

Acoustical monitoring of territorial red-crowned crane pairs: is it reality or fantasy?

Or: Long-term stability of pair-specific duet structures in the red-crowned crane can be used for the vocal-based monitoring of territorial pairs in nature.



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One of the most important aim of bioacoustics - individual vocal monitoring (“fingerprinting”) of endangered bird species.

It's applicability was proved for:

- **owls** (Galeotti & Sacchi 2001; Lengagne 2001; Delpont et al. 2002; Tripp & Otter 2006)
- **loons** (Walcott et al. 2006)
- **bitterns** (Gilbert et al. 2002; Puglisi & Adamo 2004)
- **geese** (Volodin et al. 2006)

Advantages of acoustical monitoring:

- 1) It doesn't demands of bird's capture.
- 2) It doesn't decreases survival, as, for example, radio transmitters or collars.
- 3) It allows to observe birds from lager distance.

For development of acoustical monitoring it is necessary to:

- 1) find individual differences in calls,
- 2) test sustainability of this differences from year to year



Aims of the study:

- description of red-crowned crane duet structure;
- examination of interpair differences in the red-crowned crane duets;
- examination of sustainability of interpair differences from year to year.



Totally from
10 pairs were
recorded and
analyzed 343
duets.

1. Oka Crane Breeding Center

5 red-crowned crane pairs:
from 2003 to 2006 272
duets were recorded, 40-65
duets per pair.

2. Rare Bird Reintroduction Station



3 red-crowned crane pairs:

- 2 pairs - from 2005 to 2006

53 duets were recorded, 13-40 duets per pair.

- 1 pair - 7 duets were recorded by Station staff during 1997-1999.

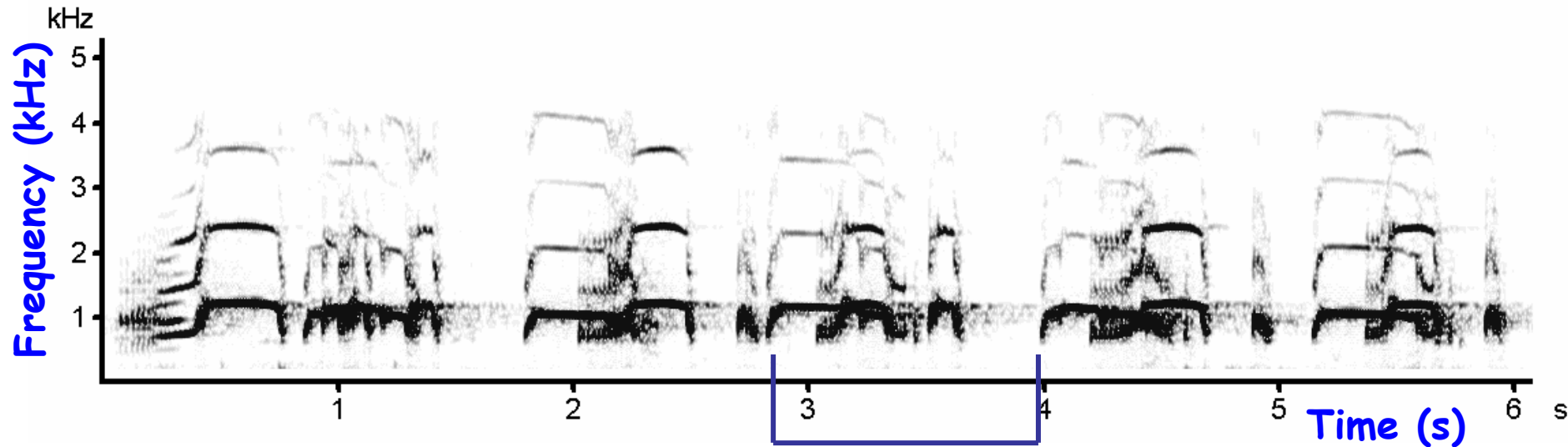
Duets of two wild red-crowned crane pairs were recorded in Muraviyev Park of Sustainable Development and in Khingansky State Nature Reserve in 2006, 5-6 duets per pair.



