



Food safety

Tom Humphrey

t.j.humphrey@liverpool.ac.uk

Professorial Fellow in Food Safety

Science Director NCZR

University of Liverpool

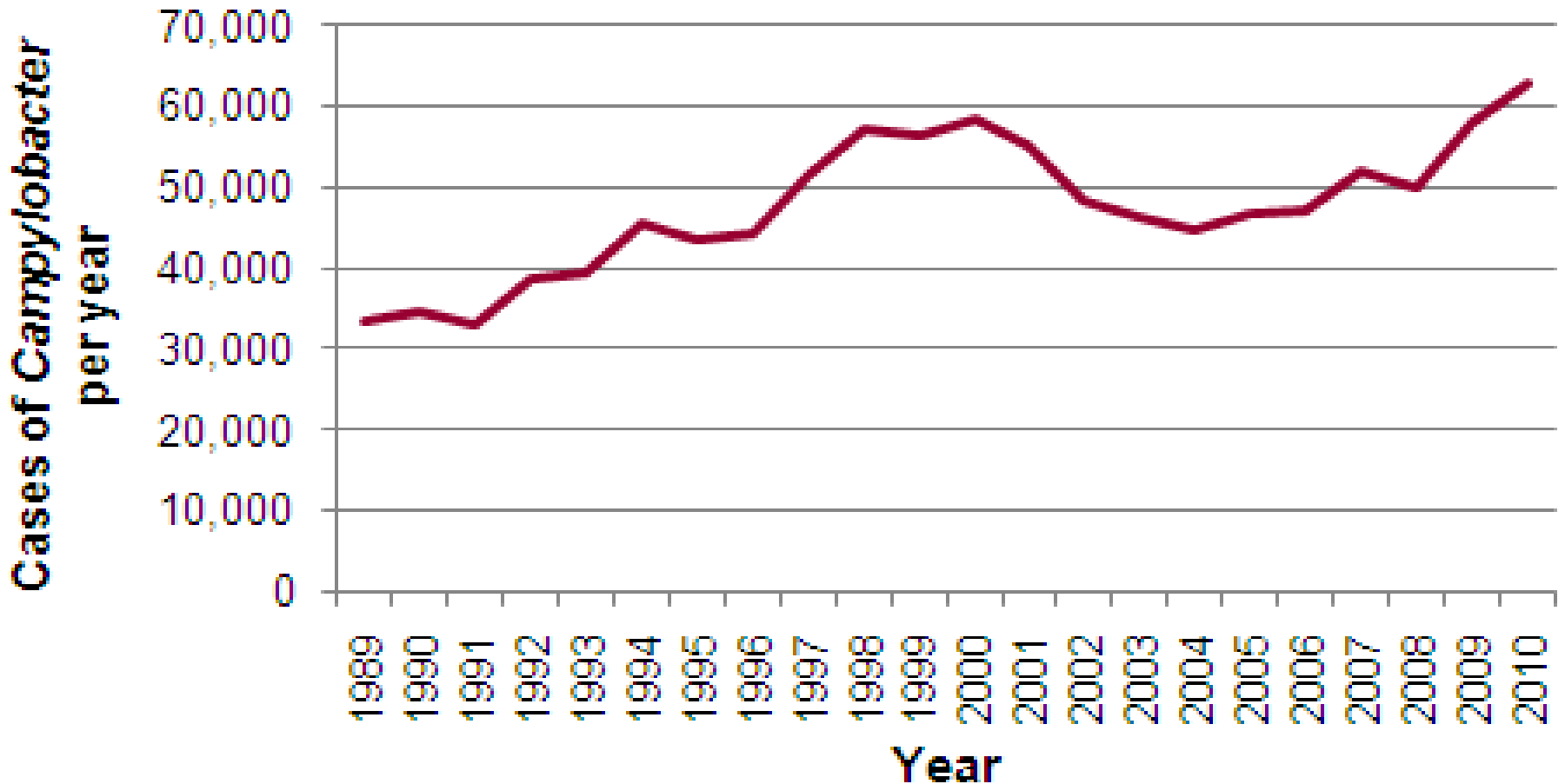


Infectious intestinal disease – how the numbers stack up

- \approx 17 million cases of IID per year in the UK (around 1 in 4 of the population)
 - Norovirus \approx 3 million cases
 - ***Campylobacter* \approx 700,000 cases**
- 1 million cases present to General Practice
 - Norovirus \approx 130,000
 - ***Campylobacter* \approx 80,000**
- Estimated school/working days lost
 - 18.8 million
 - 11.4 million in people of working age

