

Heat and Moisture Production by Broilers During Simulated Cold Weather Transport

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Heat and Moisture

- Metabolic processes of living birds generate **heat**.
- Most is “sensible” heat (i.e. heat you can feel). Heat that causes a rise in temperature.
- A proportion is “latent” heat. This is the energy used to change water in the body into water vapour. Causes a rise in humidity (and loss of \$\$\$).

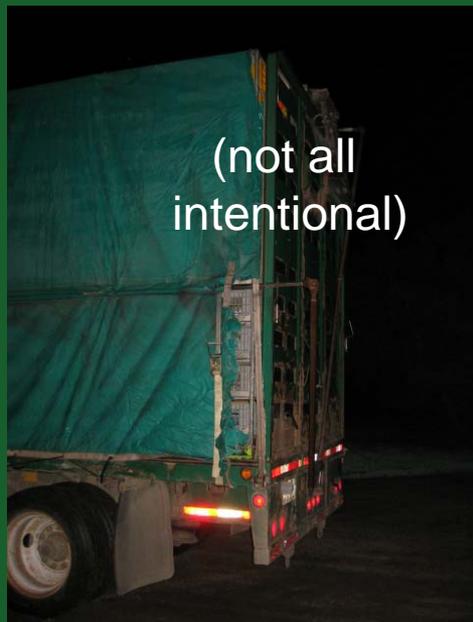




Managing heat and moisture during transport:



Limited Ventilation



(not all intentional)

Prototype trailer with active ventilation



Prototype Fully Loaded



Managing heat and moisture during transport:

- **Goals:**

Maintain acceptable temperatures in all parts of the trailer.

Remove as much water vapour as possible before it condenses.

For both engineering and management purposes it is desirable to know how much heat and moisture are being produced.



But how much?



- Most HP and MP estimates are based on birds at 20 C or more.
- Based on these estimates a loaded 53' trailer produces:
 - Heat equivalent to 20 barbecues
 - More than 100 litres/hour
 - But...



But...

- **Temperatures inside trucks vary and can reach -16 C in some areas.**
- **Is heat production of birds constant, or is it influenced by surrounding temperature?**

Scientific evidence says it is influenced, but it hasn't been measured at very low temperatures.

Research Objective

- Calculate heat and moisture produced by broilers at selected cold temperatures.
- We used a small scale simulation chamber so that airflow and temperature could be precisely controlled.
- Results can be extrapolated to full scale trailers and intermediate temperatures.

Materials and Methods

- **Two loading conditions tested:**
- **A. Smaller birds, fewer birds, lower density**
- **B. More birds, heavier birds, higher density**

Condition A

- **15 Birds/ drawer**
- **32-33 days old**
- **Average weight 1.8 Kg**
- **Drawer packing density 27 Kg/drawer**
- **Birds are smaller, fewer in number, and have more space to move about.**

Condition B (2 groups)