Results (1). Structure of red-crowned crane duet:

Main part (here it includes 4 syllables)

Introduction



One of the syllables



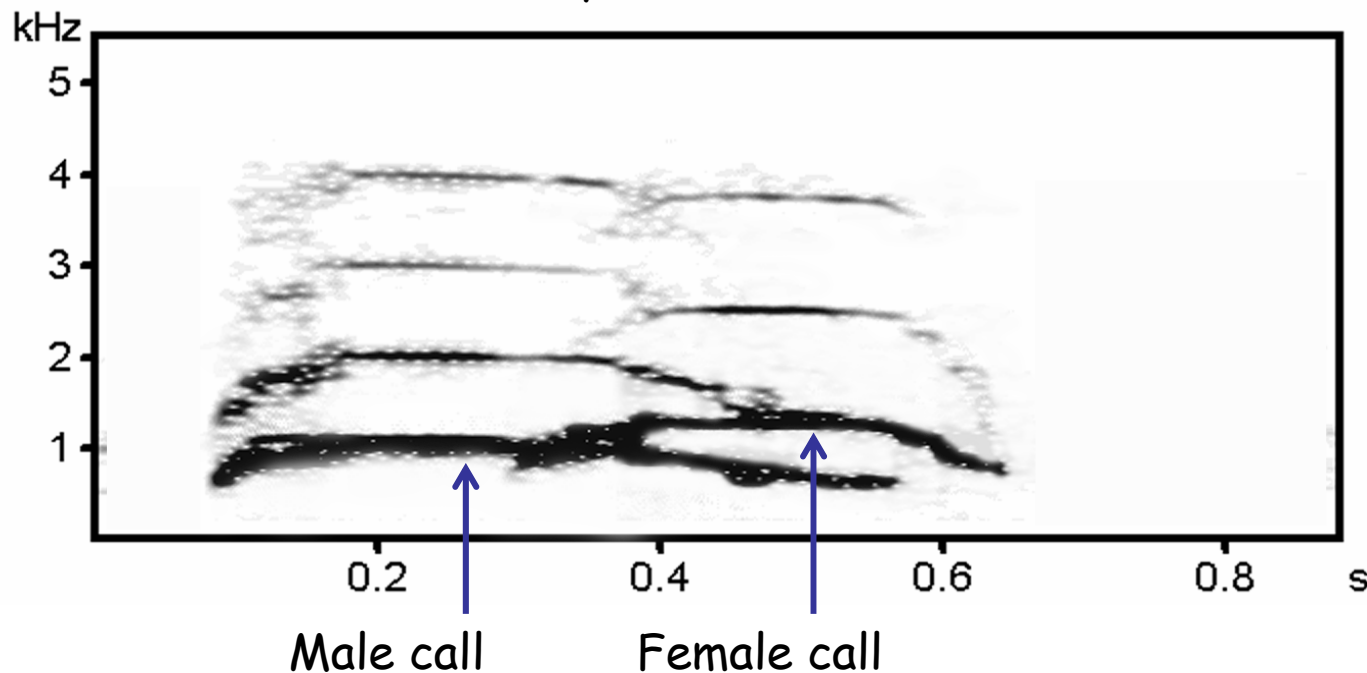
Duet duration - 6.3 - 43.9 (min-max), 19.9 ± 9.5 (mean) s, n=88

Syllable types in red-crowned crane duets

Syllable 1_1 - include one male call and one female call.

