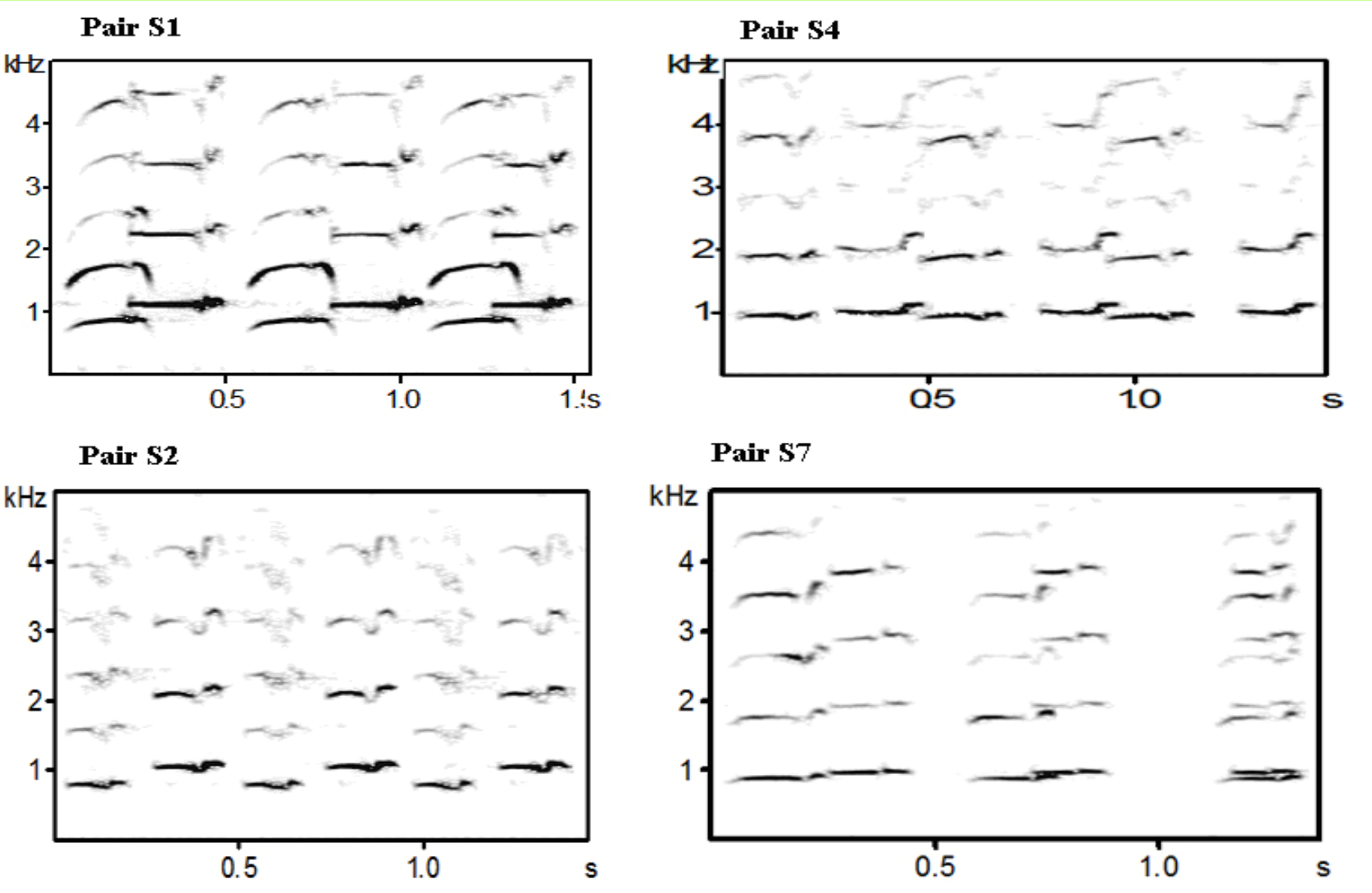
- DFA standard procedure for classification duets between pairs.

- Cross-validation procedures for identification pairs in the following years. Discriminate functions for calls of preceding years used for discrimination of calls of following years.

Interpair variability and temporal stability of duets

Results

DFA - 97.3% of correct assignment a duet to a pair.



Stability through years

Cross-validation of duets from the test sets (represented by samples of 2004 and 2006) with discriminant functions derived from the training duet sets (represented by samples of 2003 and 2004) showed 91-100% of correct assignment of a pair.

2003 within-year classification		2004 on 2003 between-year classification		2004 within-year classification		2006 on 2003 between-year classification		2006 on 2004 between-year classification		2006 within-year classification	
N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
100	**100**	67	**91.0**	95	**97.9**	110	**95.5**	160	**98.1**	180	**100**

- Single calls: well-expressed sexual features but very weak individuality.

- Duets: very high and stable interpair differences.

In breeding pair frequency of male calls tends to be lower than female's one:

- mates may tune their voices after pair formation

OR

- cranes may use vocal sexual features to recognize sex of a conspecific and choose mates

In conclusion

Immature birds: don’t need to be identify individually, but have to know a sex of conspecific for pair formation.

Breeding pair: can profit from ability to distinguish between stranger and familiar pairs because of preventing unnecessary contests.