



# Assessment of consciousness after waterbath stunning of turkeys

November 14<sup>th</sup>, 2022



Designated by  
the EU Commission



# Agenda

**10:00h:** General presentation of the Centre - V. Michel

**10:15h:** Indicators of consciousness - A. Velarde

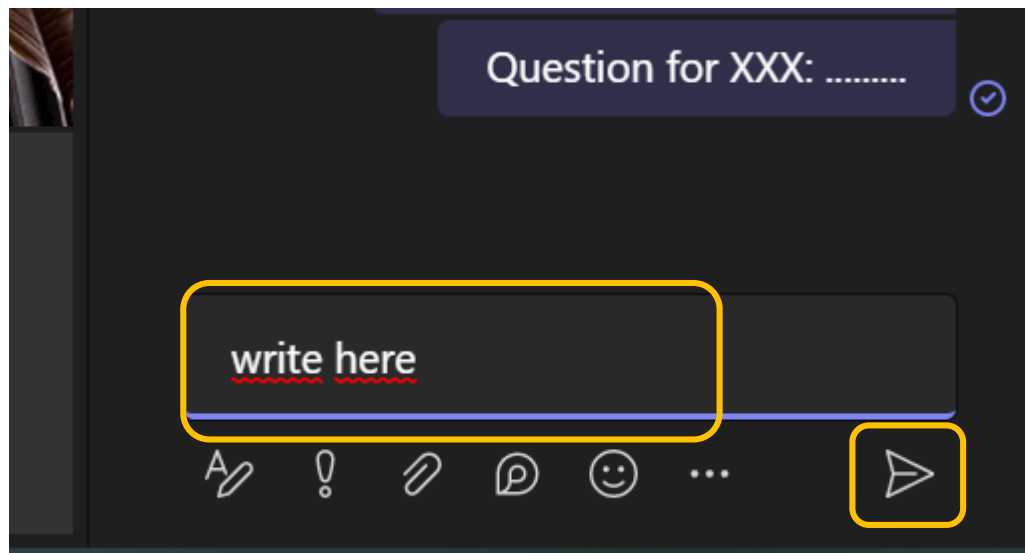
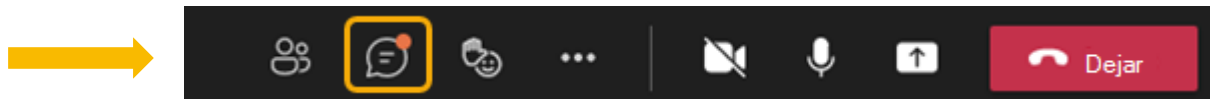
**10:20h:** Technical study - A. Contreras

**10:30h:** Methods and recommendations - A. Varvaró and V. Michel

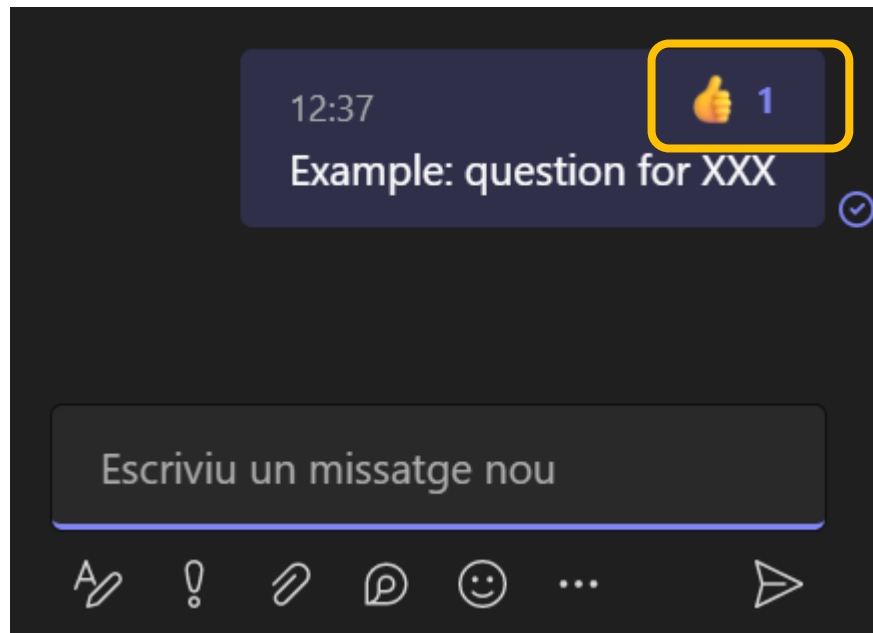
**10:45h:** Discussion

**Send your questions at any time during the webinar by:**

- Sending an email to [aida.xercavins@irta.cat](mailto:aida.xercavins@irta.cat)
- Or using the chat

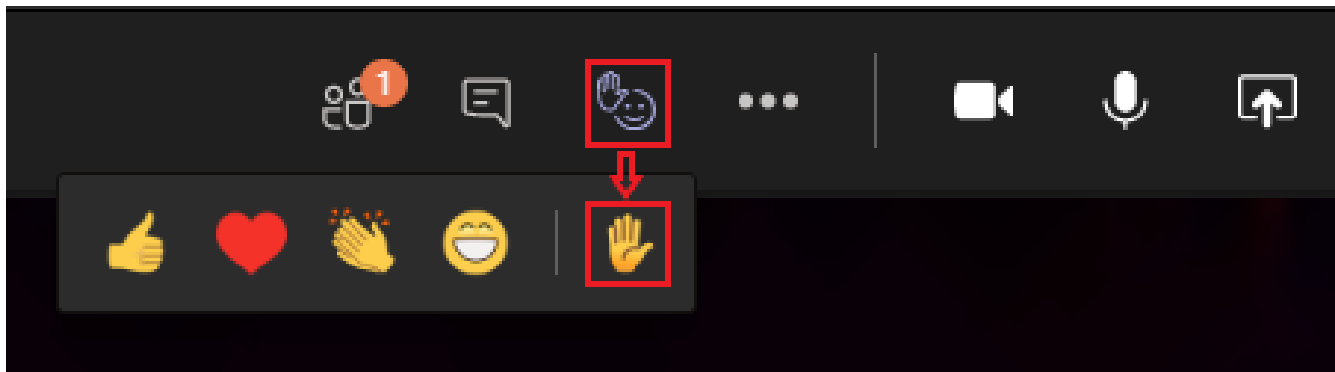


**Send your questions at any time during the webinar by:**



Question  
successfully  
registered

- During the discussion we will address as much questions as possible, in chronological order.
- If you still have any concern or you want to further discuss the given answer, please use the option “**raise hand**”:



Then **we will open your microphone** and let you speak.

Thank you for your collaboration!

# General presentation of the Centre

Virginie Michel (Coordinator, ANSES)



Designated by  
the EU Commission

# REGULATION (EU) 2017/625 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 March 2017

### Art. 95 of 'The Official Controls Regulation':

"The Commission shall, by means of implementing acts, designate European Union reference centres for animal welfare that shall **support the activities of the Commission and of the Member States**"



## Three Centres



*Since October 2018*



*Since February 2020*



*Since May 2021*



# Main Target groups and objective

- **Target groups:** European Commission, Competent Authorities, National Reference Centres and ‘Supporting Bodies’ from MSs: science, training, communication
- **Objectives:** to support implementation of welfare legislation in a harmonized way through MSs
  - on farms, transportation and killing
  - poultry & other small farmed animals

# EURCAW-Poultry-SFA's team

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Steen H. MØLLER



Kaitlin WURTZ



## What the Centre is and is not...

✓ <b>The Centre is</b>	✗ <b>The Centre is not</b>
To assist Commission and MSs	To be solicited by other institutions
Able to deliver scientific and technical advice	To do risk assessment
To help implementation of legislation	To interpret legislation

## Priority areas

1. Broiler chickens on farm
2. Laying hens housed in alternative housing systems
3. State of consciousness after stunning
4. Rabbits on farm, with a focus on alternative housing systems
5. Turkeys on farm and during transport



## Activities:

1. Coordinated assistance
2. Animal welfare indicators
3. Scientific and technical studies
4. Training courses
5. Disseminating research and innovations



## Activity 2. Animal welfare indicators

1. Compile a list of legal requirements to check during official controls
2. Identify relevant welfare indicators to verify compliance with the legal requirements identified
3. Propose validated indicators and methods for assessment

## Activity 3. Scientific and technical studies

- To provide scientific and technical expertise on the official controls and the implementation of the legislation related to poultry.
- To identify the gaps of knowledge and the bottlenecks regarding legislation and formulate different topics for scientific and technical studies.
- To develop in the framework of the Centre, some scientific studies designed to answer questions raised in activity 2.
- Identify best practices

# 1. Waterbath stunning - broiler chickens and turkeys

## 1. Reviews

- List of the **relevant indicators** for the assessment of consciousness of broilers and turkeys after waterbath stunning.
- Description of the considered **validated indicators and associated methodology**
- **Identification of gap of knowledge** regarding indicators.



# 1. Waterbath stunning - broiler chickens and turkeys

## 1. Reviews

## 2. Scientific studies

- Repeatability and feasibility of indicators of consciousness in **broiler chicken** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.
- Repeatability and feasibility of indicators of consciousness in **turkeys** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.

## 1. Waterbath stunning - broiler chickens and turkeys

### 1. Reviews


### 2. Scientific studies

### 3. Factsheets

European Union Reference Centre for Animal Welfare Poultry SFA

Indicator Factsheet

### How to assess the state of consciousness in broilers (waterbath stunning)



**Introduction**

- Waterbath stunning (WBS) is intended to induce unconsciousness until death that occurs due to bleeding.
- As WBS is not always effective, it is required to monitor that birds are unconscious at the exit of the WBS and do not regain consciousness before death.
- This factsheet explains the method to check the state of consciousness of birds with the most feasible, repeatable and valid animal-based indicators (ABIs) regardless of line speed and the method for sample size calculation.

**Method for the assessment**

**Place for the assessment:** At two different stages.

- Stage 1:** From the exit of the WBS and before bleeding to assess the effective stunning of the birds.
- Stage 2:** During bleeding, to assess that unconscious birds do not recover consciousness before death.

**Position:** if possible, check the birds in ventral position.

**ABIs:** use all those listed in Table 1 simultaneously on each bird according to the stage of observation. Commented videos linked to QR codes.

Any bird showing at least one outcome of consciousness should be considered as conscious or recovering consciousness.

**Sampling procedure:**

**Stage 1:**

- Visually follow animals individually during 2-3 s.
- Consciousness occurs if the birds shows at least one outcome of consciousness.

**Stage 2:**

- Place at a distance from neck cutting where you detect broilers that begin to show outcomes of consciousness (e.g., approx. 10s after caudal section).
- Then, visually follow animals individually during 4-5 s.
- Consciousness occurs if the birds shows at least one outcome of consciousness.

**ABIs:**

- Breathing
- Wing flapping
- Vocalization
- Head shaking

**Figure 1:** Places for the assessment. The red segments are the observation areas.


**Position:** if possible, check the birds in ventral position.

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European Union Reference Centre for Animal Welfare Poultry SFA

Indicator Factsheet

### How to assess the state of consciousness in turkeys (waterbath stunning)



**Introduction**

- Waterbath stunning (WBS) is intended to induce unconsciousness until death that occurs due to bleeding.
- It is required to monitor that turkeys are unconscious at the exit of the WBS and do not regain consciousness before death. Hence, turkeys that show indicators of consciousness should be re-stunned using back-up methods to avoid them unnecessary pain, distress and suffering.
- This factsheet contains:

- The method for the assessment of the state of consciousness after WBS.
- The most relevant Animal-Based Indicators (ABIs).
- The method for sample size calculation.

**Method for the assessment**

**Place for the assessment:** At two different stages (Figure 1)

- Stage 1:** From the exit of the WBS and before bleeding to assess the effective stunning.
- Stage 2:** During bleeding, to assess that unconscious turkeys do not recover consciousness before death.

**Position:** if possible, check the birds in ventral position.

**Sampling procedure and recommended ABIs:**

**Stage 1:**

- Follow visually individual turkeys during 2-3 s (according to the possibilities in the plant).
- Assess the two ABIs of the state of consciousness listed in Table 1 and shown on videos linked to QR codes in Figure 2.
- Record the outcome of the ABIs for every turkey assessed.