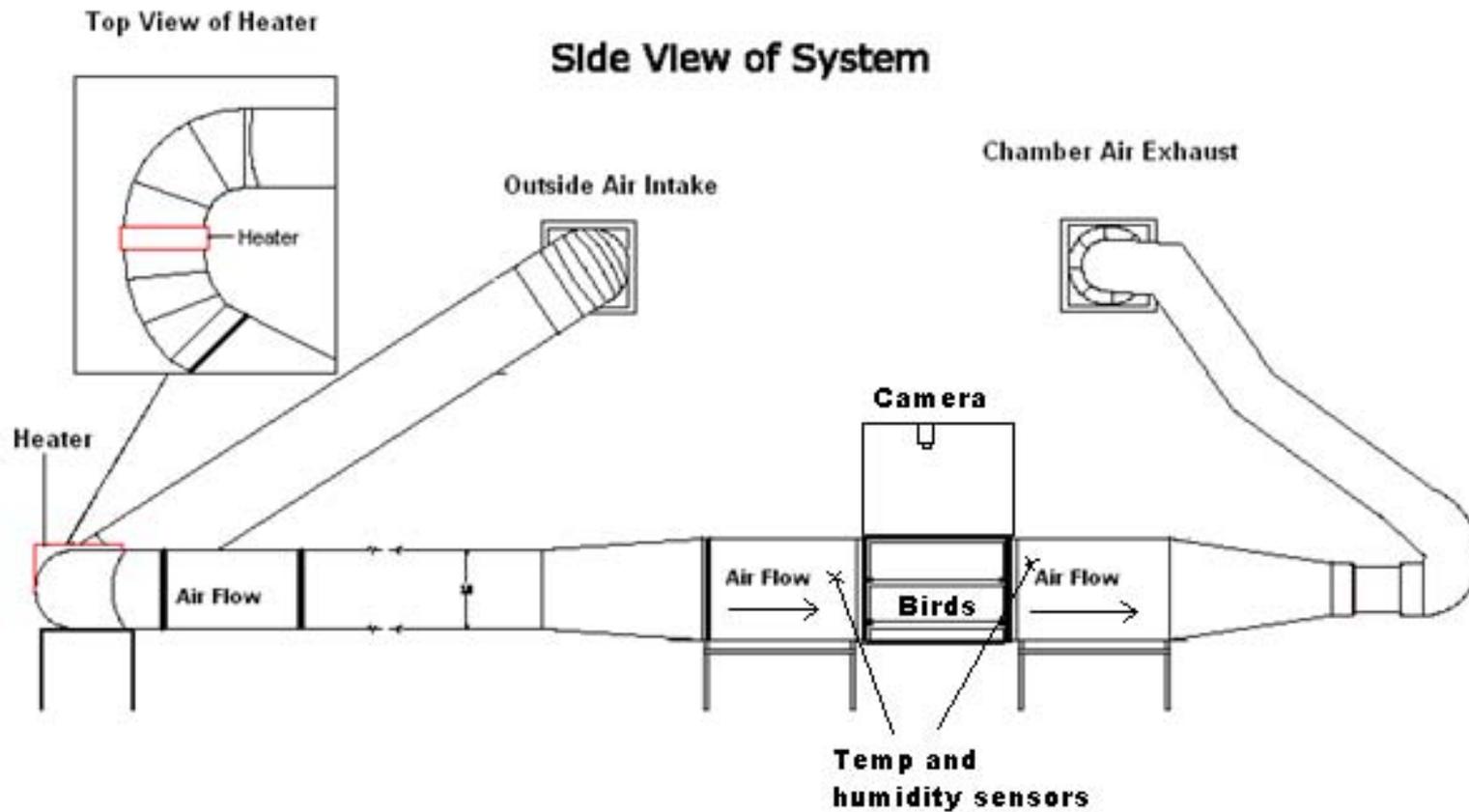
- 19 or 22 birds/ drawer
- 39-40 or 35-36 days old
- Weight 2.68 Kg or 2.29 Kg
- Drawer packing density constant at approx 50 Kg/drawer (twice as much as Condition A)
- Birds are bigger, more numerous and more closely packed. i.e. have less room to move about

Materials and Methods

- **Condition A:**
- **9 trials**
- **3 each at -5, -10 and -15 C**

- **Condition B:**
- **15 trials**
- **3 at +20, 12 at temperatures ranging from -8 to -18 C**

Environmental Chamber



Environmental Chamber



Materials and Methods

- **Birds given internal temperature logger and fasted for 7h.**
- **Placed in standard transport drawer with mesh lid to acclimate for 2h.**
- **Drawer placed in chamber at controlled temperature and air flow rate for 3 h.**