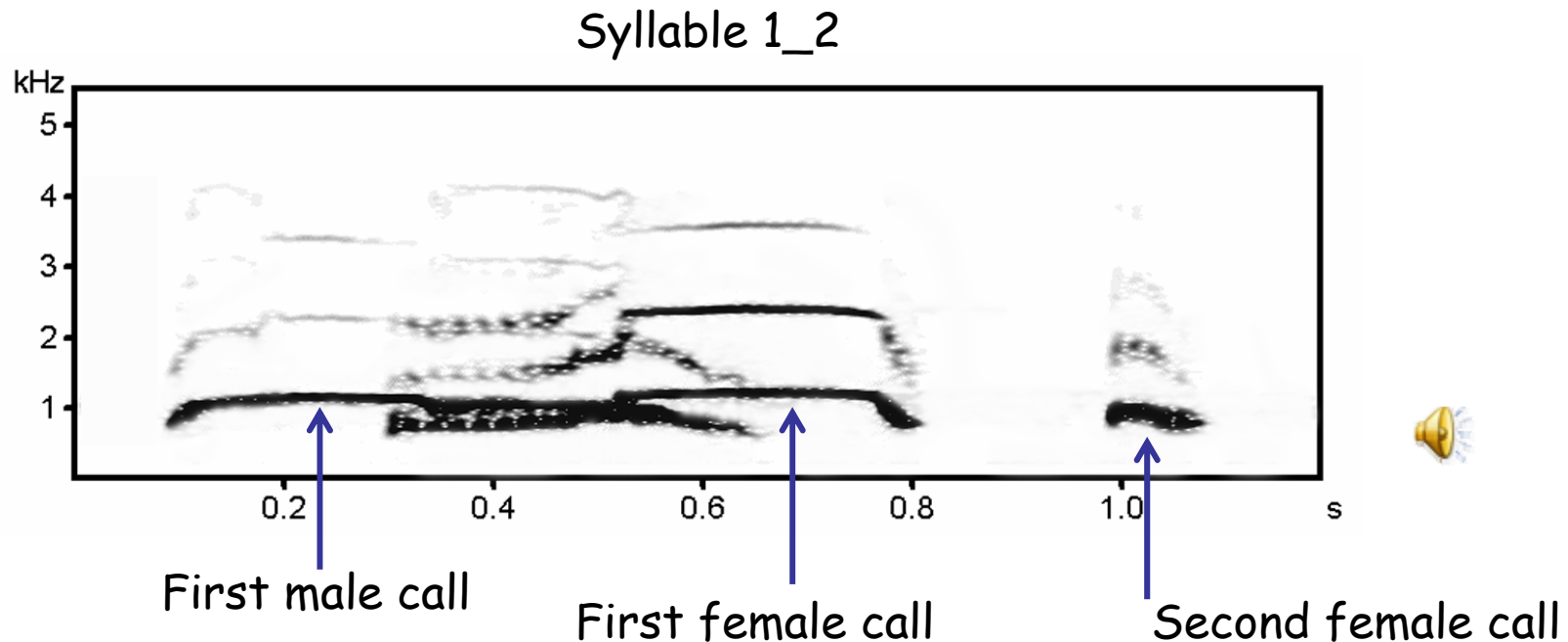


Syllable 1_1



Syllable types in red-crowned crane duets

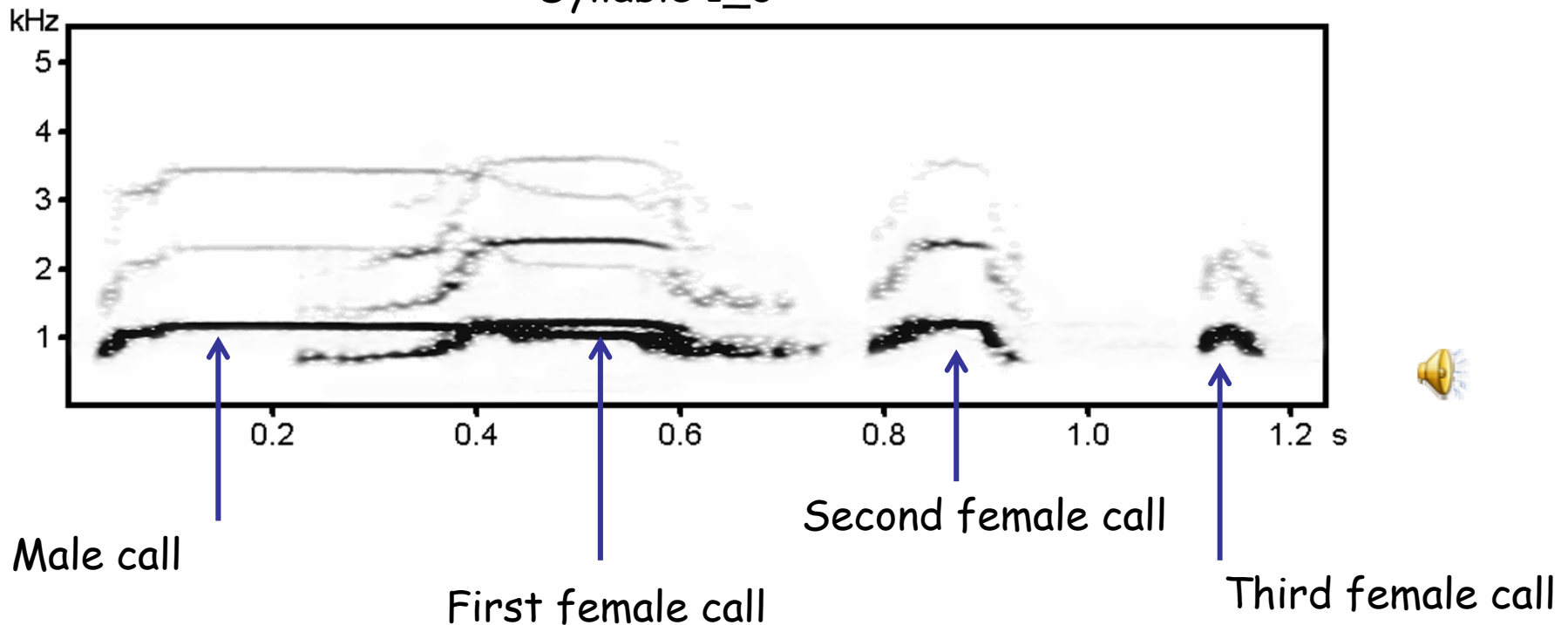
Syllable 1_2 - include one male call and two female calls.