**Stage 2:**

- Place at a distance from neck cutting where you might detect turkeys that begin to show outcomes of consciousness (e.g., approx. 10s after caudal section).
- Then, visually follow animals individually during 4-5 s.
- Assess the ABIs of the state of consciousness listed in Table 1 and shown on videos linked to QR codes in Figure 2.
- Record the outcome of the ABIs for every turkey assessed.

**Figure 2:** Relevant ABIs of consciousness. Red arrows indicate where to put the attention on the turkey's body. Videos linked to QR codes.

Although less: persistent and less repeatable between observers, presence of vocalization in stage 1 and presence of head shaking in stage 2 should not be neglected as ABIs of consciousness (see Table 1).


Any bird showing at least one outcome of consciousness should be considered as conscious or recovering consciousness.

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European Union Reference Centre for Animal Welfare Poultry SFA

Best practice Factsheet

### Captive bolt as a back-up stunning method during slaughter of turkeys



**Introduction**

- Stunning methods are not always effective since failure at inducing unconsciousness and recovery of consciousness of turkeys before death might happen.
- Legislative requirements on the protection of animals at the time of killing include assessing the state of consciousness of the animals regularly and ensuring that appropriate back-up equipment is immediately available on the spot to be used in the case of failure of the stunning equipment initially used.
- However, re-stunning turkeys that show outcomes of consciousness after the stunning procedure is a process that remains pending for most of poultry slaughterhouses. In most of the cases, turkeys are manually re-stunned out after bleeding when stunning or bleeding is not efficient.

**Back-up stunning method**

This factsheet shows a good practice related to a back-up stunning method for turkeys.

- Penetrative captive bolt stunners adapted for turkeys are hung with an extension cord from the ceiling and placed at the business operator's shoulder height.
- When a turkey is showing at least one sign of consciousness, the business operator is change tubes with one hand a V-shaped, 1-meter-long fork and restrains the bird's head while moving on the shackle line.
- With the other hand, the captive bolt is taken and placed perpendicular to the bird's head and is fired through the skull into the brain causing instant death to the bird.
- Several captive bolts are placed along the slaughter line allowing for re-stunning of animals at any place from stunning to the scalding tank.

**Advantage for welfare:** it allows re-stunning on the line of heavy birds difficult to unshackle and spares avoidable pain, distress and suffering to ineffectively stunned turkeys.

**Flaw:** in most of slaughterhouse design does not allow to re-stun turkeys between the exit of the waterbath and bleeding because of lack of space and time before neck cutting.

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# 1. Waterbath stunning - broiler chickens and turkeys



## Webinars:

- Repeatability and feasibility of indicators of consciousness in **broiler chicken** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.
- Repeatability and feasibility of indicators of consciousness in **turkeys** after waterbath stunning and the impact of electrical key parameters on stunning efficiency.




## Motion video:

- Method and relevant indicators of the state of consciousness in broiler chickens



## 2. Controlled atmosphere stunning (CAS)

### 1. Review

- Main welfare aspects of stunning broilers by exposure to controlled atmosphere:
  - List of CAS methods and legal requirements
  - For each CAS methods:
    -  Description and available equipment
    -  Positive welfare aspects
    -  Negative welfare aspects





## 2. Controlled atmosphere stunning (CAS)

### 1. Review

### 2. Factsheet

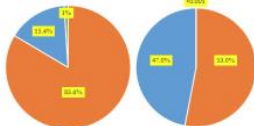


#### Main welfare aspects of stunning broilers by exposure to controlled atmosphere



##### Introduction

- There are two main types of stunning systems commercially used in poultry, electrical waterbath stunning (WBS) and controlled atmosphere stunning (CAS).
- CAS consists in exposing the chickens to modified gas environments or by reducing the atmospheric pressure, which induce a gradual loss of consciousness.
- WBS is used in both small-scale and large-scale abattoirs, while CAS is nearly always used in large-scale abattoirs, likely because CAS systems involve large investments but also increase the slaughter capacity.



Proportion of slaughterhouses (left) and slaughtered chickens (right) according to the different stunning methods used in the European Union in 2021. Data extracted from 20 out of 27 European Member States that replied a EURCAW-Poultry-SFA survey in 2021.

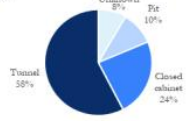
##### CAS methods

- Stunning with carbon dioxide (CO<sub>2</sub>) in two phases
- Stunning with inert gases
- Stunning with carbon dioxide associated with inert gases
- Low atmospheric pressure stunning (LAPS)

##### Available equipment

Currently, CO<sub>2</sub> in two phases is by far the most common CAS method in use in the European Union.

- Tunnel
- Closed cabinet
- Pit



Percentage of the different CO<sub>2</sub> stunning equipment that are currently in use in European Union. Data extracted from 20 out of 27 European Member States that replied a EURCAW-Poultry-SFA survey in 2021.

##### Advantages of CAS

- No uncrating and shackling conscious birds.
- Stunning can be either reversible or irreversible.
- When irreversible, it prevents from recovery before death occurs.

##### CAS welfare concerns

- Induction of unconsciousness is not instantaneous and involves a transitional period during which negative welfare outcomes may occur.
- CAS systems may incorporate windows or cameras for monitoring the behaviour of the animals. However, it does not allow a clear view of all animals.

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#### Thematic Factsheet

#### Main welfare aspects of stunning broilers by exposure to controlled atmosphere

##### 1. Stunning with CO<sub>2</sub> in two phases

- Broilers are first exposed to low concentration of CO<sub>2</sub> (up to 40%) until unconsciousness occurs. Thereafter, the CO<sub>2</sub> concentration is increased in the second phase inducing a deeper state of unconsciousness and then death.
- It renders the bird unconscious when using a low level of CO<sub>2</sub> (< 40%) followed by a second phase where broilers are killed painlessly with exposure to a high CO<sub>2</sub> concentration.
- If birds are conscious, concentrations of CO<sub>2</sub> at above 40% cause unpleasant sensation, pain and respiratory distress when inhaled. This could occur when the exposure time in the first phase is too short leading to animals arriving conscious in the second phase in which CO<sub>2</sub> is above 40%.

##### 3. Stunning with CO<sub>2</sub> associated with inert gases

- Broilers are induced to unconsciousness by direct or progressive exposure to a gas mixture containing CO<sub>2</sub> up to 40% associated and inert gases.
- Broilers tolerate the inhalation of concentrations below 40% CO<sub>2</sub>; inert gases are imperceptible to birds and the reduction of available oxygen is not perceived either.
- The duration of induction to unconsciousness is shorter than with inert gases.
- The occurrence of vigorous convulsions expressed as wing flapping in unconscious birds are less pronounced than the other CAS methods and thus, the likelihood of unconscious animal while convulsing to harm neighbouring birds that are still conscious is lowered.

##### 2. Stunning with inert gases

- Broilers are exposed to inert gas mixtures with a maximum of 2% residual oxygen, leading to loss of consciousness. Inert gases displace oxygen from the atmospheric air and this ensures that the birds are stunned by anoxia (i.e., lack of oxygen) and dead if the duration of the process is prolonged enough.
- Inhalation of inert gases does not cause aversive reactions after initial exposure, as they are imperceptible to birds.
- After loss of consciousness, birds can perform severe convulsion which may produce wing fractures as well as injuries and distress to other birds that have not yet lost consciousness.
- The duration of induction to unconsciousness is longer than with CO<sub>2</sub> in two phases. If birds are not exposed enough time, they can recover consciousness rapidly if breathing atmospheric air at the exit of the stunning system.

##### 4. LAPS

- Broilers are induced to a non-recovery state of unconsciousness through progressive hypobaric anoxia (i.e., lack of oxygen due to lowered atmospheric pressure).
- It produces a non-recovery state of birds and thus, it does not compromise the welfare of the bird during the following slaughtering procedures.
- Pain may happen since defecation and prolapse of cloaca were observed during LAPS suggesting expansion of gas trapped in gut and probably also in other body cavities.
- Only approved for the stunning of broilers of less than 4 kg of body weight according to a prescribed pressure curve carefully described in the implementing regulation.

#### Thematic Factsheet

#### Related to controlled atmosphere stunning methods

Carbon dioxide in two phases, inert gases or in carbon dioxide in association with inert gases: Specific requirements	COUNCIL REGULATION (EC) No 1099/2009 [Annex I, Chapter II] "8. Under no circumstances shall gases enter into the chamber or the location where animals are to be stunned and killed in a way that it could create burns or excitement by freezing or lack of humidity."
Carbon dioxide in two phases, inert gases or in carbon dioxide in association with inert gases: Gas stunning equipment	COUNCIL REGULATION (EC) No 1099/2009 [Annex II] "6.1. Gas stunners, including conveyor belts, shall be designed and built to: (a) optimise the application of stunning by gas; (b) prevent injury or contusions to the animals; (c) minimise struggle and vocalisation when animals are restrained."
LAPS: General requirements	COMMISSION IMPLEMENTING REGULATION (EU) 2018/723 of 16 May 2018 amending Annexes I and II to Council Regulation (EC) No 1099/2009 [Annex I, Chapter 2, point 10] "10.1. During the first phase, the decompression rate shall not be greater than equivalent to a reduction in pressure from standard sea level atmospheric pressure 760 to 250 Torr for a period of not less than 50 seconds." "10.2. During a second phase, a minimum standard sea level atmospheric pressure of 160 Torr shall be reached within the following 210 seconds." "10.3. The pressure time curve shall be adjusted to ensure that all birds are irreversibly stunned within the cycle time." "10.4. The chamber shall be leak tested and pressure gauges calibrated before each operational session and not less than daily." "10.5. Records of absolute vacuum pressure, time of exposure, temperature and humidity shall be kept for at least one year."
LAPS: Layout, construction and equipment of slaughterhouses	COMMISSION IMPLEMENTING REGULATION (EU) 2018/723 of 16 May 2018 amending Annexes I and II to Council Regulation (EC) No 1099/2009 [Annex II, point 7] "7.1. Low atmospheric pressure stunning equipment shall be designed and built to ensure a vacuum of the chamber enabling slow gradual decompression with reduction in available oxygen and holding at minimal pressure." "7.2. The system shall be equipped to measure continuously, display and record the absolute vacuum pressure, the time of exposure, the temperature, the humidity and to give a clearly visible and audible warning if the pressure deviates from the required levels. The device shall be clearly visible to the personnel."



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suggestions regarding this  
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## 2. Controlled atmosphere stunning (CAS)

1. Review

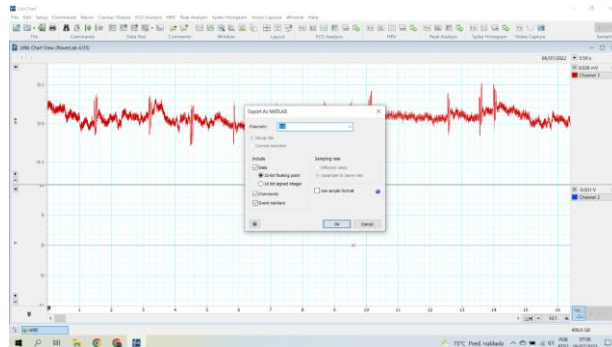
2. Factsheet

3. Scientific study

- Assessment of welfare during exposure to alternative gas mixtures to carbon dioxide in two phases in broiler chickens

Gas mixtures tested:

- CO<sub>2</sub> in two phases (1st: 40% CO<sub>2</sub> (2 min); 2nd: 90% CO<sub>2</sub> (2 min))
- 40% CO<sub>2</sub> + 60% N<sub>2</sub> (<2% O<sub>2</sub>); 4 min
- 20% CO<sub>2</sub> + 80% N<sub>2</sub> (<2% O<sub>2</sub>); 4 min



## Activity 5. Dissemination of research findings and innovations

<https://www.eurcaw-poultry-sfa.eu>

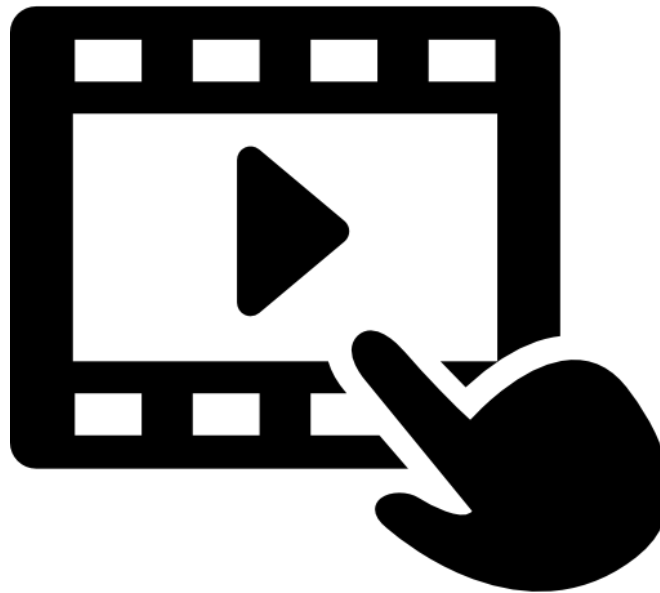
→ [info@eurcaw-poultry-sfa.eu](mailto:info@eurcaw-poultry-sfa.eu)

✓ Develop website, factsheets, translation.