Chickens in drawer

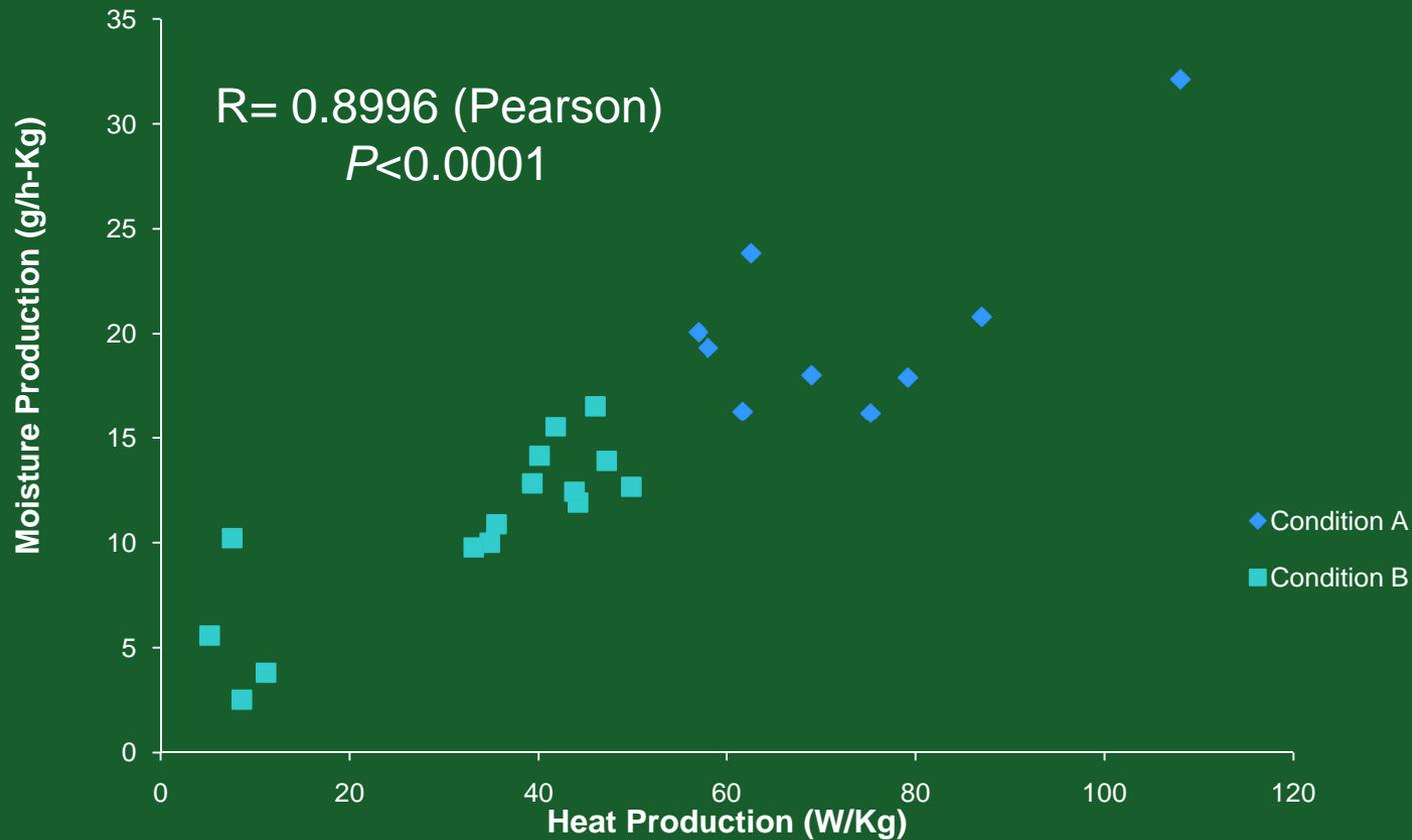


Materials and Methods

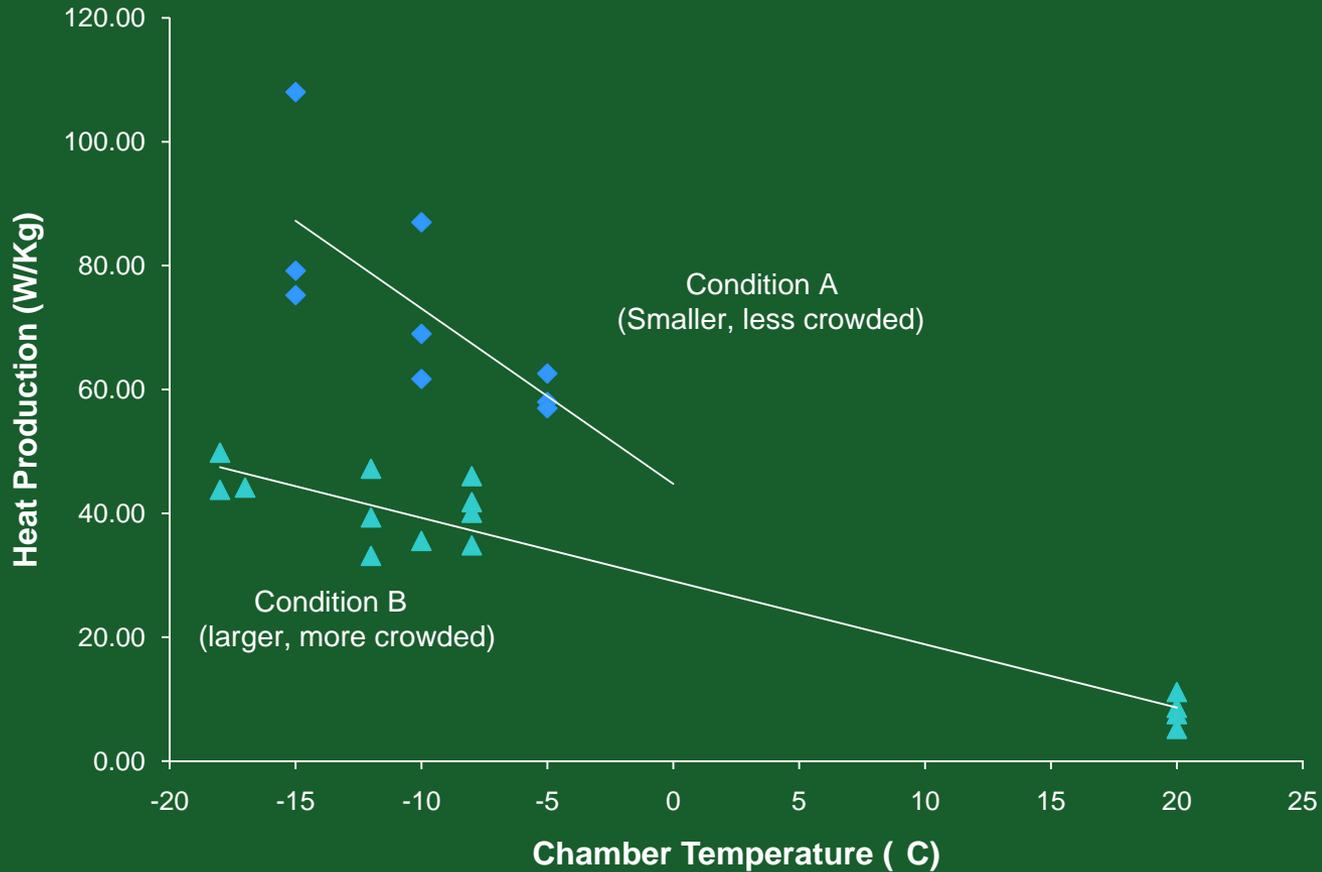
- **Temperature and humidity in air measured just before it reached the bird compartment and