Syllable types in red-crowned crane duets

Syllable 1_3 - include one male call and three female calls.

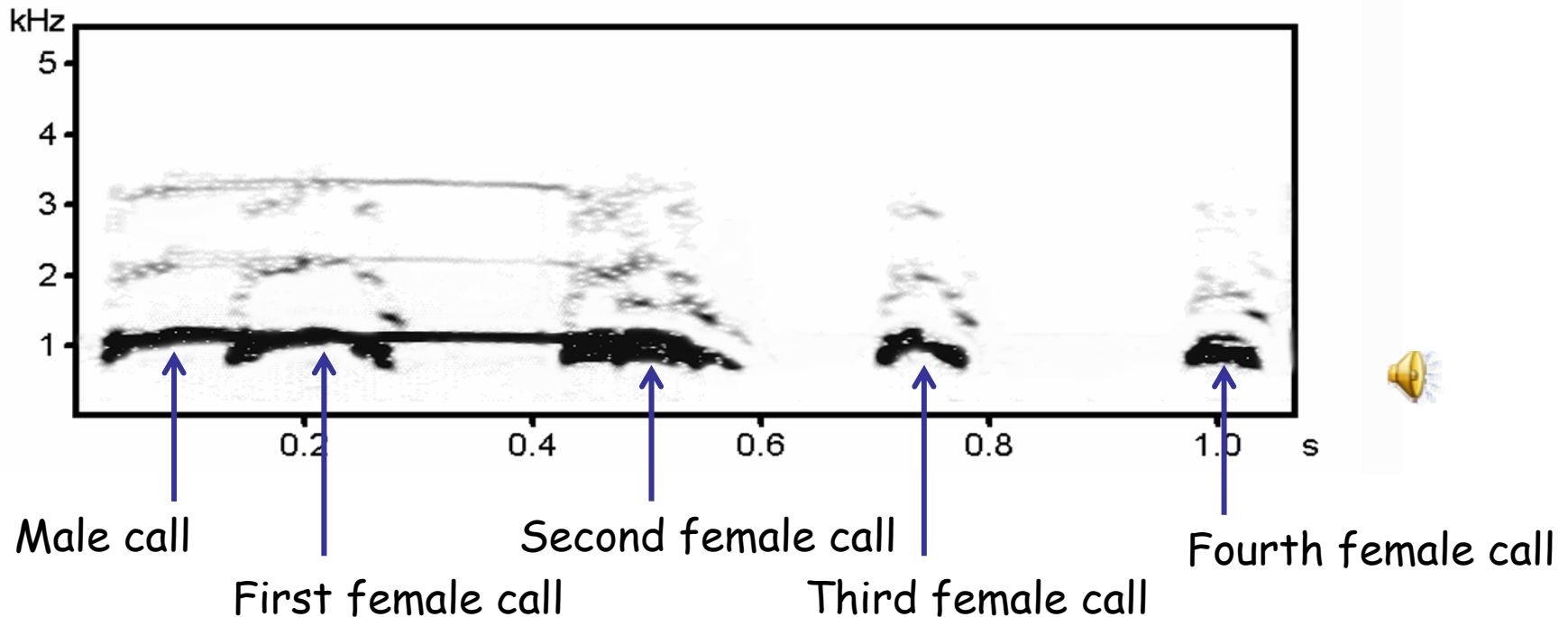
Syllable 1_3



Syllable types in red-crowned crane duets

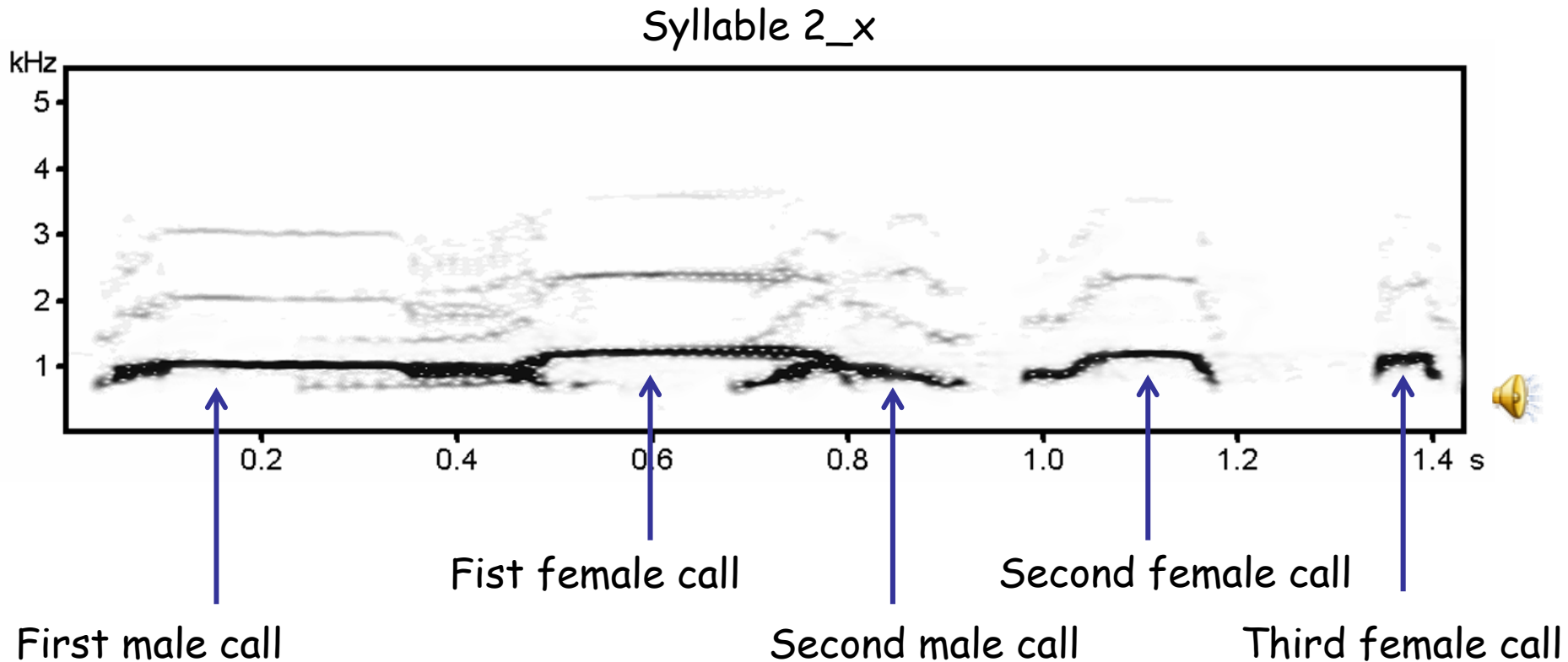
Syllable 1_4 - include one male call and four female calls.