- Website: published mid-July 2021
- **9** Factsheets online,
- **2** Reviews online,
- **3** Factsheets *translated into 4 languages (DE online soon)*
- **2** scientific papers published,
- **2** Newsletters, third one soon.
- **1** Stop motion videos (*coming soon*)



## Activity 5. Dissemination of research findings and innovations



VIDEO



# Indicators of consciousness

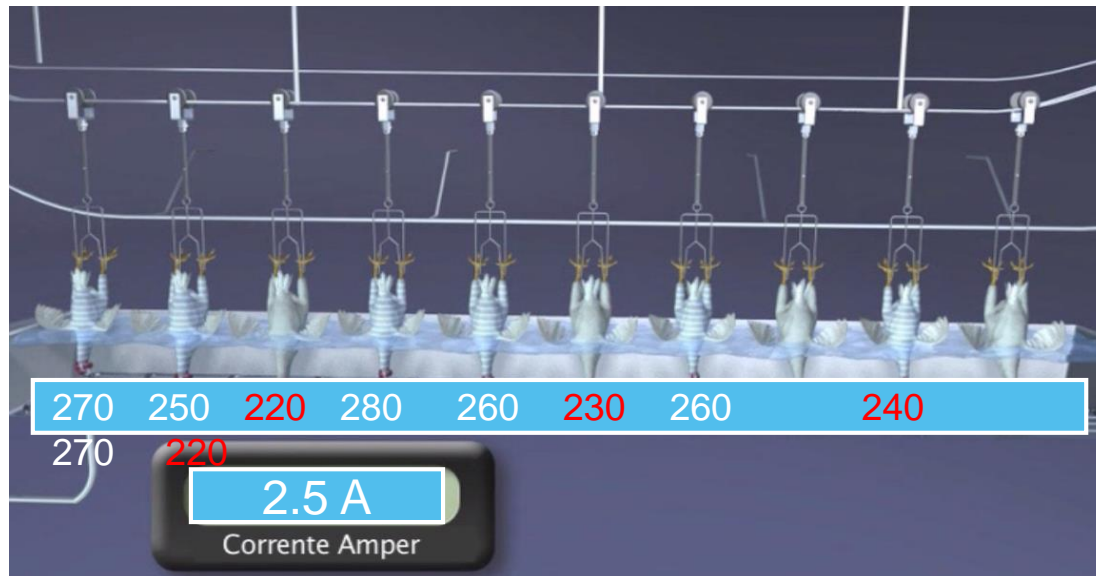
Antonio Velarde (Deputy, IRTA)



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the EU Commission

# Regulation 1099/2009

Frequency (Hz)	Chickens	Turkeys	Ducks and geese	Quails
< 200Hz	100 mA	250 mA	130 mA	45 mA
From 200 to 400 Hz	150 mA	400 mA	Not permitted	Not permitted
From 400 to 1500 Hz	200 mA	400 mA	Not permitted	Not permitted



# Regulation 1099/2009



**Article 5:** requires operators to carry out regular checks to ensure that animals do not present any signs of consciousness or sensibility

**Article 16:** requires slaughterhouse operators to put in place and implement monitoring procedures.

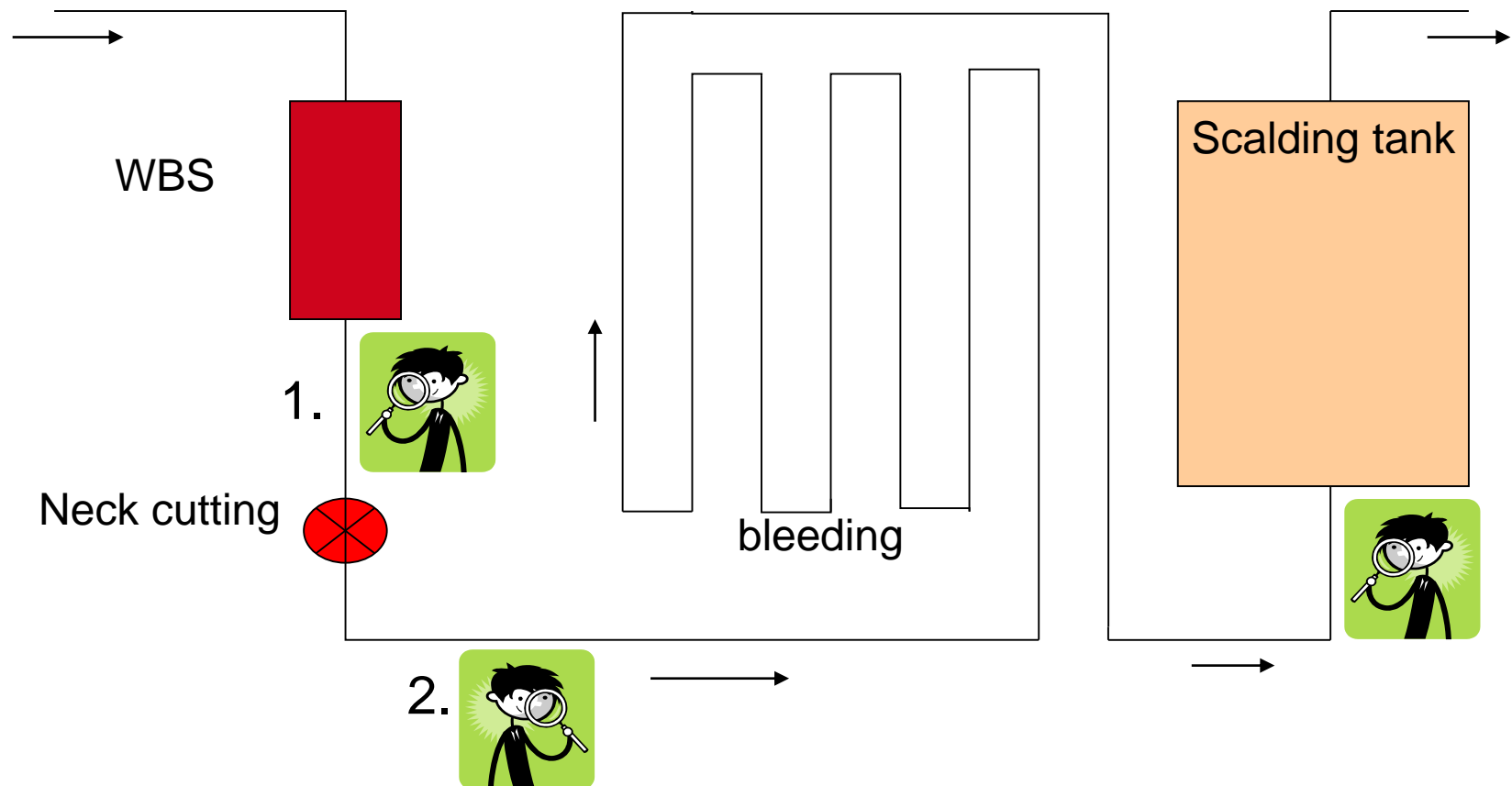
# Animal-based indicators



- ✓ EEG
- ✓ Indicators of the state of consciousness

1. **Behaviour** (e.g. escape attempts)
2. **Physical signs** (e.g. onset of seizures, cessation of breathing, fixed eye)
3. **Presence or absence of response to external stimulus** (e.g. corneal reflex and response to pain stimulus)

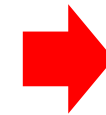
# Evaluation of the state of consciousness



# Sensitivity and specificity

**Sensitivity:** is the percentage of (truly) conscious animals that are tested as conscious

	Reality	
Indicator	Conscious	Unconscious
Conscious Corneal Reflex +	✓	Animal is unconscious, but diagnosed as conscious
Unconscious Corneal Reflex -	Animal is conscious, but diagnosed as unconscious	✓



