

Measurement and Analysis of Drinking Behaviour Traits in Broilers

*Julija Rusakovica¹, Thomas Ploetz¹, Valentin Kremer², Santiago Avendano²,
Ilias Kyriazakis¹*

¹Newcastle University, UK

² Aviagen, UK

INTRODUCTION

General overview

- Lack of research related to water use and drinking behaviour in poultry
- Water is a scarce resource having implications for resource utilisation and environmental impact
- At a bird level water impacts gut health and foot pad dermatitis through litter quality

Current study approach

- Availability of RFID-based automated systems
- Record individual drinking events in a social, group-housed environment
- Allows to focus on bird behaviour, not only on water intake

BACKGROUND: RESOURCE UTILISATION

Broiler water intake:

- To reach 2.1kg BW * 1.62 FCR = 3.4 kg Feed
- 3.4kg Feed * 1.75 Water/Feed =
~ 6litres water/chicken (1.75 litres water at 21C)
- 100,000 broilers * 6 litres water/chicken =
600,000 litres in the grow cycle



<http://www.planetware.com>

Volume of water through Niagara falls = 567, 811 litres per second

DRINKING BEHAVIOUR & WATER USE

- Use of automated water stations
- Individual water intake recording
- Monitors drinking behaviour
- Records time of each visit, visit duration and drinker ID for each bird



OBJECTIVE

Identify novel drinking behaviour traits in broilers that could be incorporated into genetic selection programme

Specific Objectives

- How do we measure drinking behaviour traits?
- What are the biologically relevant traits for drinking behaviour?
- Which drinking behaviour traits can be used in genetic selection programmes?
- Are there differences in drinking behaviour between different genetic lines?

MATERIALS & METHODS: DATA

Data from two purebred commercial broiler lines:

- **Line 1:** 1878 birds from 15-35 days of age (1,577,530 events)
- **Line 2:** 2048 birds from 13-32 days of age (2,641,233 events)

DRINKING BEHAVIOUR & DRINKING BEHAVIOUR TRAITS

Hypothesis

- Visits occur generally at random and are affected by social interaction
- Visits to the water station can be clustered into bouts