Syllable 1_4

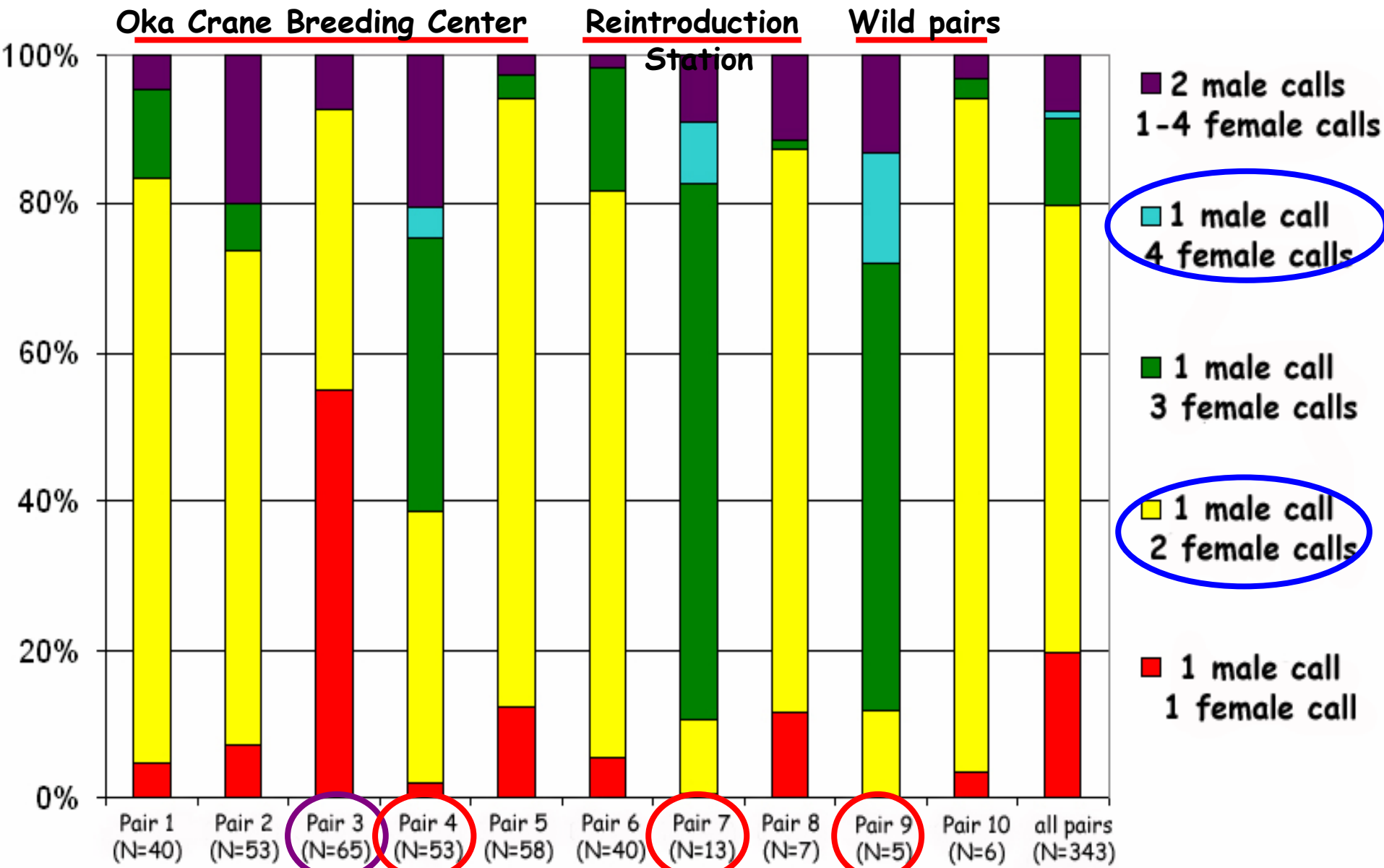


Syllable types in red-crowned crane duets

Syllable 2_x - include two male calls and one-four female calls.

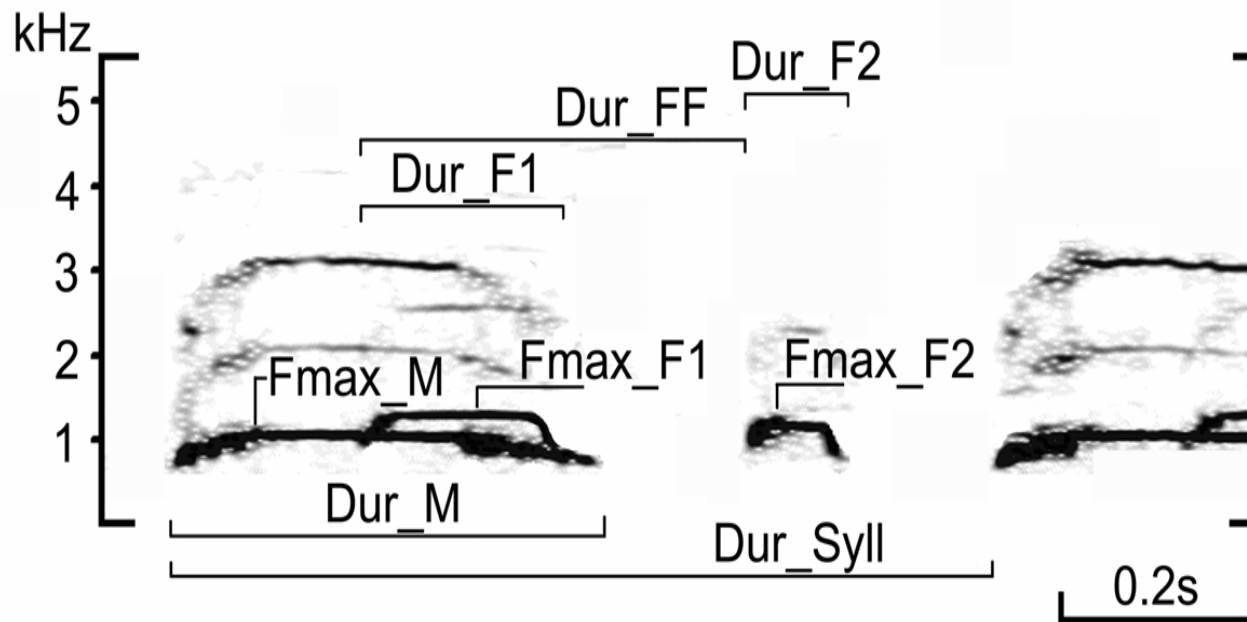


Occurrence of different syllable types in red-crowned crane duets



Interpair differences in red-crowned crane duets

Measured parameters of duet syllables:



Dur_Syll - syllable duration;

Dur_M - male call duration;

Dur_F1 and **Dur_F2** - first and second female call duration;

Dur_FF - duration from the beginning of first female call to the beginning of second female call;

Fmax_M - maximum fundamental frequency of male call;

Fmax_F1 and **Fmax_F2** - maximum fundamental frequency of first and second female calls.