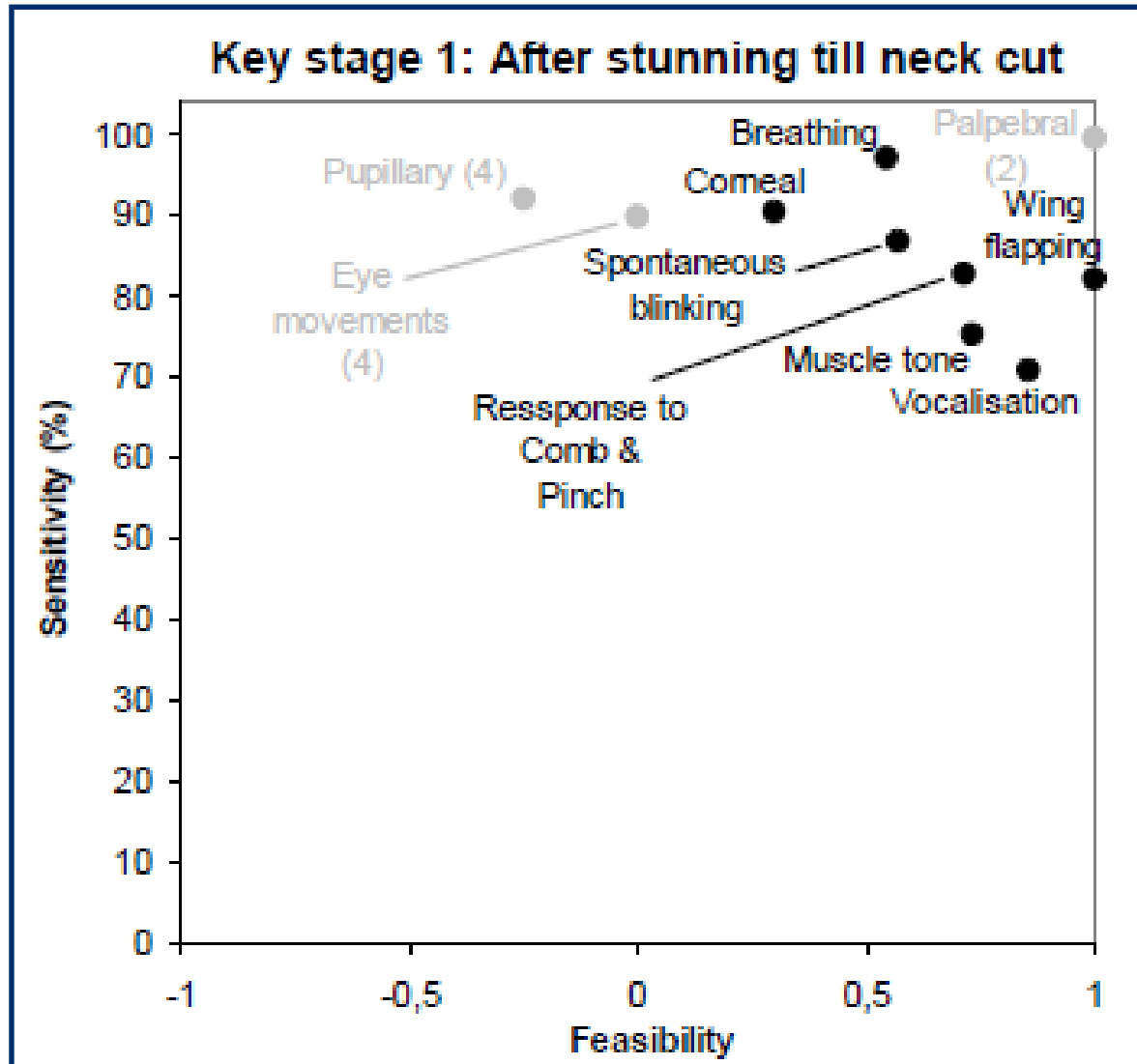
Logistic problem



Welfare problem

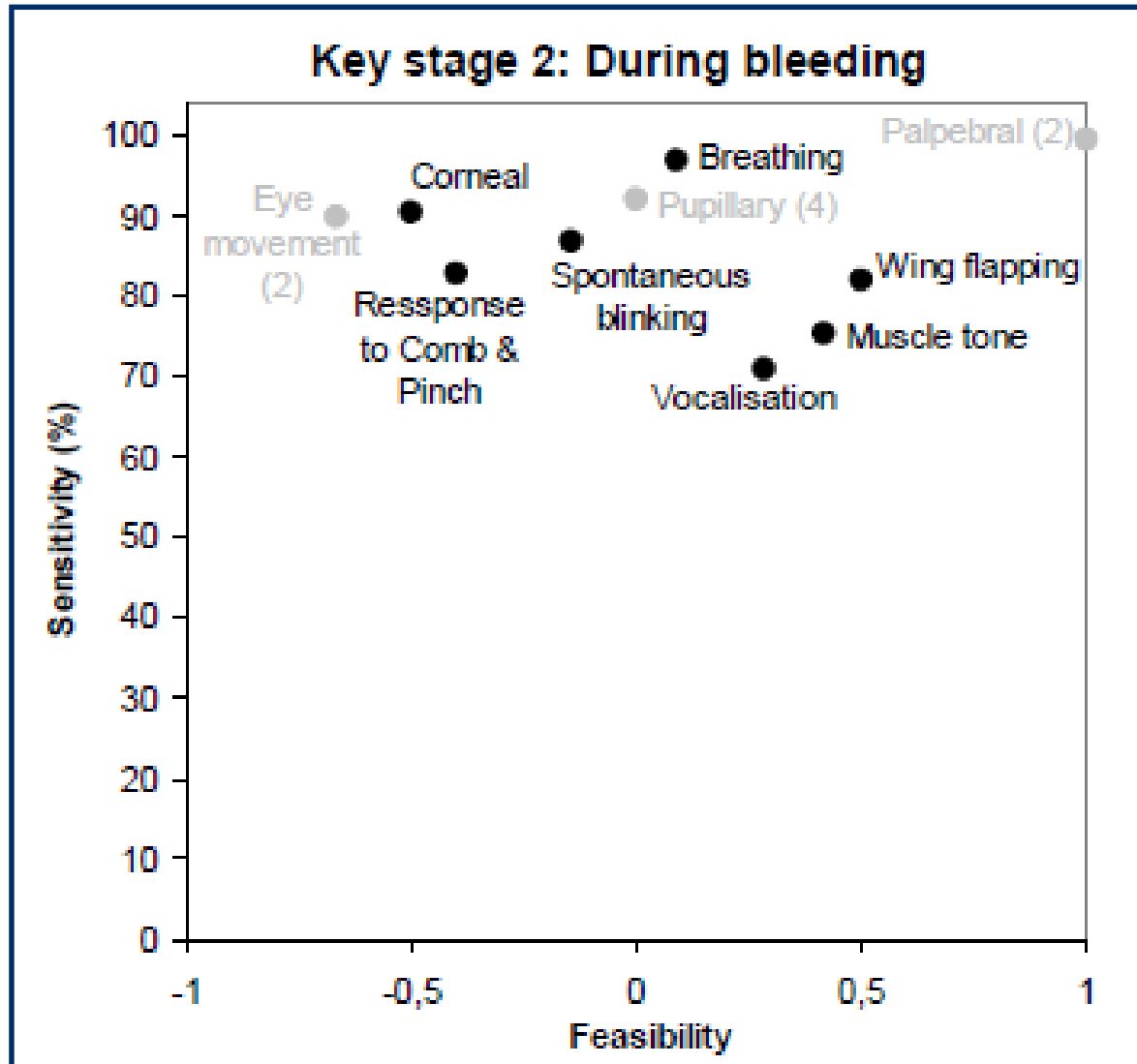
EFSA (2013)

# Sensitivity and feasibility



EFSA (2013)

# Sensitivity and feasibility



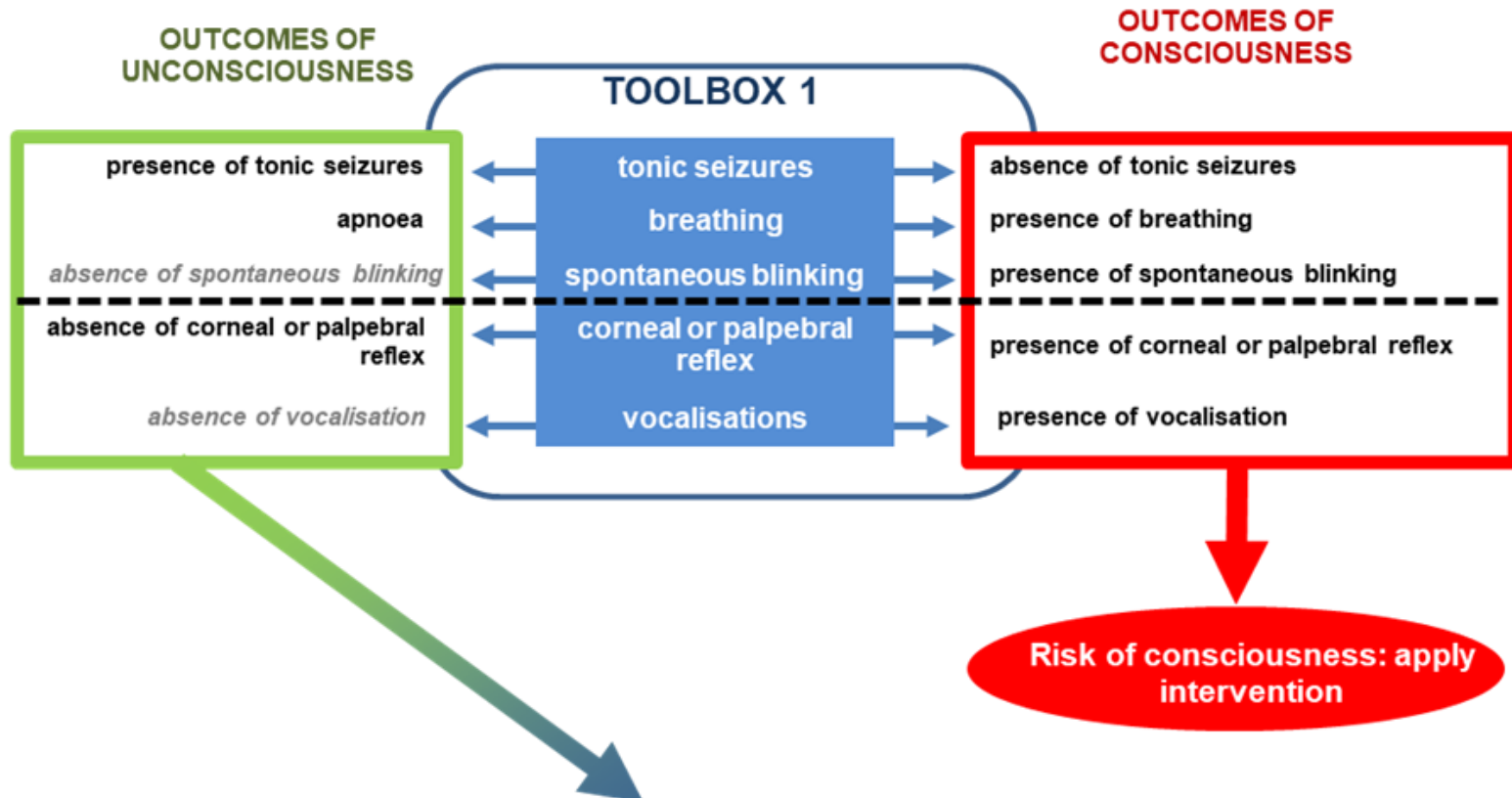
EFSA (2013)



# Sensitivity and feasibility

## SLAUGHTER WITH STUNNING (ELECTRICAL WATERBATH)

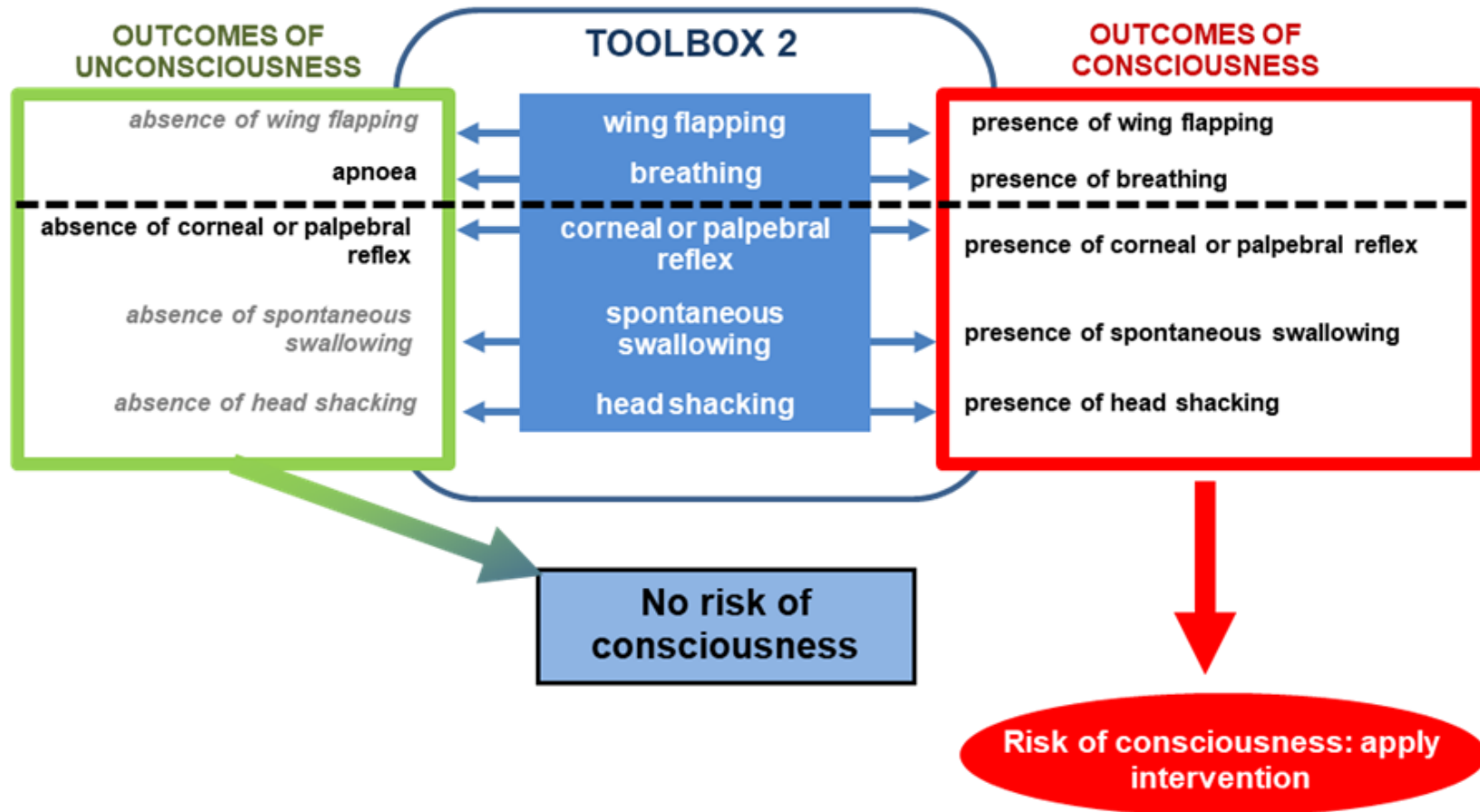
**Key Stage 1 (between the exit from the waterbath stunner and neck cutting):** check for outcomes of consciousness



**Key Stage 2 (during bleeding):** check for outcomes of consciousness

# Sensitivity and feasibility

**Key Stage 2 (during bleeding):** check for outcomes of consciousness



EFSA (2013)

# Technical study

Alexandra Contreras (IRTA)



Designated by  
the EU Commission

# Introduction

- Waterbath stunning is intended to induce unconsciousness until death occurs, but it is not always effective ([Shields and Raj, 2010](#))
- [Regulation 1099/2009](#): The state of consciousness must be monitored at the exit of the WB and the animals do not regain consciousness before death.
- Recommended ABIs according to validity and feasibility ([EFSA, 2013](#)).
- Monitoring the state of consciousness is not always performed and when it is, there is no uniformity in the applied criteria ([Devos et al., 2018](#))



# Objectives

## General:

Identify refined and validated ABIs with good level of repeatability that can be used for the assessment of the state of consciousness in turkeys to **ensure consistency of controls**.

