The use of vocalisation sounds to assess responses of broiler chicken to environmental variables

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Introduction

- Increasing demand for poultry meat → to obtain animals that grow faster with high feed efficiency, and higher final weight

- Intensive poultry farming condition that can affect the animal welfare and health

- Use of indices of animal welfare like behaviours to measure animal health

- Need to find other indices: audio and video recording due to their strong relationship with animal behaviours and welfare

Introduction

- Importance of vocalisation in broilers:
  - At the hatchery to syncronize the hatch ;
  - To identify their mother and their siblings;
  - Social interaction in chicks is important for individuals and group development.

- The analysis of vocalisations may be considered a potential indicator of animal health and welfare.

- **Recent PLF approach** → application of sound analysis techniques to discriminate and classify specific vocalisation in poultry houses

Aim of the work

Identification and characterisation of vocalisations emitted by chicks during their first five days of life under normal farm conditions, in order to detect the possible vocal changes in terms of frequency and type of sound emitted with increasing age and environmental changes.

Material and methods

PHASE 1

Data recording at farm level (Barn)

- 1 hour every two days from day 1 to day 5
- Collection of sound data in farm with 2 microphones

Mic 1 : above the feeder   Mic 2 : above the drinkers

Data recording at group level (Box)

Camera + Microphone
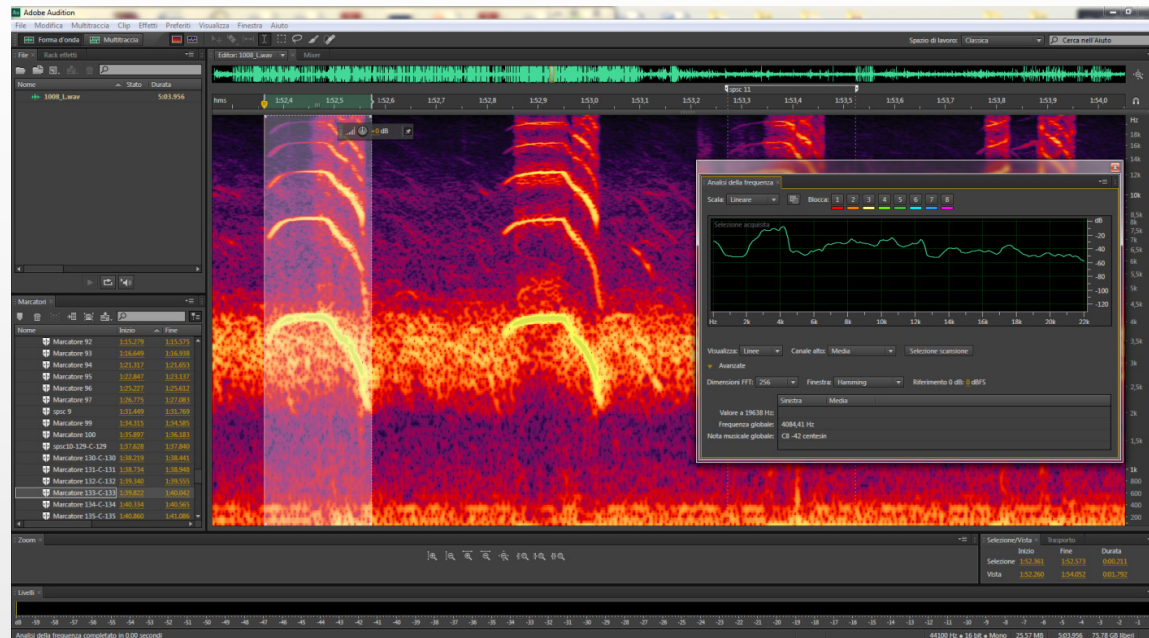
> 3 chicks were separated from the flock

- Recording session lasted 5 minutes

Material and methods

PHASE 2

Sound and image analysis

- Manual labelling using Adobe® Audition™ CS6 of sounds collected in the Barn and in the Box

- For each sound the peak frequency (PF= representing the frequency of maximum power) was manually extracted.