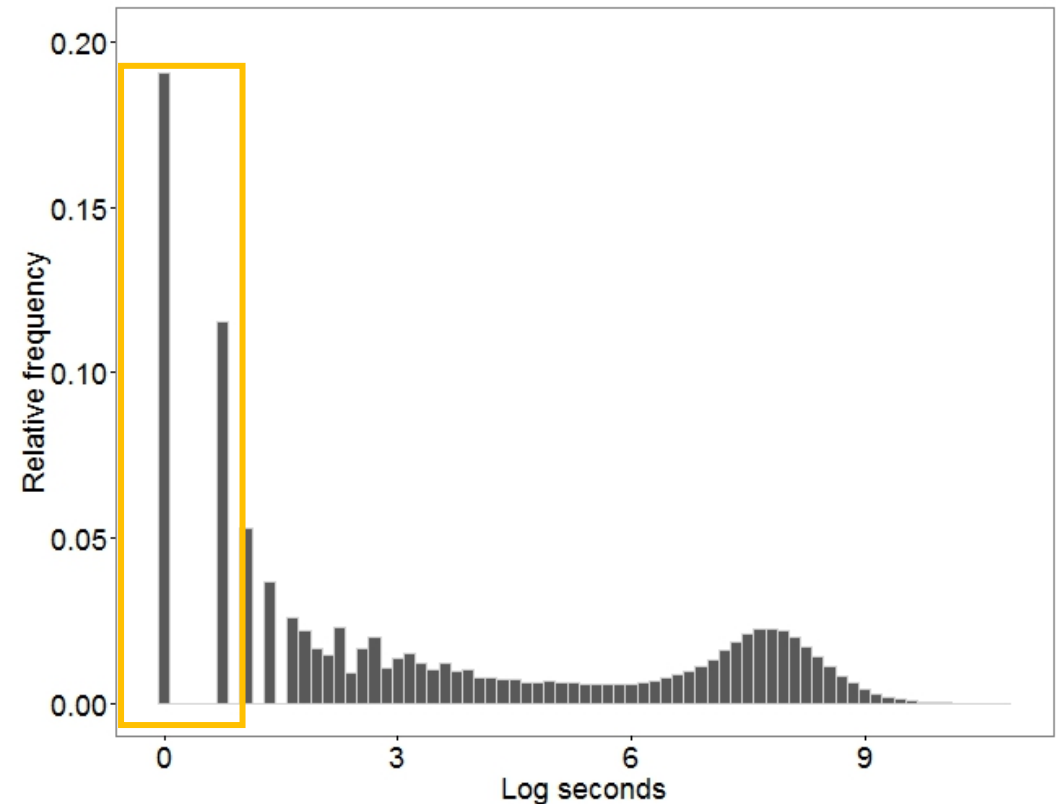
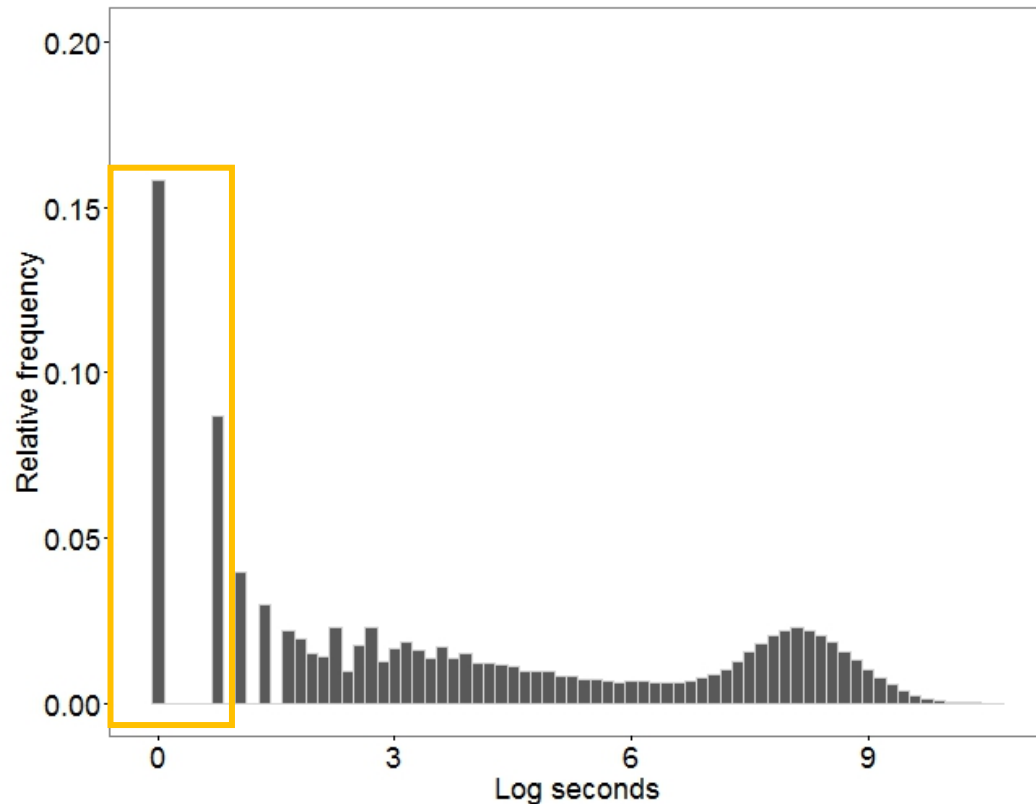
Genetic basis of water drinking behaviour (next step)

- Heritability and genetic correlations with feed efficiency
- Genetic basis of drinking behaviour strategies