## Specific:

1. Assess the **inter-observer repeatability** of the most valid and feasible ABIs.
2. Elucidate the **correlation** among the outcomes of consciousness of the ABIs.
3. Compare the **effectiveness of stunning** according to different combinations of waterbath electrical key parameters used in different commercial slaughterhouses.



# Material and methods

## ❑ Characteristics of the slaughterhouses included in the study

	Slaughterhouse							
	1	2	3	4	5	6	7	8
Location	FR	FR	FR	ES	ES	ES	ES	FR
WB length (m)	1.9	3.0	3.6	3.6	0.8	2.1	2.6	3.4
Birds in the WB (n)	5	4	8	5	2	7	7	10
Exposure time (s)	NA	7-9	12-16	18	6	22	13	22
Line speed (birds/h)	1,000	2,100-3,000	1,800-2,800	700	300	350	1,300-2,000	1,860
Stun-to-stick interval (s)	8-9	6	6	29	30	23	NA	13
Bleeding method*	M	M	M	M	M	M	A	M

WB: waterbath

NA: not available

\*Bleeding method: M (manually); A (mechanically)

# Material and methods

## □ Observers

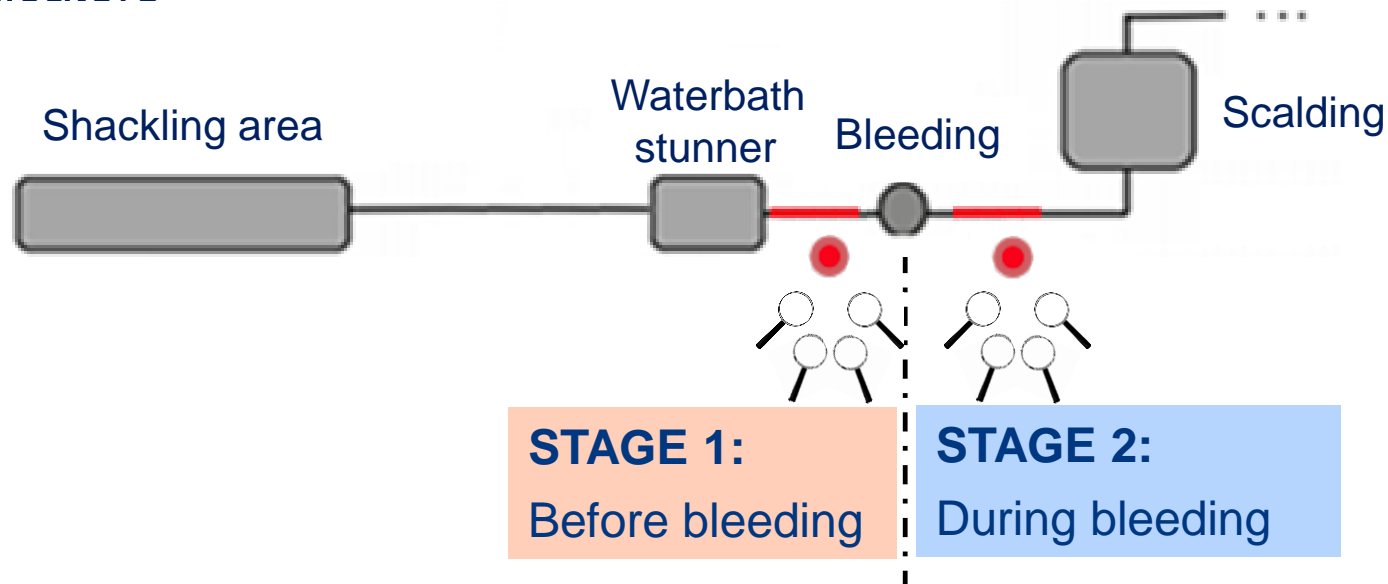


4 trained observers

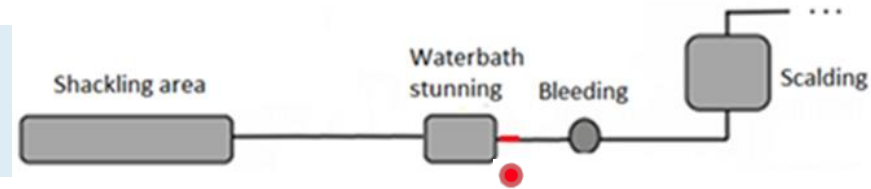
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1 person randomly selecting birds by pointing with a laser

## □ Sample assessment: Position and stages during the assessment of indicators



# Stage 1: Before



## ❑ Animal-based indicators (ABI) assessed and descriptions of the outcomes of consciousness

### BREATHING

Presence of either a minimum of two movements of the beak or abdominal muscles around the cloaca associated to breathing

### VOCALIZATION

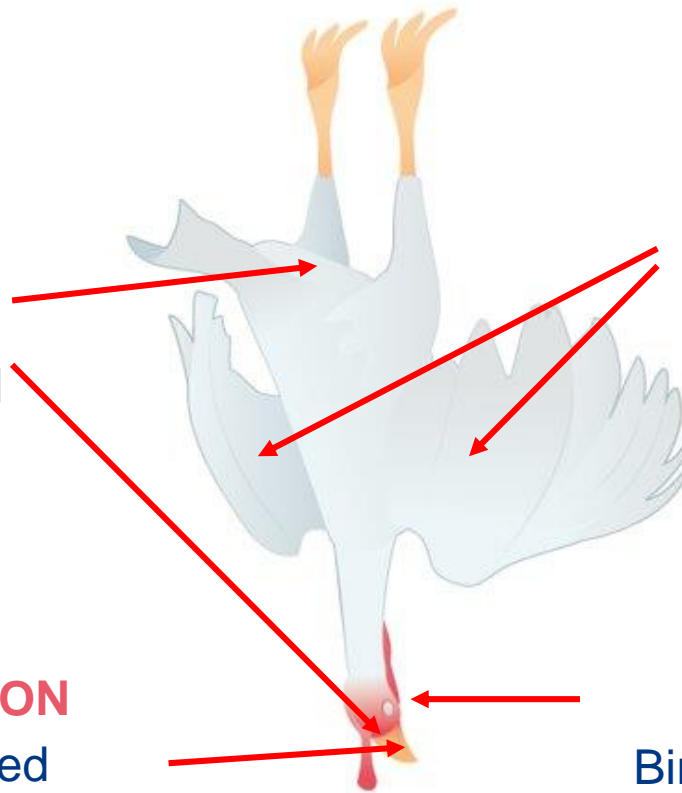
Single or repeated shrieking (screaming)

### TONIC SEIZURE

Bird shows arched and stiff neck (*i.e.*, necks appear parallel to the ground) and wings held tightly close to the body

### SPONTANEOUS BLINKING

Bird opens/closes eyelid on its own (fast or slow) without stimulation





## Stage 2: After



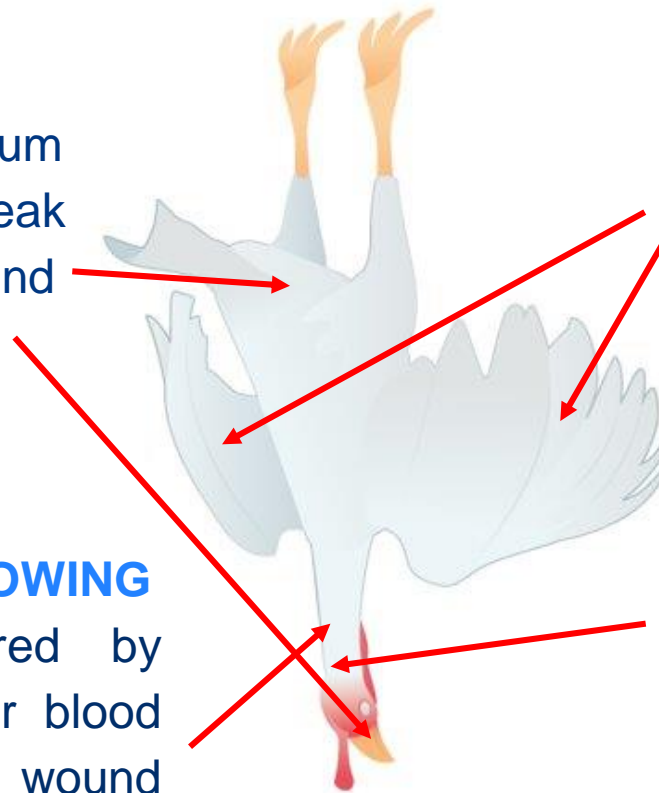
### ❑ Animal-based indicators (ABI) assessed and descriptions of the outcomes of consciousness

#### BREATHING

Presence of either a minimum of two movements of the beak or abdominal muscles around the cloaca associated to breathing

#### SPONTANEOUS SWALLOWING

Deglutition reflex triggered by water from the stunner or blood from the neck-cutting wound entering the mouth during bleeding.



#### WING FLAPPING

Flapping with both wings and should not be confused with rapid trembling of the entire body of the bird

#### HEAD SHAKING

Bird shakes its head from side to side to get rid of blood or water entering the nostrils.

## a) Inter-observer repeatability of ABIs



### 1. Crude proportion of agreement (PoA): % of agreement

Can be misleading as it does not take into account the scores that the observers assign due to chance

### 2. Fleiss' kappa ( $\kappa$ ): degree to which the observed proportion of agreement among observers exceeds what would be expected if all observers made their ratings completely randomly. Ranges from -1 to 1.

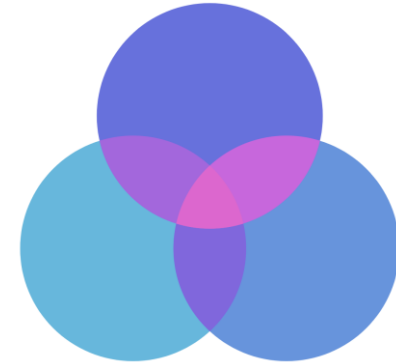
According to Fleiss et al. (2003):

- $\kappa > 0.75$ : **Excellent** agreement beyond chance
- $0.40 < \kappa < 0.75$ : **Fair to good** agreement beyond chance
- $\kappa < 0.40$ : **Poor** agreement beyond chance

$\kappa \approx 0$  when there is an insufficient scoring variation (i.e., low prevalence of outcomes of consciousness) despite high agreement between observers

## b) Association between the observed ABIs

- **Proportions among combinations of ABIs:** displayed as Venn diagram



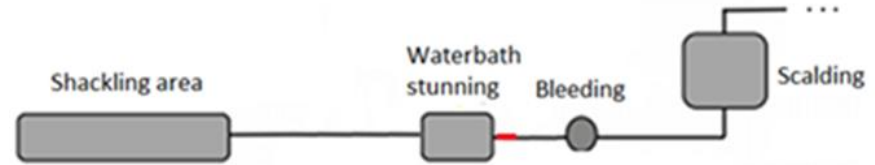
## c) Relationship between electrical parameters and stunning efficiency

Compare the effectiveness of stunning among the different combination of electrical key parameters through:

- **Prevalence:** % of birds showing at least one outcome of consciousness

# Results: Inter-observer repeatability

## Stage 1: Before bleeding

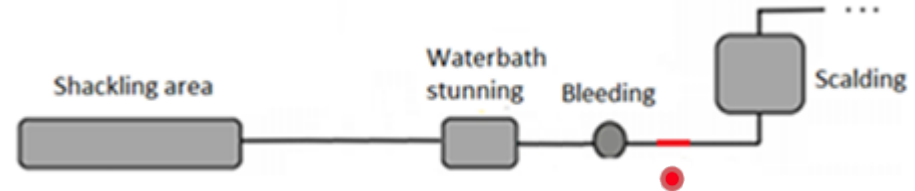


Slaughterhouse									
Item	1	2	3	4	5	6	7	8	All
<b>Tonic seizure</b>									
PoA, %	100	58.6	93.8	100	92.2	97.5	76.7	76.7	88.4
κ interpretation	*	Poor	Good	*	Good	Good	Exc	Exc	Exc
<b>Breathing</b>									
PoA, %	99.8	99.2	98.4	99.5	93.6	99.0	99.7	99.7	98.6
κ interpretation	Poor	Poor	Good	Poor	Exc	Poor	Exc	Exc	Exc
<b>Spont. blinking</b>									
PoA, %	99.8	98.2	99.7	99.5	97.6	100	99.9	99.9	94.4
κ interpretation	Poor	Poor	Poor	Poor	Poor	*	Good	Good	Poor
<b>Vocalisation</b>									
PoA, %	100	100	100	100	99.0	100	100	100	99.9
κ interpretation	*	*	*	*	Poor	*	*	*	Poor

\* κ not able to be computed. No scoring variation.