Material and methods

<u>**PHASE 3**</u>

Statistical analysis

- Statistical analysis was performed using the statistical software SAS 9.3 for Windows:

  - T–test was used to compare sounds in different situation (isolated/in group) and in different days (day 1 and 5)

  - Vocalisation were compared to verify their similarity and dissimilarity (PDIFF of PROC GLM of SAS)

  - Modelling of the response of the chicks outside the box according to the PF of the vocalisation of chicks isolated from the flock (PROC LOGISTIC)

Results

- 12 different kind of vocalisations have been found in the box (more clear sounds)

Day 1   Day 5
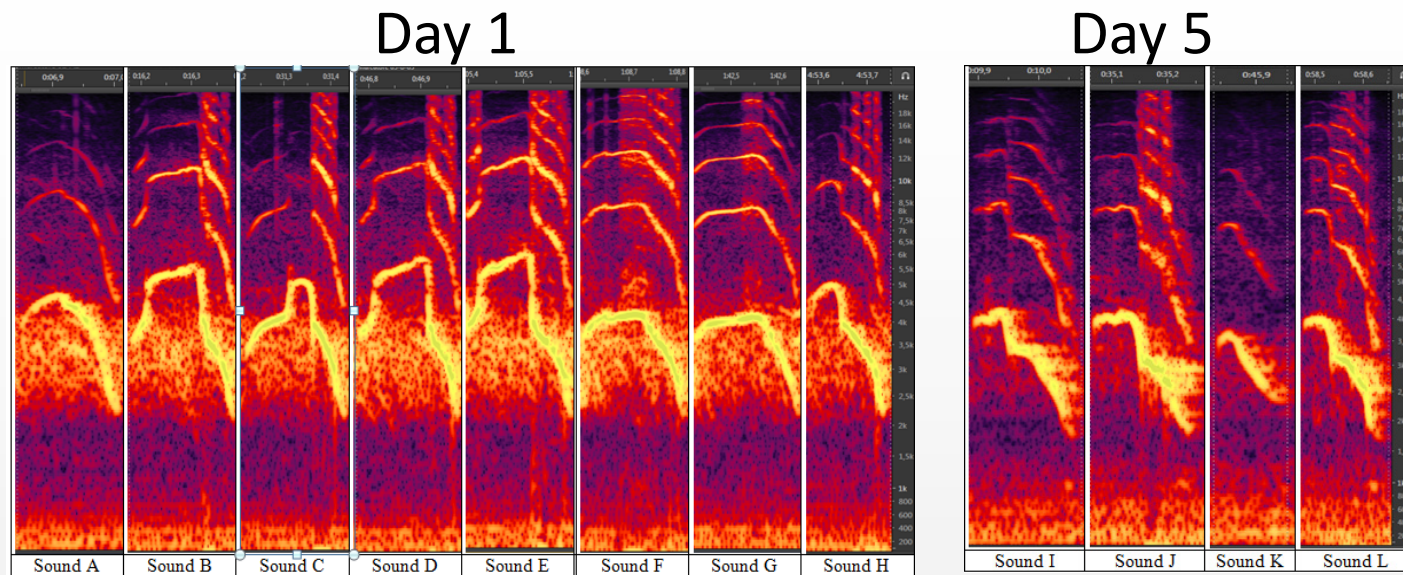
- Video and sound were synchronised in order to link the behaviours to the sounds emitted by the animals.