just after it left at 1 min intervals.**
- **Difference in values due to heat and moisture given off by the birds.**

Results

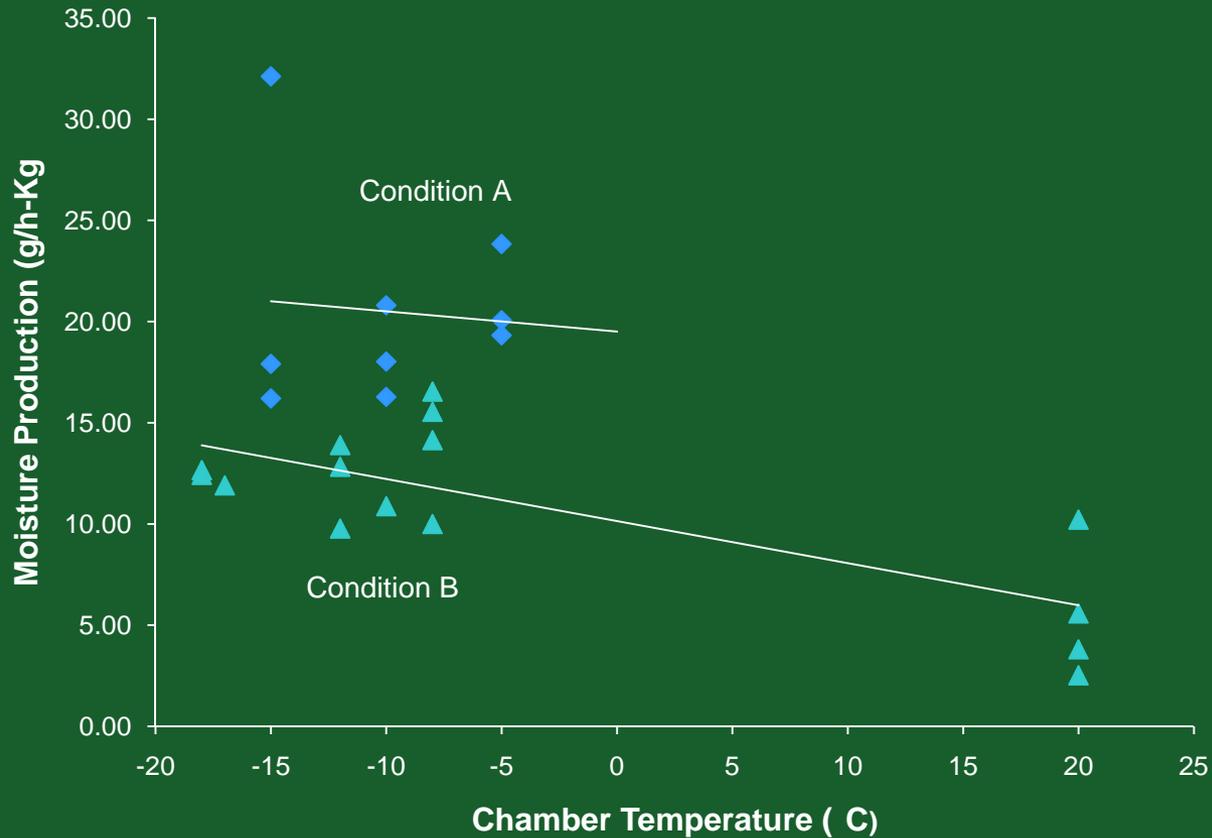
Relationship between heat and moisture production