# Results: Inter-observer repeatability

## Stage 2: After bleeding



Slaughterhouse									
Item	1	2	3	4	5	6	7	8	All
<b>Wing flapping</b>									
PoA, %	100	94.9	98.1	98.3	97.7	99.0	100	99.1	98.4
k interpretation	*	Good	Exc	Exc	Exc	Exc	*	Exc	Exc
<b>Breathing</b>									
PoA, %	100	95.1	98.6	96.9	98.9	98.7	99.8	99.3	98.5
k interpretation	*	Good	Good	Exc	Exc	Exc	Exc	Good	Exc
<b>S. swallowing</b>									
PoA, %	100	99.8	100	100	100	100	100	100	99.9
k interpretation	*	Poor	*	*	*	*	*	*	Poor
<b>Head shaking</b>									
PoA, %	100	97.8	99.6	98.6	99.7	99.7	99.8	100	99.5
k interpretation	*	Good	Poor	Poor	Poor	Poor	Poor	*	Poor

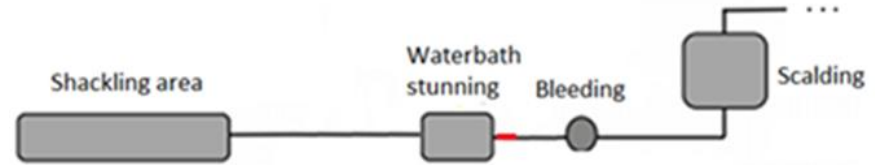
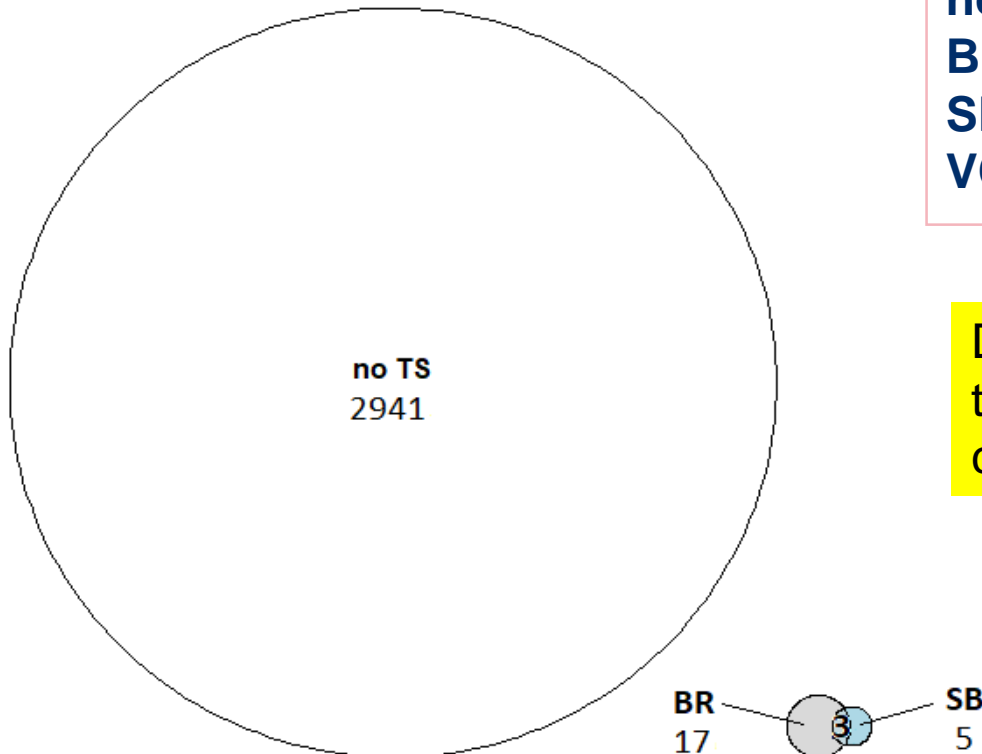
\* κ not able to be computed. No scoring variation.

# Results: Association between ABIs

## Stage 1: Before bleeding

Turkeys assessed: 3,659

### □ Venn diagram



### Indicators were:

**no TS:** absence of tonic seizure

**BR:** presence of breathing

**SB:** presence of spontaneous blinking

**VC:** presence of vocalizations

Difficult to rely on the absence of tonic seizure to measure consciousness

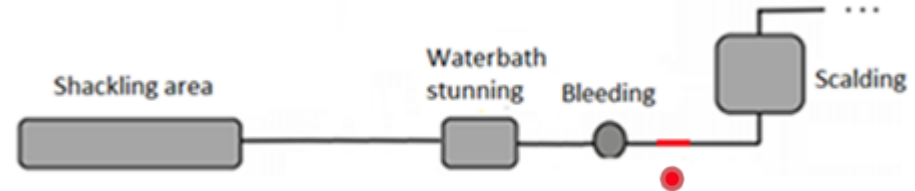
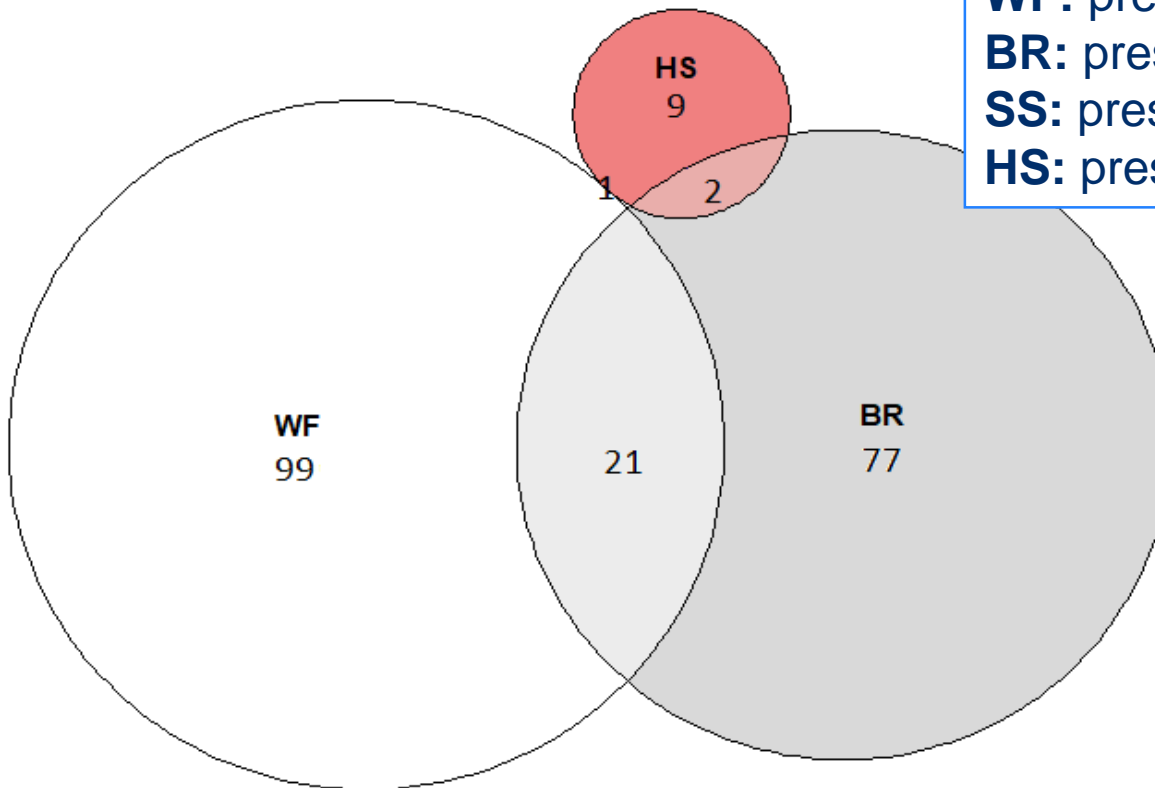
**No correlation among ABIs**

# Results: Association between ABIs

## Stage 2: After bleeding

Turkeys assessed: 4,218

□ Venn diagram



### Indicators were:

**WF:** presence of wing flapping

**BR:** presence of breathing

**SS:** presence of spontaneous swallowing

**HS:** presence of head shaking

**No spontaneous swallowing**

# Results: Stunning efficiency

## Stage 1: Before bleeding 1/2

SH	Batch	n	Sex	BW	Electrical parameters in waterbath			Birds with outcomes of consciousness, %	
					Current, mA/bird	Frequency, Hz	Voltage, V	Mean	CI 95%
1	2	199	♂	3.8	345±33	150	300	1.5	[0.5-4.3]
	3	250	♀	3.8	367±25	150	300	0.0	[0.0-1.5]
2	2	187	♂	16.2	319±65	199	141±2	0.7	[0.1-3.0]
	4	192	♀	6.3	278±46	199	140	0.0	[0.0-1.9]
3	1	199	♂	16.3	NA	199	NA	0.8	[0.1-2.8]
	2	200	♂	7.7	NA	199	NA	0.5	[0.1-2.8]
	3	181	♂	15.1	NA	199	NA	1.2	[0.3-3.9]
	4	199	♂	16.0	284±50	196	187±3	1.5	[0.5-4.3]
	5	69	♂	11.1	287±35	196	186±8	1.4	[0.3-7.8]
	6	198	♂	12.1	302±55	196	206±3	2.0	[0.8-5.1]
	7	246	♂	15.6	311±61	196	229±2	2.8	[1.4-5.8]



# Results: Stunning efficiency

## Stage 1: Before bleeding 2/2

SH	Batch	n	Sex	BW	Electrical parameters in waterbath			Birds with outcomes of consciousness, %	
					Current, mA/bird	Frequency, Hz	Voltage, V	Mean	CI 95%
4	1	66	♀*	10.5	659±66	400	375±13	0.0	[0.0-5.5]
	2	120	♀*	7.6	634±49	400	360	0.4	[0.1-4.6]
5	1	197	♀*	12.4	214±88	75	285	<b>5.8</b>	[3.5-10.3]
	2	99	♀*	12.4	177±94	75	285	<b>15.9</b>	[10.2-24.7]
6	1	50	♀	7.6	479±125	330	350	0.5	[0.0-7.1]
	2	13	♀	10.7	400±119	330	350	0.0	[0.0-22.8]
	3	137	♀	10.5	241±80	330	350	0.0	[0.0-2.7]
7	1	99	♀	7.9	372±26	100	330±2	1.0	[0.0-3.7]
	2	217	♀	8.5	408±34	100	330±3	0.0	[0.0-1.7]
	3	177	♀	7.8	436±47	100	330±3	0.0	[0.0-2.1]
8	1	200	♂**	15.4	275±57	171	243±2	1.3	[0.3-3.6]

\* Mostly ♀ but some ♂; \*\* Mostly ♂ but some ♀

## Stage 2: After bleeding 1/2

SH	Batch	n	Sex	BW	Electrical parameters in waterbath			Birds with outcomes of consciousness, %	
					Current, mA/bird	Frequency, Hz	Voltage, V	%	CI 95%
1	1	200	♀	4.2	289±29	150	300	0.0	[0.0-1.9]
	2	200	♂	3.8	345±33	150	300	0.0	[0.0-1.9]
	3	200	♀	3.8	367±25	150	300	0.0	[0.0-1.3]
2	1	39	♂	15.9	293±39	199	145	10.8	[4.1-23.6]
	2	150	♂	16.2	319±65	199	141	17.6	[12.7-24.9]
	3	190	♀	7.8	303±33	199	140	6.6	[4.1-11.4]
	4	68	♀	6.3	278±46	199	140	2.6	[0.8-10.1]
3	1	200	♂	16.3	NA	199	NA	1.4	[0.5-4.3]
	2	213	♂	7.7	NA	199	NA	4.3	[2.2-7.8]
	3	180	♂	15.1	NA	199	NA	3.6	[1.9-7.8]
	4	213	♂	16.0	284±50	196	187±3	2.5	[1.0-5.4]
	5	180	♂	11.1	287±35	196	186±8	2.0	[1.0-5.6]
	6	200	♂	12.1	302±55	196	206±3	8.5	[3.1-9.6]
	7	200	♂	15.6	311±61	196	229±2	8.5	[3.1-9.6]