Day 1
Chicks around the box
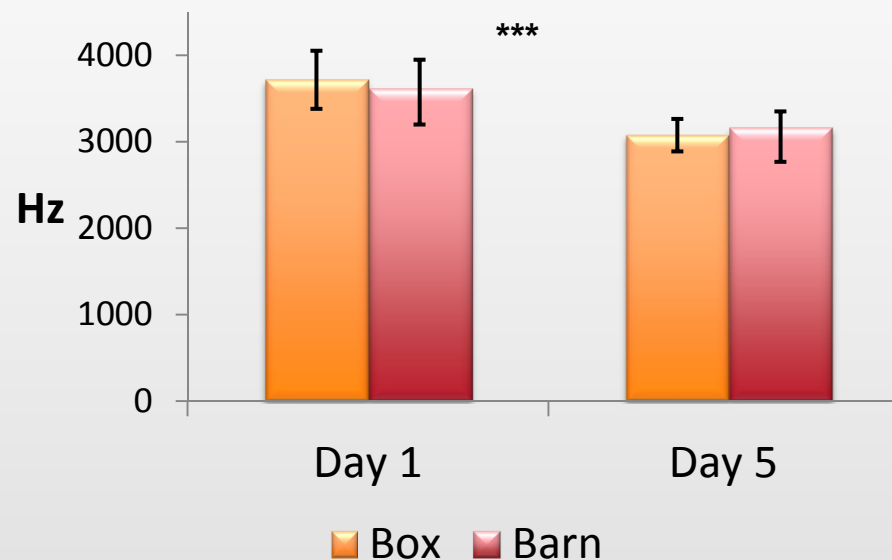
Day 5
NO chicks around the box

Results

Sound type	Day of recording	Range of PF (Hz)	Mean duration (s)	Mean interval (s)	N of Repetition
A	1	3445-3962	00:00.205	00:00.264	14
B	1	3101-3618	00:00.214	00:00.222	31
C	1	3445-3962	00:00.214	00:00.282	9
D	1	3445-3618	00:00.210	00:00.237	31
E	1	3445-3790	00:00.222	00:00.247	26
F	1	4134-4307	00:00.223	00:00.236	7
G	1	3962-4134	00:00.222	00:00.308	11
H	1	3273-3790	00:00.176	00:00.266	8
I	5	2929-3273	00:00.199	00:00.195	78
J	5	2929-3273	00:00.209	00:00.190	7
K	5	2756-3273	00:00.123	00:00.246	7
L	5	2929-3273	00:00.180	00:00.190	6

The range of PF of the vocalisations emitted by one day old chicks (day 1 of recording) are higher than the PF of the vocalisations emitted by five days old chicks (day 5 of recording).

Results

Variabile	N	Mean (Hz)	Dev std (Hz)	Minimum (Hz)	Maximum (Hz)
box_day1	40	**3717**	336	3187	4393
box_day5	20	**3075**	188	2670	3531
barn_day1	68	**3613**	415	2670	5426
barn_day5	68	**3162**	395	2498	4393

The PF of the sounds emitted by the birds decrease of about 500 Hz in five days
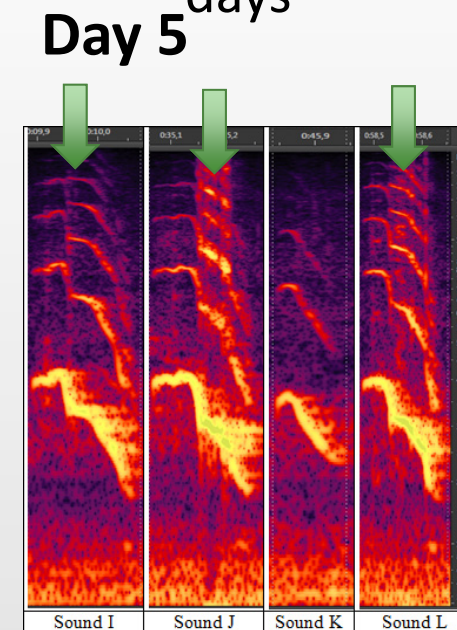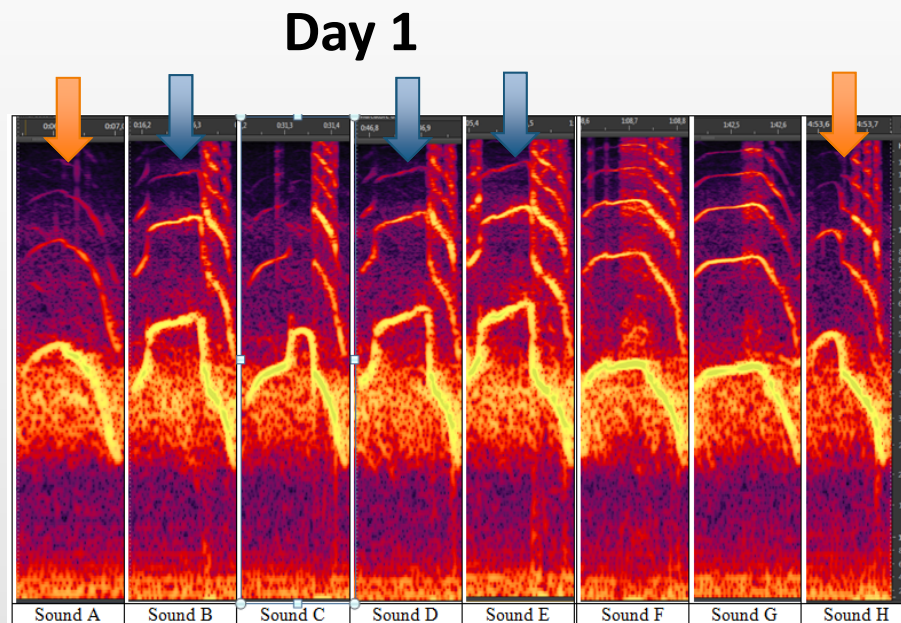