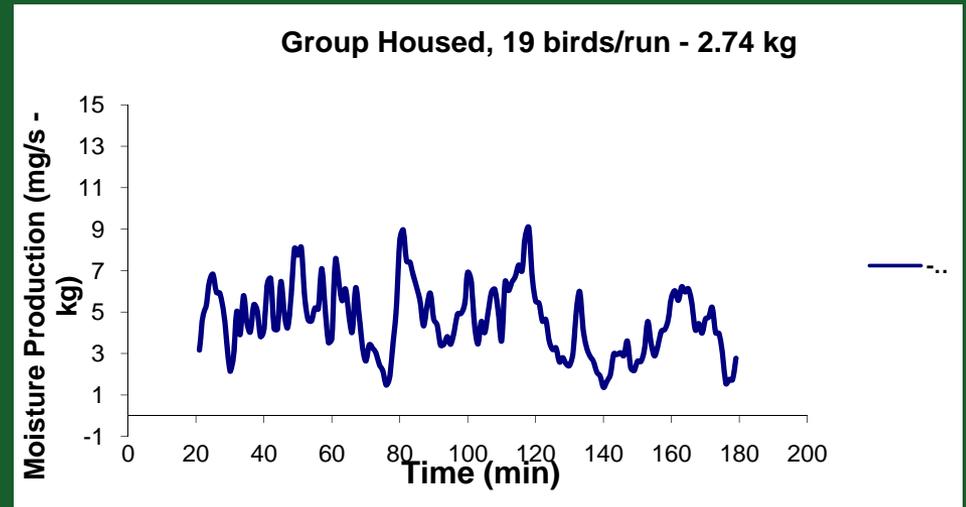
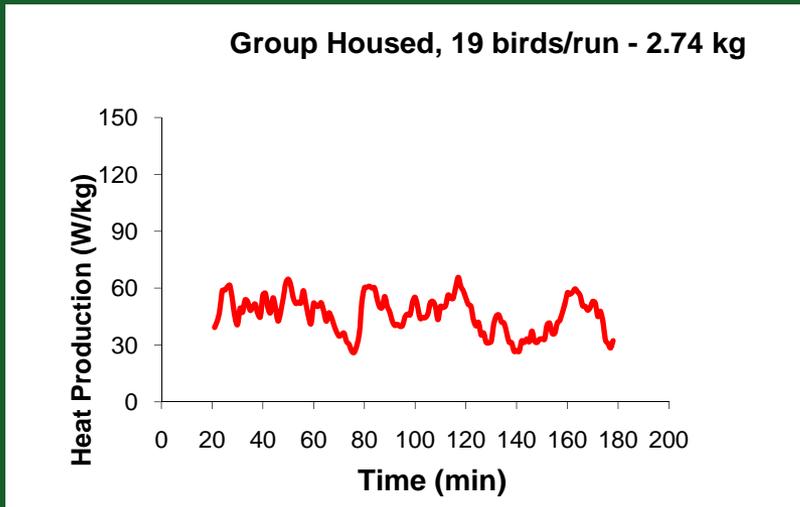
Heat Production