## Stage 2: After bleeding 2/2

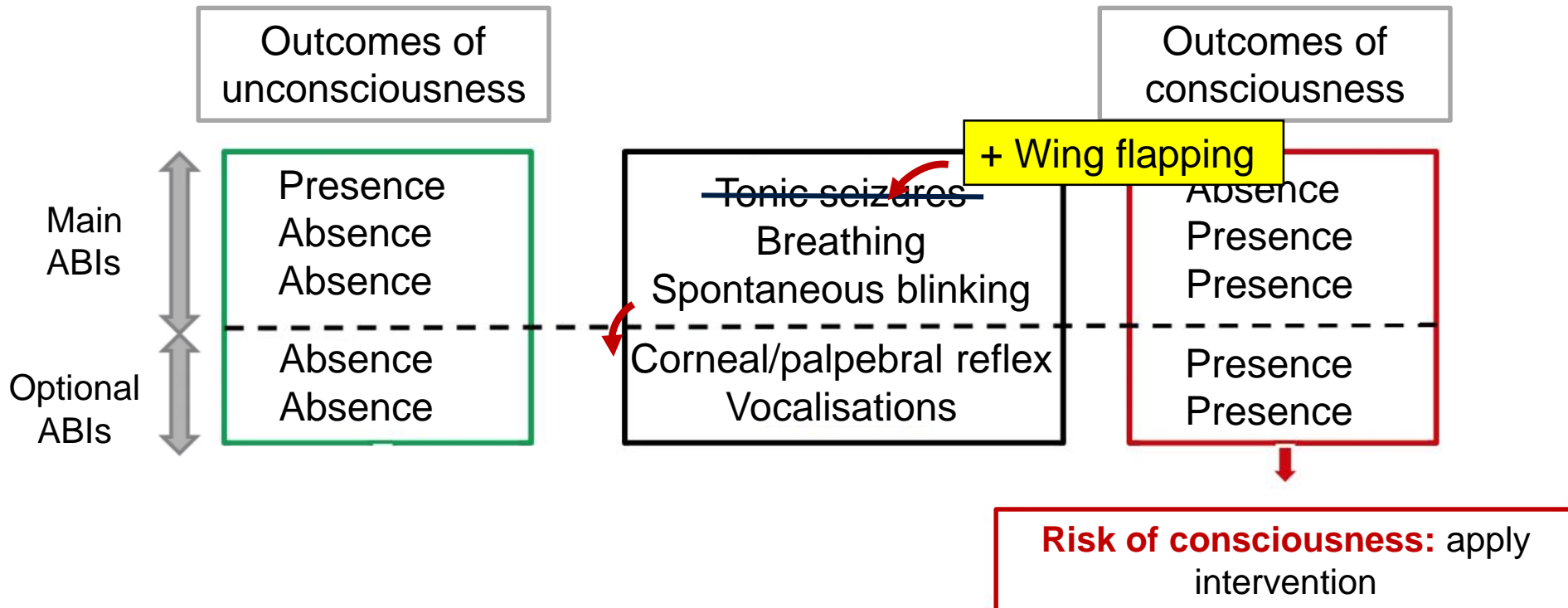
					Electrical parameters in waterbath			Birds with outcomes of consciousness, %	
SH	Batch	n	Sex	BW	Current, mA/bird	Frequency, Hz	Voltage, V	%	CI 95%
4	1	150	♀*	10.5	659±66	400	375±13	7.0	[4.1-12.6]
	2	58	♀*	7.6	634±49	400	360	1.7	[0.3-9.1]
	3	142	♀*	12.4	677±75	400	407±5	9.0	[5.4-15.0]
5	1	200	♀*	12.4	214±88	75	285	5.8	[3.5-10.2]
	2	148	♀*	7.6	177±94	75	285	5.1	[2.8-10.3]
6	1	90	♀	10.7	479±125	330	350	8.6	[4.6-16.6]
	2	100	♀	10.5	400±119	330	350	8.0	[4.1-15.0]
	3	121	♀	7.9	241±80	330	350	10.4	[6.4-17.5]
7	1	200	♀	8.5	372±26	100	330±2	1.0	[0.3-3.6]
	2	87	♀	7.8	408±34	100	330±3	0.0	[0.0-4.3]
	3	123	♀	15.4	436±47	100	330±3	0.0	[0.0-3.0]
8	1	224	♂**	10.5	275±57	171	243±2	1.3	[0.5-3.9]

\* Mostly ♀ but some ♂; \*\* Mostly ♂ but some ♀

# Conclusions

1. This study serves at identifying refined and validated ABIs with good level of repeatability that can be used for the assessment of the state of consciousness in commercial slaughterhouses.

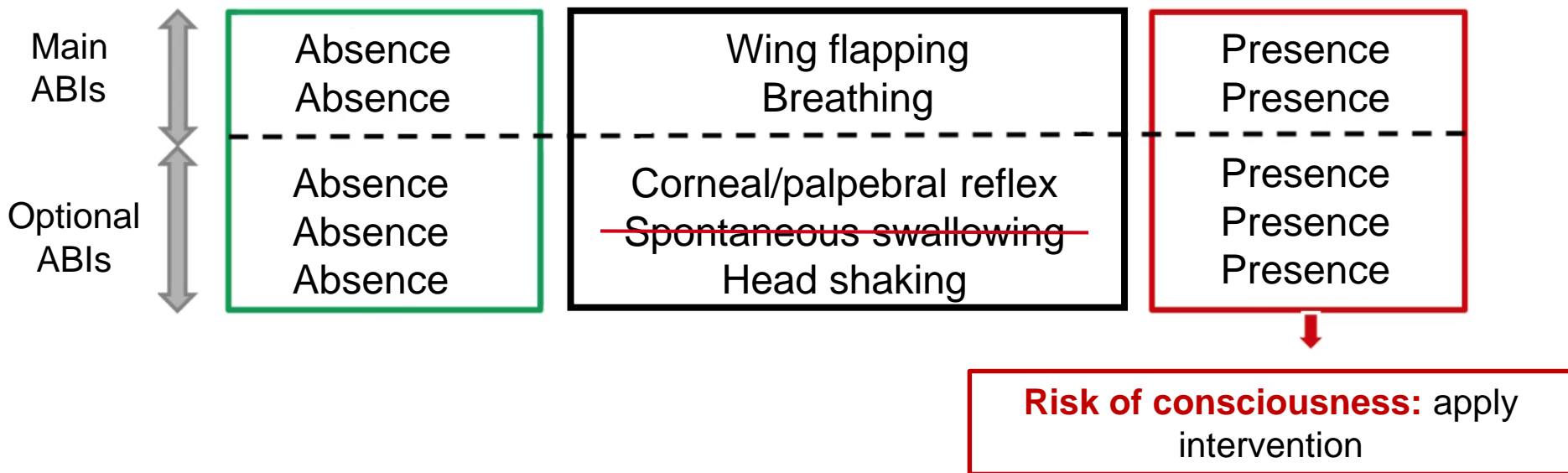
## Stage 1: Before bleeding



# Conclusions

1. This study serves at identifying refined and validated ABIs with good level of repeatability that can be used for the assessment of the state of consciousness in commercial slaughterhouses.

## Stage 2: After bleeding



# Conclusions

2. Repeatability at detecting indicators of consciousness among observers it is likely to be increased by **better training** and surely is a key point to control animal welfare assessment at slaughterhouse.

3. In the turkey industry, there is a **broad range of body weights** at slaughter. Some combinations of electrical parameters that resulted in effective stunning were found when:

- $\approx$  4 kg of body weight (340 mA/bird, 150 Hz and 300 V)
- $\approx$  8 kg of body weight (402 mA/bird, 100 Hz and 330 V)
- $\approx$  15 kg of body weight (440 mA/bird, 100 Hz and 330V)

4. **Sexual dimorphism** in turkeys **should be taken into account**:

- Males found in a batch of females are more prone to be ineffectively stunned because the combination of electrical parameters might be adequate for the females (lower body weight) but not for the males.
- Females found in a batch of males are more prone to miss the WB due to shorter stature.

# Acknowledgements

Acknowledgments to the official veterinary services and slaughterhouses that allowed us to carry out this technical study at their facilities and helped us selflessly



Thank you for your attention!



EURCAW Poultry SFA

European Commission

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# Methods and recommendations

Aranzazu Varvaró (IRTA)



Designated by  
the EU Commission



# Method of assessment

## 1. Where and how should we do the assessment?

- Best visibility toward the animals → recommended ventral position.



Animals in ventral position

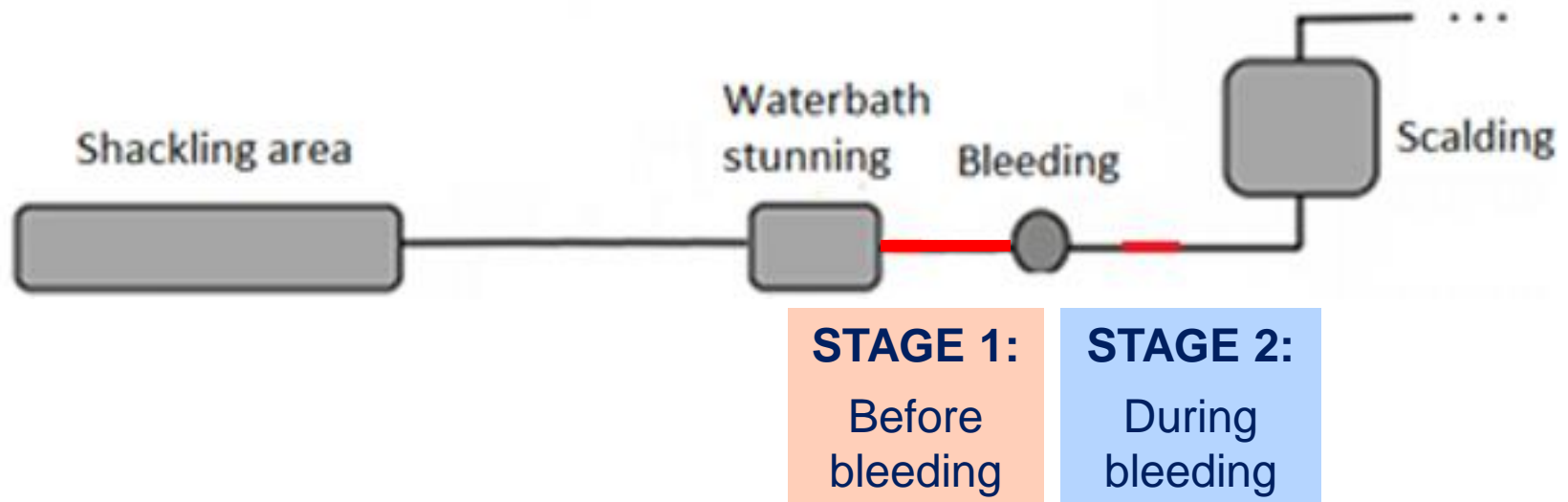


Animals in dorsal position

# Method of assessment

## 1. Where and how should we do the assessment?

- **Stage 1:** from the exit of the waterbath until bleeding.
- **Stage 2:** during bleeding at approximately 10s after severing the carotids.



# Method of assessment

## 2. How many time should we assess the animals?

- Visually follow animals individually for a few seconds.