***: P<0.001

- Significant difference between sounds recorded in day 1 and 5
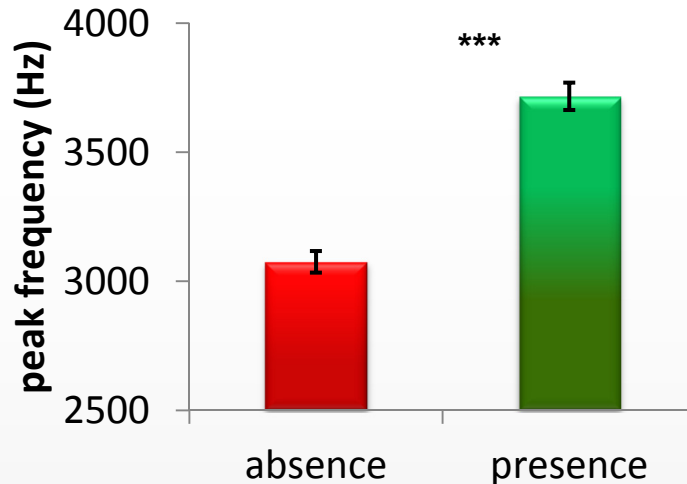- No difference between sounds recorded the same day

Results

	Box Day 5	Barn Day 1	Barn Day 5
Box Day 1	0.50***	**0.75*****	**0.20*****
Box Day 5		**0.22*****	**0.70*****
Barn Day 1			0.50***

***: P<0.001

- Significant correlation between sounds recorded in the same day
- Low correlation between sound recorded in different days

Day 1

Day 5

Results

***: P<0.001

The odds ratio showed a significant association between the high frequency of vocalisation of chicks inside the box and the positive response (presence) of chicks outside it (OR=1.012; Wald CL 95%=1.006-1.019).

Results of logistic regression for changes in Peak Frequency

Parameters	Estimate	Std Err	CL 95%	χ2- wald	Pvalue
PF_Hz=3000	0.037	0.036	0.005	10.17	<0.001
PF_Hz=3200	0.298	0.120	0.12	2.22	NS
PF_Hz=3400	0.825	0.095	0.563	5.51	<0.05
PF_Hz=3600	0.981	0.021	0.841	11.49	<0.001
PF_Hz=3800	0.998	0.003	0.948	13.01	<0.001
PF_Hz=4000	1.000	0.000	0.983	13.54	<0.001
PF_Hz=4200	1.000	0.000	0.994	13.77	<0.001
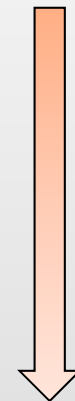
Conclusions

- The peak frequency of the sounds emitted by the animals is typical to the age of chicks and it is inversely proportional to the age;

- Sounds emitted by one-day-old chicks isolated from the group can be classified as "calling sounds" directed towards their conspecifics;

- Sounds emitted by five day old chicks can be classified as "distress calls" due to the social (and physical) isolation.

- PLF can be used to characterize vocalisation and eventually evaluate in relation to environmental variables