RESULTS: ORIGINAL DATA

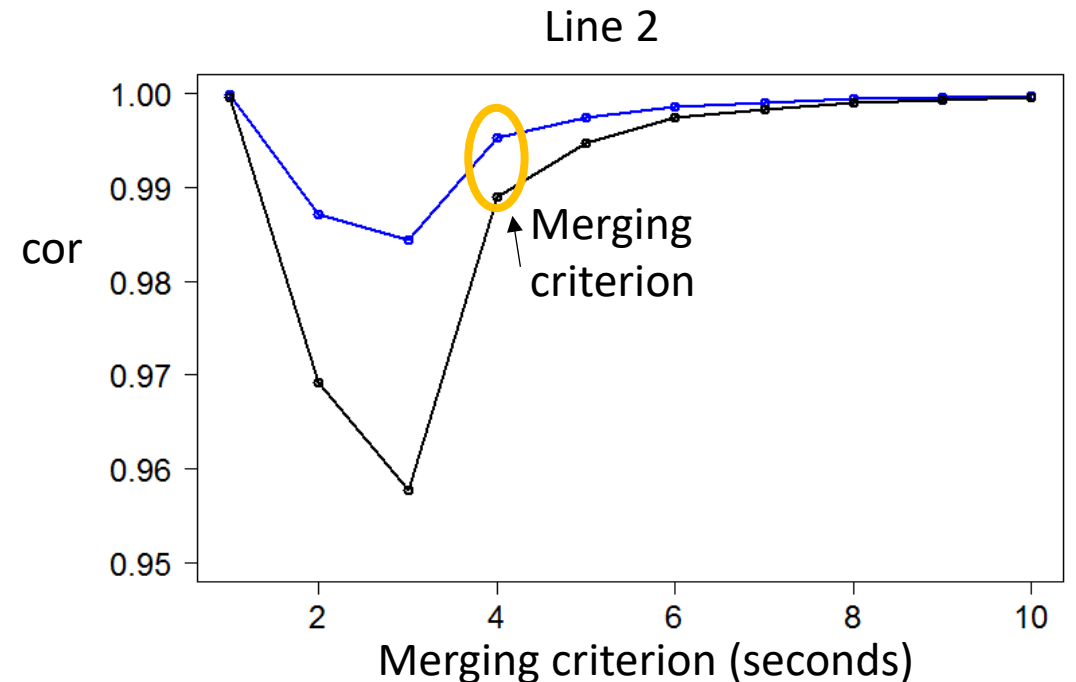
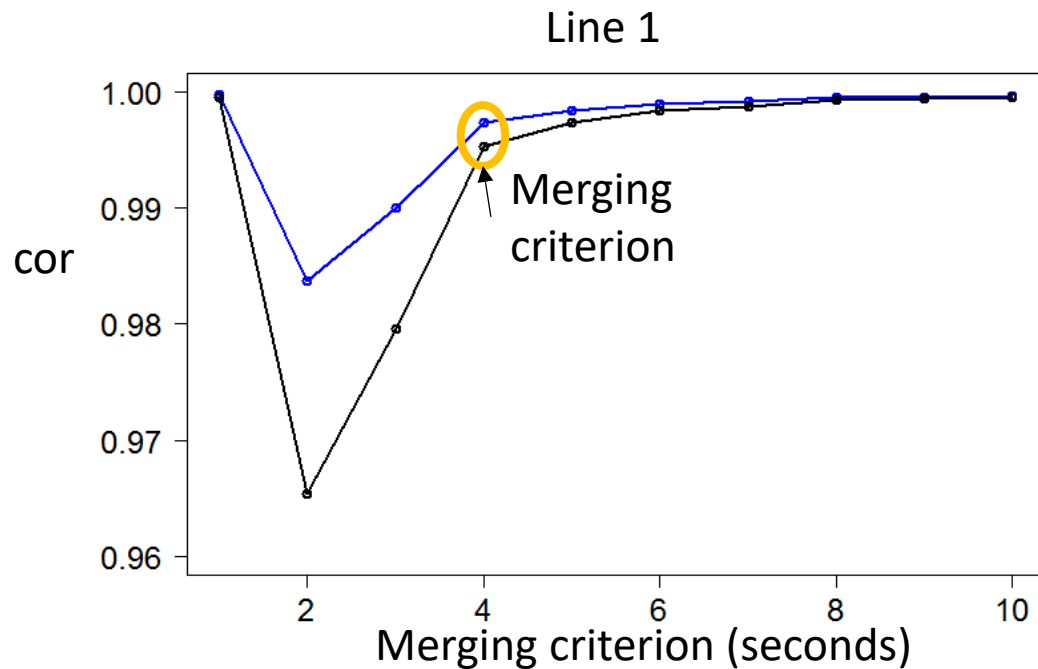
Intervals between drinking events