## 3. Which ABIs should we assess?

- **Stage 1:** from the exit of the waterbath and before bleeding.
  - Breathing
  - Wing flapping\*
  - Vocalizations
- **Stage 2:** during bleeding
  - Breathing
  - Wing flapping



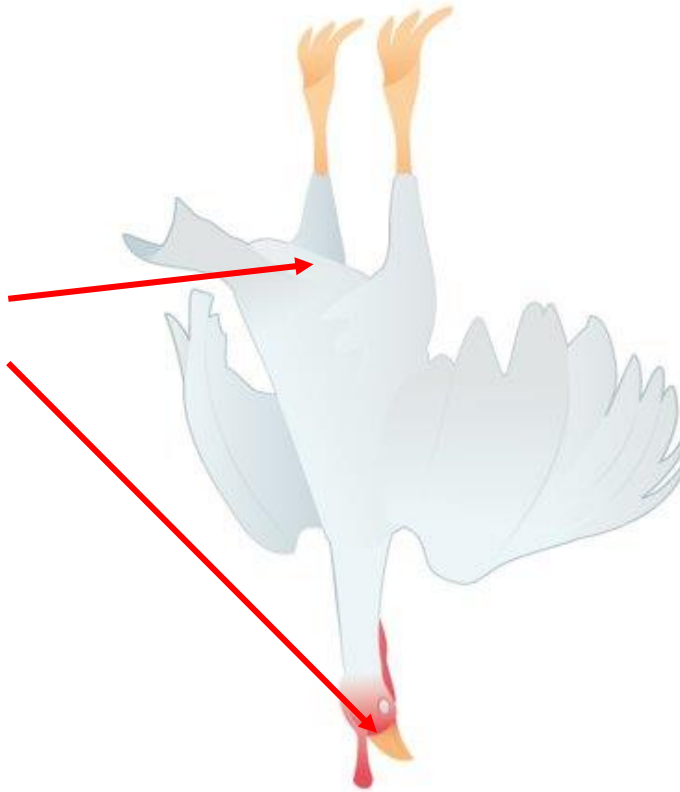
If the animal shows any of these ABIs, the bird is conscious or regaining consciousness

## 3. Which ABIs should we assess?

- **Stage 1:** from the exit of the waterbath and before bleeding

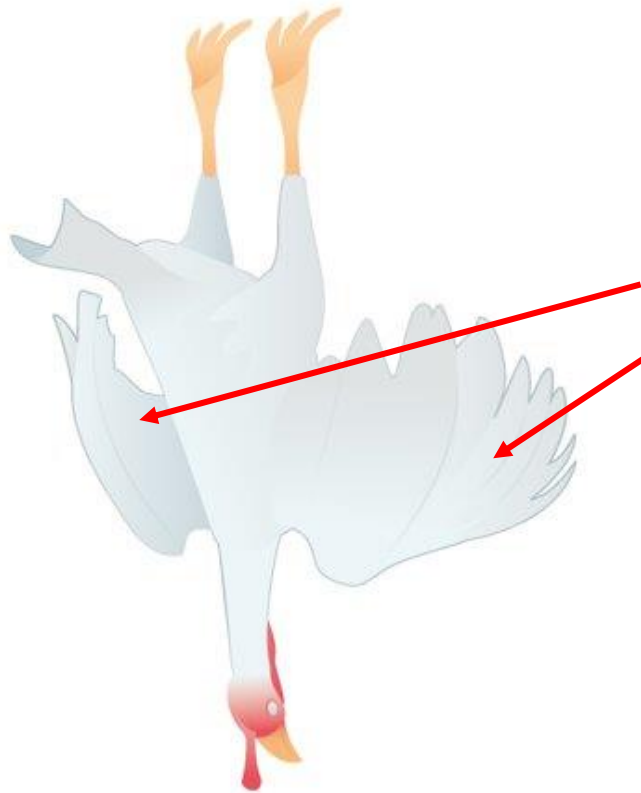
### BREATHING

Presence of either a minimum of two movements of the beak or abdominal muscles around the cloaca associated to breathing



## 3. Which ABIs should we assess?

- **Stage 1:** from the exit of the waterbath and before bleeding

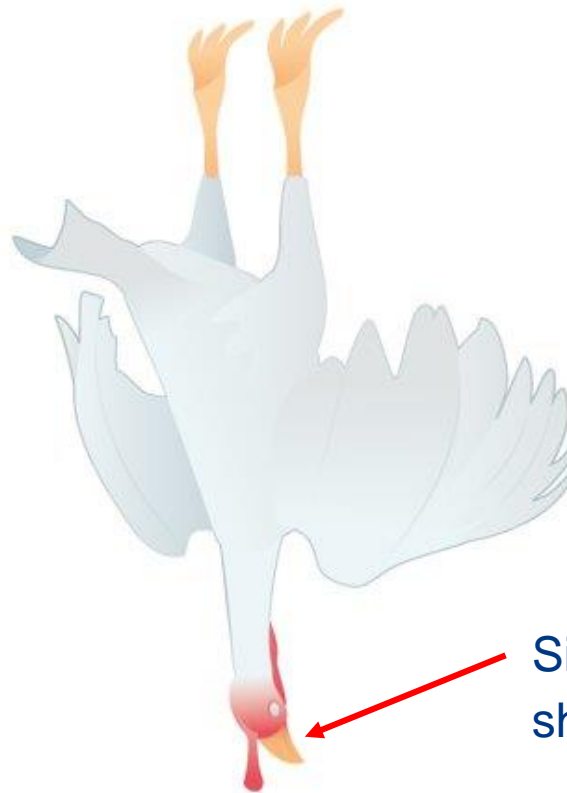


### WING FLAPPING

Flapping with both wings and should not be confused with rapid trembling of the entire body of the bird

## 3. Which ABIs should we assess?

- **Stage 1:** from the exit of the waterbath and before bleeding



### VOCALIZATION

Single or repeated  
shrieking (screaming)

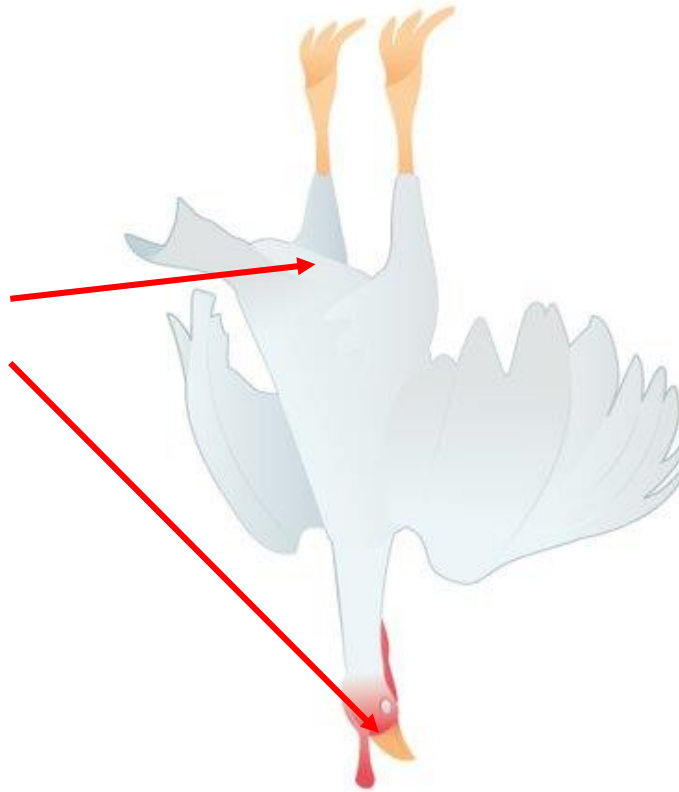


## 3. Which ABIs should we assess?

### ➤ Stage 2: during bleeding

#### BREATHING

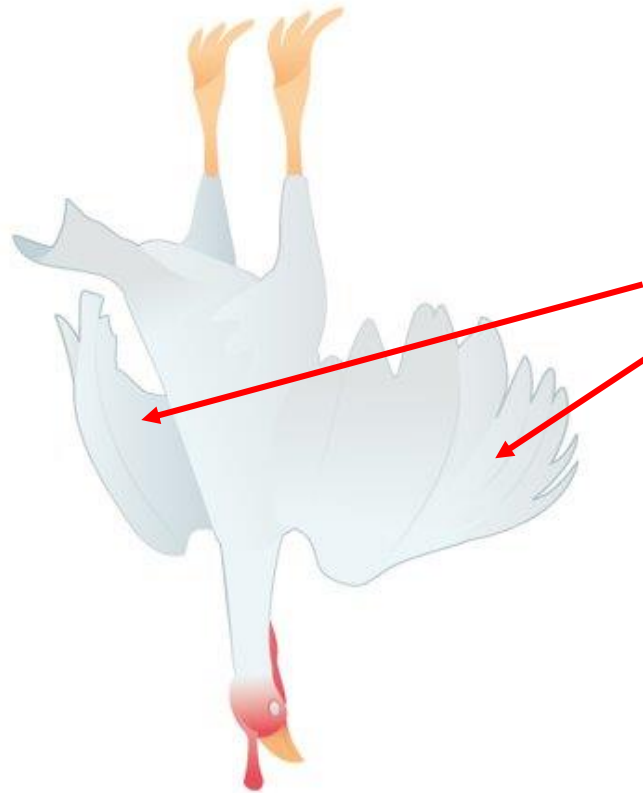
Presence of either a minimum of two movements of the beak or abdominal muscles around the cloaca associated to breathing





## 3. Which ABIs should we assess?

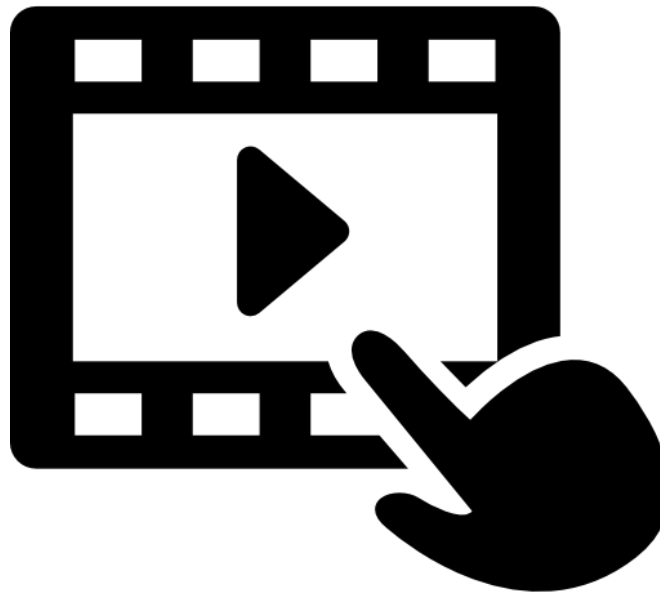
- **Stage 2:** during bleeding



### WING FLAPPING

Flapping with both wings and should not be confused with rapid trembling of the entire body of the bird

## 3. Which ABIs should we assess?



VIDEOS

# Recommendations

## Captive bolt as a back-up stunning method during slaughter of

- Re-stunning turkeys that show outcomes of consciousness pending process.
- Factsheet shows a good practice related to a back-up stunning method for turkeys.
- Penetrative captive bolt stunners adapted for turkeys.
- Best practice: it allows re-stunning on the line of heavy birds difficult to unshackle.



# Method of assessment

## Regulation 1099/2009



**Article 5.1.** Those checks shall be carried out on a sufficiently representative sample of animals and their frequency shall be established taking into account the outcome of previous checks and any factors which may affect the efficiency of the stunning process.

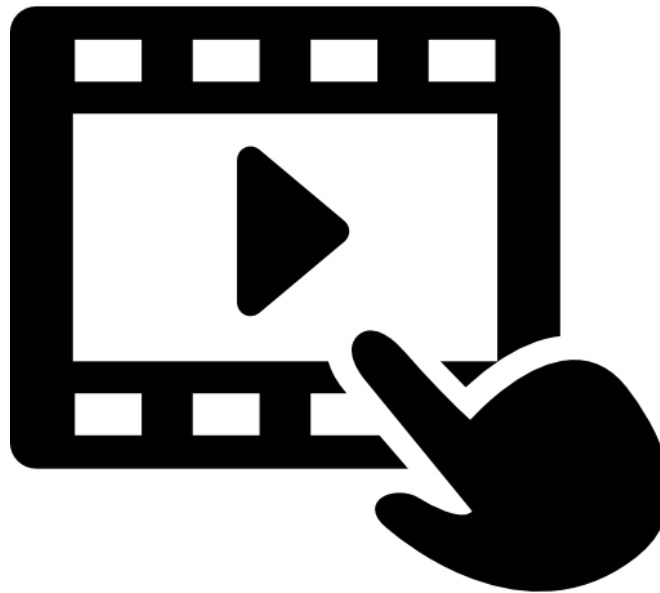
## 4. How should we do the sampling?

- To decide the frequency of the sampling: every flock? Some flocks?

At least 2 flocks a day, at different period of the day (*Anses, 2021*)

- Random sampling in the flock will ensure representativity
- Sample of the flock according to «factors which may affect the efficiency of the stunning process»
- Sample size: depends on your objective: assess a prevalence of birds showing indicators of consciousness? Monitor consciousness through time? both?  
Consecutively (*Anses, 2021*)

## 3. Which ABIs should we assess?



VIDEOS

**Thank you for your  
attention**



Designated by  
the EU Commission