Moisture Production



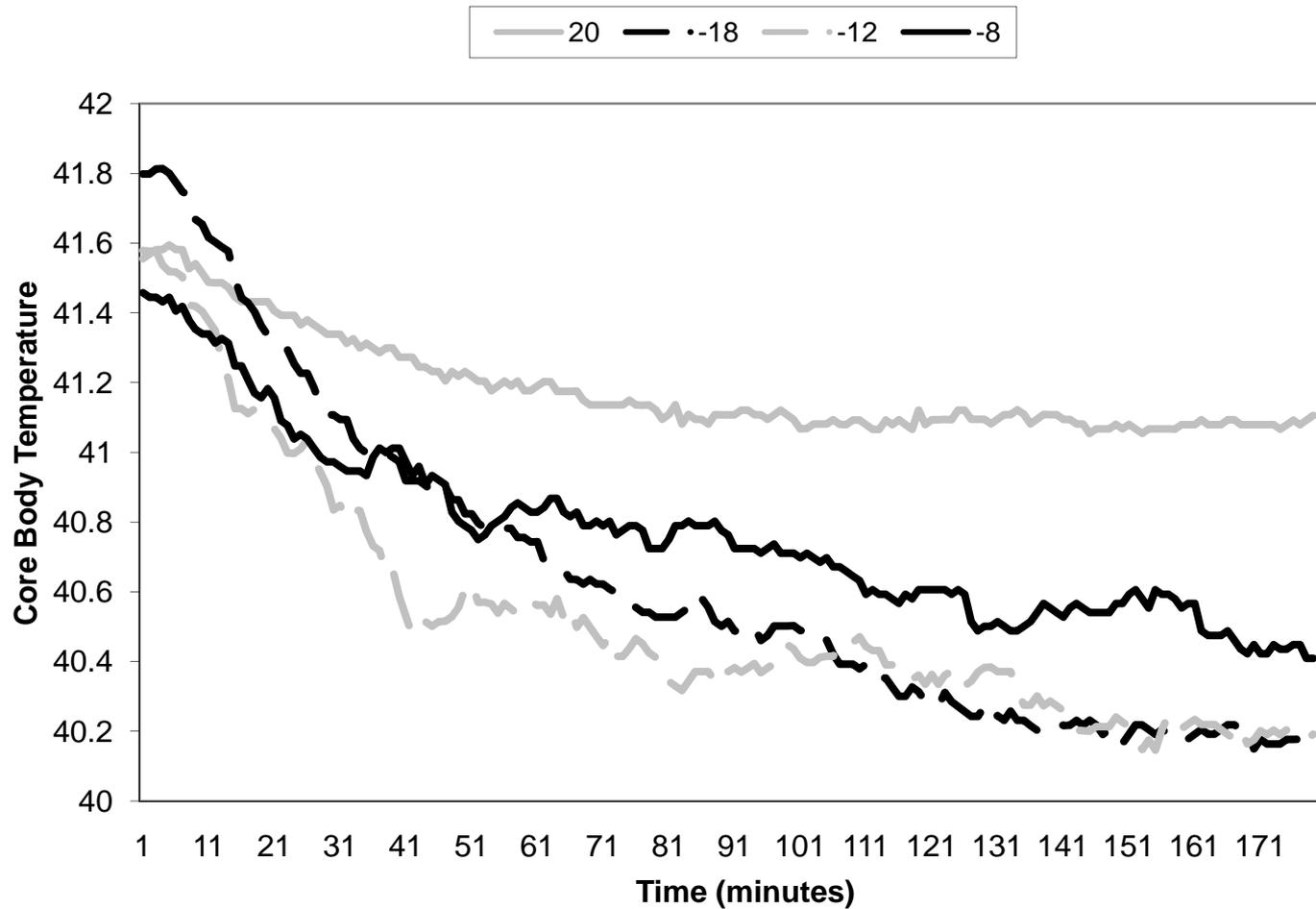
What happens to birds?