From 2 to 14 syllables were analyzed for each duet.

Results (2). Interpair differences in duets

Использовали дискриминантный анализ - метод, оценивающий межпарные различия на основании всего комплекса параметров.

Results of discriminant analysis:

	Number of duets	% of correct assignment
Pair 1	10	100
Pair 2	10	→ 90
Pair 3	10	100
Pair 4	10	100
Pair 5	10	100
Pair 6	10	100
Pair 7	10	100
Pair 8	7	100
Pair 9 (wild)	5	100
Pair 10 (wild)	6	→ 83.3
Total	88	97.7

In analysis were included duets of 10 pairs, 5-10 duets per pair, total 88 duets.

Random value = 22.1

Results (3). Sustainability of interpair differences

We used crossvalidation analysis:

Step 1. We counted discriminate functions for **training** samples (for duets recorded during one or few preceding years)

Step 2. We used this functions for classification of **test** samples (for duets recorded during the following year)

Thus, duets **2004** were classified using cues of **2003 year**;
2005 - cues of **2003+2004 years**;
2006 - cues of **2003+2004+2005 years**.

In this analysis were included duets of 5 pairs, recorded during 2003-2006, 4-20 duets per pair, total 272 duets.

Sustainability of interpair differences

Results of crossvalidation analysis (shown only crossvalidation of duets, recorded in 2006 year):

	Discriminant analysis		Crossvalidation analysis	
	Number of duets (2003-2005)	% of correct assignment	Number of duets (2006)	% of correct assignment
Pair 1	20	100	20	100
Pair 2	33	100	20	→ 95
Pair 3	45	95.6	20	→ 85
Pair 4	49	100	7	100
Pair 5	38	100	20	100
Total	185	98.9	87	95.4