- Intervals between drinking events were log-transformed
- High proportion of very short intervals between drinking events



RESULTS: MERGING CRITERION FOR BROILERS

- System validation step revealed system oversensitivity to bird movements, fragmenting some visits with short intervals between drinking events
- To merge such visits, a merging criterion was calculated used a correlation coefficient between the duration of visits (black) and water intake (blue) per visit from 0 to 10 seconds



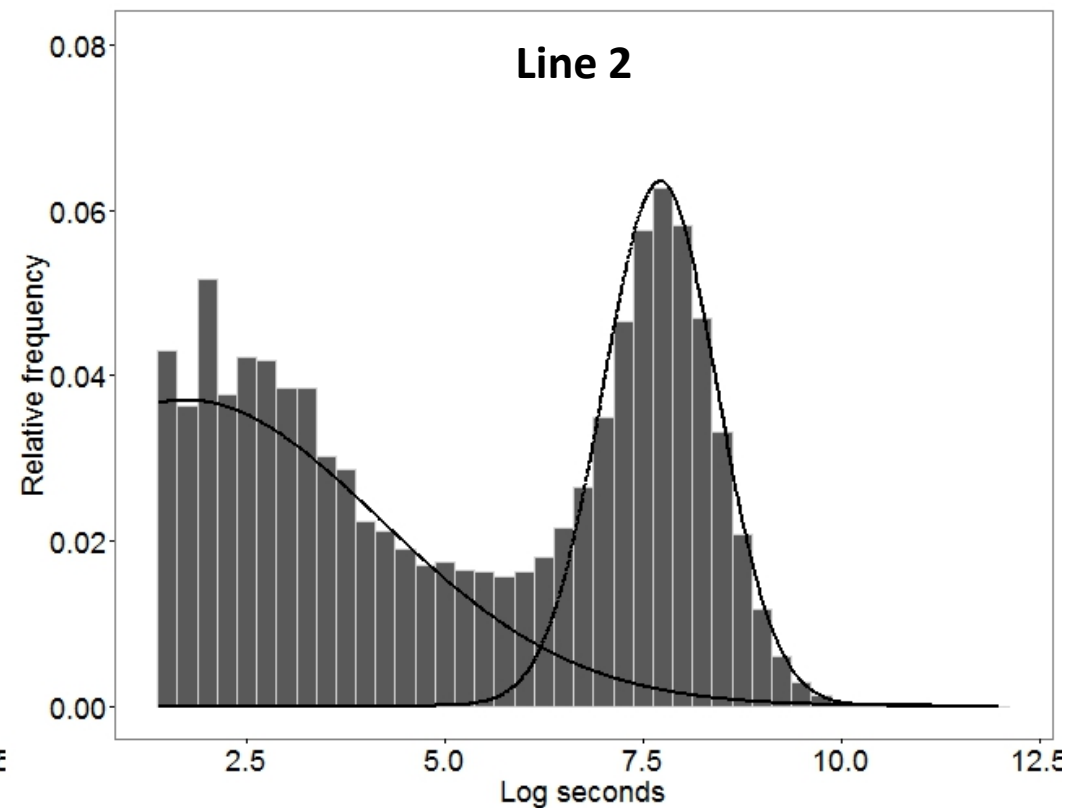
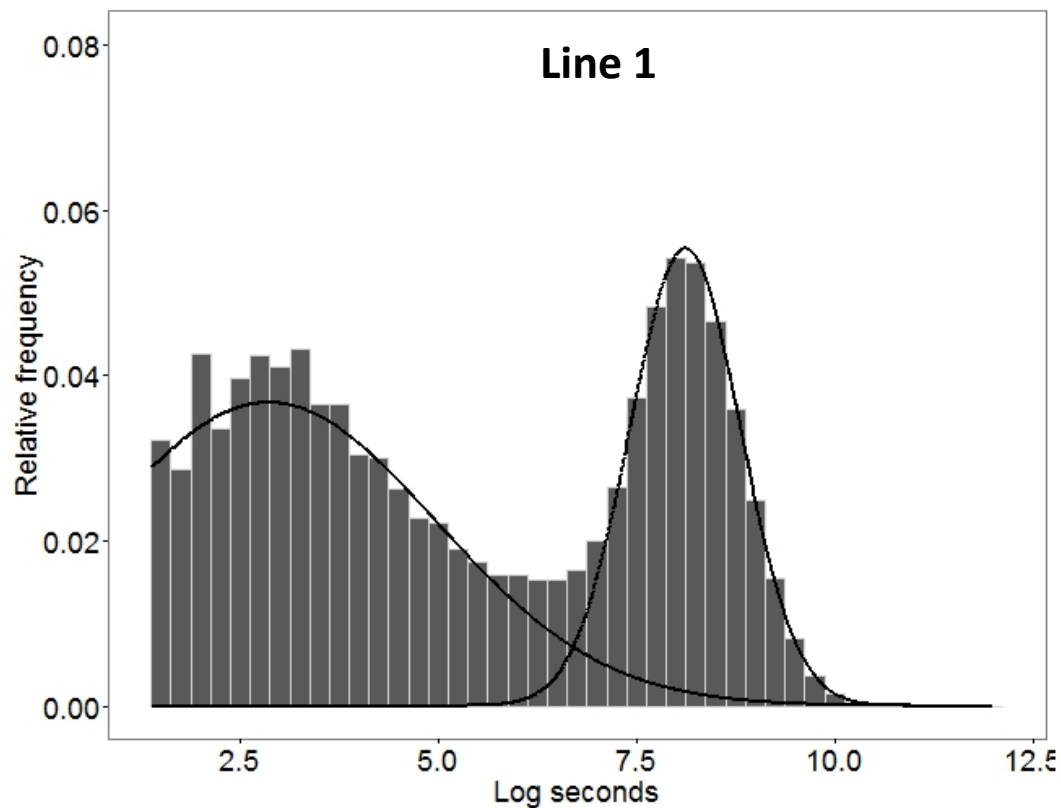
MATERIALS & METHODS: MODELLING