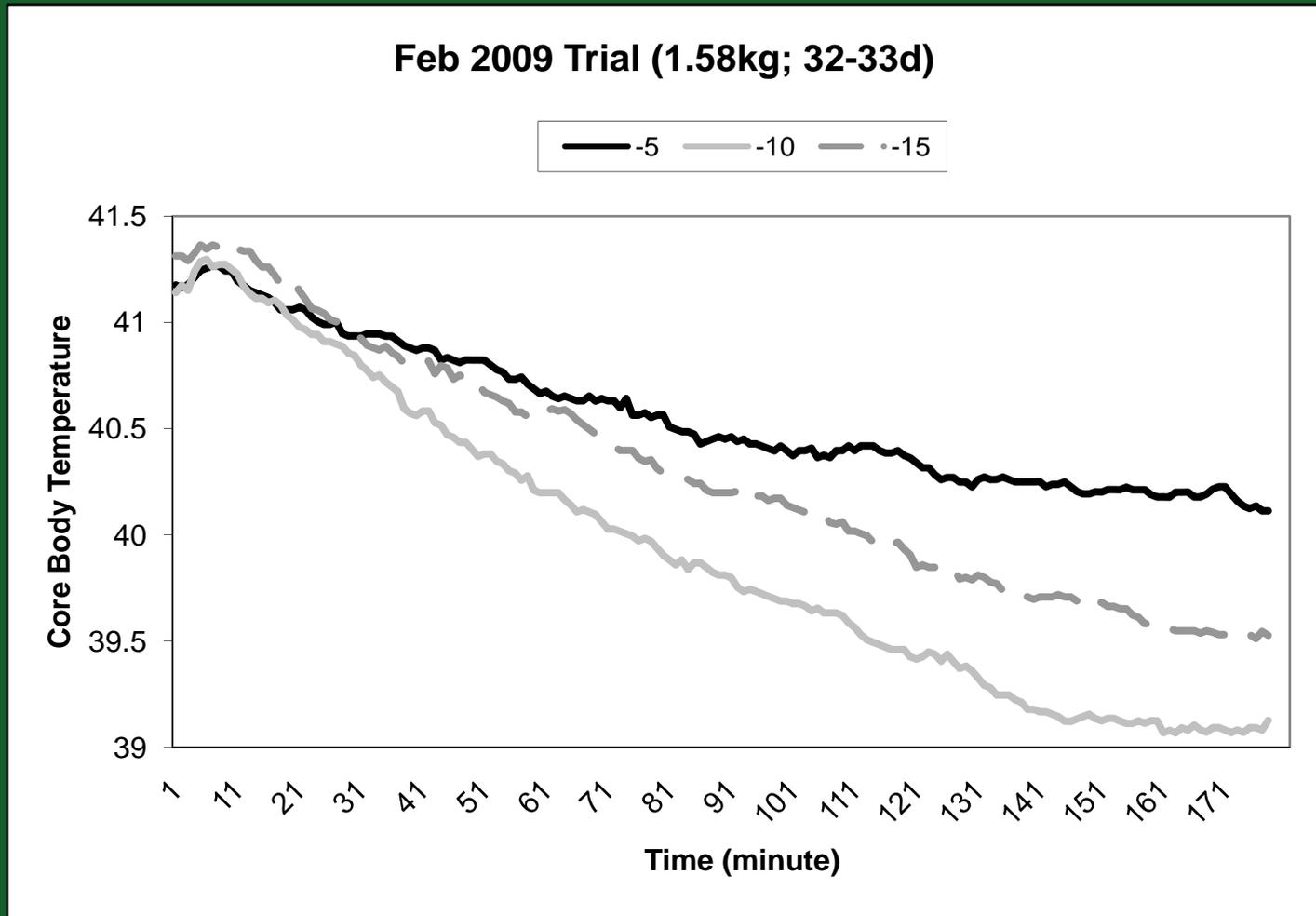
Heat and moisture production oscillate about a mean, but are sustained over 3h.

What happens to birds?

Dec 2009 Trial (2.6 kg; 39-41d)



What happens to birds?



Summary

- **At cold temperatures broilers can give off up to 5 or 6X more heat than at normal barn temperature, and increased moisture in proportion.**
- **The amount of heat and moisture that needs to be managed during winter transport is much higher than we thought based on previously published data.**

Summary

- **Smaller, less crowded birds produce more heat and moisture than bigger, more crowded birds.**
- **Heat output appeared sustainable at these temperatures for 3 h.**
- **No birds suffered serious hypothermia and all were able to resume normal behaviour when removed from chamber.**

Summary

- **Birds seemed able to cope with and recover from exposure to these temperatures for 3h.**
- **But...**
- **There were signs that they would not be able to cope indefinitely with these conditions.**

Acknowledgements



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