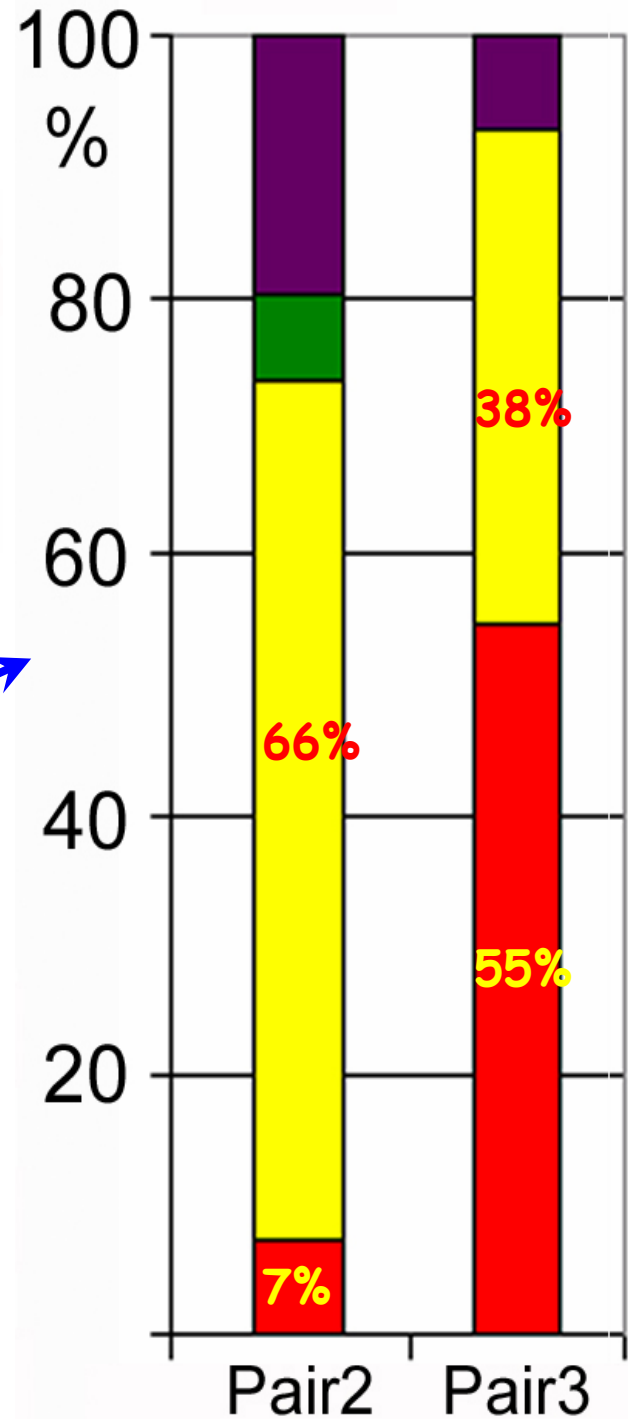
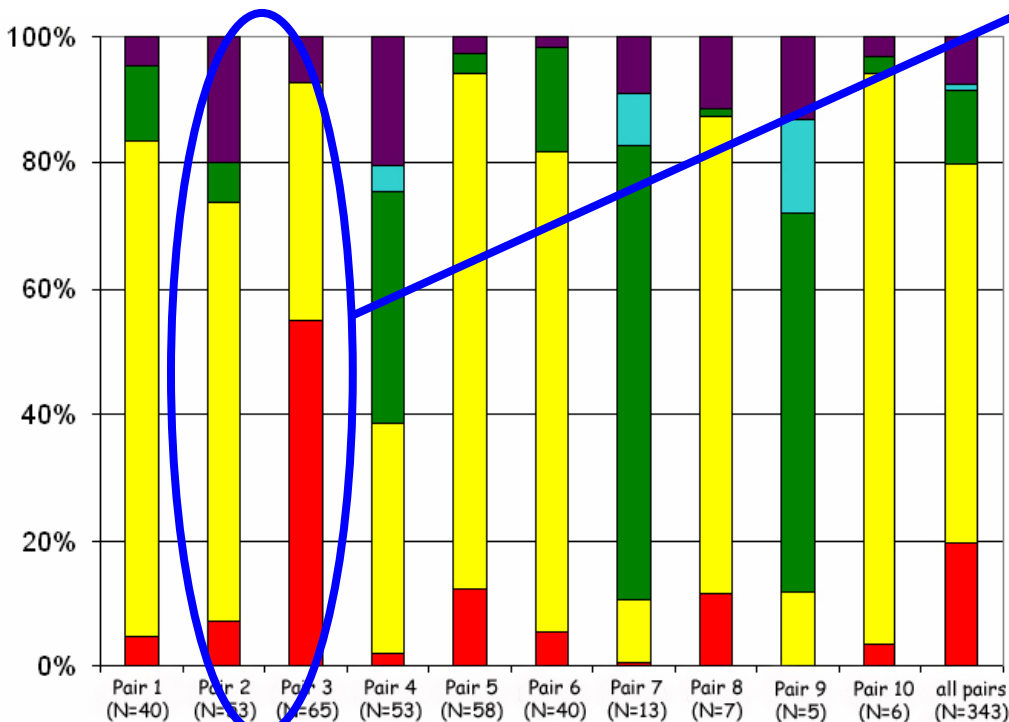
Training
sample

Test
sample

Combination of qualitative and quantitative characteristics increase correct assignment values to 100% for all pairs

1 male call
2 female calls

1 male call
1 female call



Interpair differences in red-crowned crane duets are so obvious that can be heard by unarmmed ear

For example here presented duets from 4 different pairs, 1 duet per pair: 📢



Conclusions:

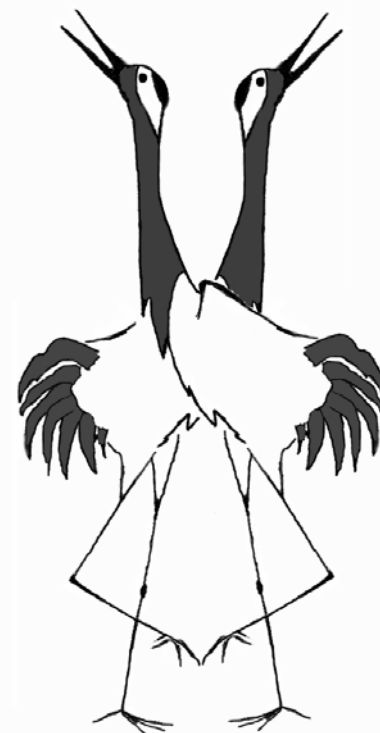
- In red-crowned crane duets there are strong interpair differences
- Pair specific characteristics are stable during long time periods
- Further study is necessary to test changes of duet structures in case of re-mating



Thank you for attention!
Спасибо за внимание!



**Авторы благодарны
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