Grouping drinking behaviour into bouts using Mixture Models

- Comes from previous studies on feeding behaviour
- Each bout is defined as time interval spent in proximity to the drinker
- Requires identification of a **bout criterion** – the shortest interval between visits to the drinker that is considered to be part of a bout
- Truncated log-normal distribution was used for within-bout intervals, log-normal for between bout intervals
- Bout criterion (t) was estimated at the intersection point between two distributions

RESULTS: MODELLING

- The bout criterion was estimated at the intersection point between the two distributions and resulted in **846 seconds** for line 1 and **566 seconds** for line 2



DRINKING BEHAVIOUR & DRINKING BEHAVIOUR TRAITS

Visit Level

- Number of visits per bout
- Drinking rate

Bout Level

- Daily bout frequency
- Water intake per bout
- Drinking time per bout

Day Level

- Daily bout duration
- Daily drinking time
- Daily water intake

RESULTS: DRINKING BEHAVIOUR TRAITS

Traits	Line 1	Line 2
Number of visits per bout	2.12±0.03*	1.99±0.03*
Drinking rate (ml/min)	7.78±0.04*	5.51±0.03*
Daily bout frequency	12.42±0.07*	18.78±0.10*
Water usage per bout (ml)	22.64±0.14*	11.91±0.07*
Drinking time per bout (s)	175.30±1.34*	132.55±1.04*
Daily bout duration (min)	62.90±0.56*	66.91±0.44*
Daily drinking time (min)	36.17±0.23*	40.84±0.22*
Daily water usage (ml)	282.48±0.86*	221.15±0.56*

All traits were significantly different between the lines ($p < 0.01$) based on Kruskal-Wallis test.

CONCLUSIONS

- Drinking behaviour in broilers follows the satiety principles; this enables biologically significant traits to be defined
- Novel drinking behaviour traits have been derived; they include 2 traits at a visit level, and 3 traits each for bout and day levels
- Lines showed differences in the organisation of drinking behaviour
- The novel traits may be used in genetic selection by identifying birds that utilise water more efficiently or spent less time in drinking associated activities

ACKNOWLEDGEMENT

- Colleagues at Newcastle University
- Aviagen for data and support on farm
- BBSRC for funding the project



Thank you!