Source: Tam *et al.* Gut 2011 Jul 5. [Epub ahead of print]

Campylobacter infections: England and Wales 1989-2010



Source: Health Protection Agency

Contaminated chicken meat is the major vehicle for *Campylobacter* infection



- Chicken source of 50-80% of *Campylobacter* cases
- ~ 80% carcasses positive at retail
- **Control in chicken production essential to improve public health**

It is rarely like this

Campylobacter and chicken: two health threats



- High level surface contamination (10^9):
A cross-contamination risk
- Contamination of liver and muscle tissues:
Heightened risk from under-cooking (20% muscle +)
- ~80% of cases chicken-related
- Many chicken liver paté outbreaks
- Eating chicken out, a major risk factor



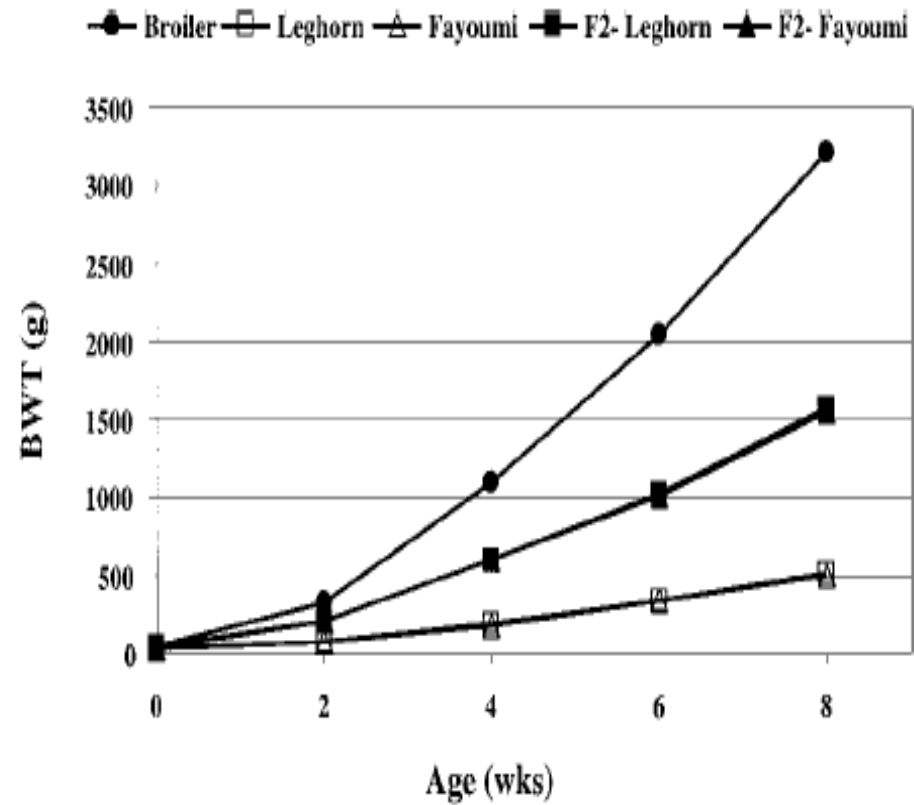
In vivo behaviour of *C. jejuni* in chickens is strongly linked to the health and welfare of the host

- Chickens' responses to endemic disease and/or environment important
- Birds can experience acute stress
- Change in pathogen behaviour
- Invasive phenotypes of *Campylobacter*
- Can this be mitigated?



Campylobacter and broilers: disconnection between productivity and food safety

- Are modern broilers more *Campylobacter*-susceptible because:
 - Grow more quickly
 - Have poorer gut health
 - More APEC-susceptible
 - Clear link between infections
 - Compromised immune responses
- There is a need to understand how 'fast' and 'slow' birds differ
 - Gut environment
 - Microbiota
 - Immune responses



Broilers in higher welfare systems:

- Slower-growing breeds are used in RSPCA schemes
- Better gut health: lower hock marks and pododermatitis
- Lower levels of endemic disease: avian pathogenic *E. coli* (APEC)
- A better environment: dry litter with a neutral pH
- Fewer birds that are *Campylobacter*-positive and less extra-intestinal spread



Hock marks



APEC infection



Pododermatitis

Housed systems and bird type and *Campylobacter*

- Longitudinal studies to compare production systems
- FF v STD
- FF had lower *Campylobacter*
- Much less likely to have APEC
- Is this bird type, stocking density, diet and/or environment?

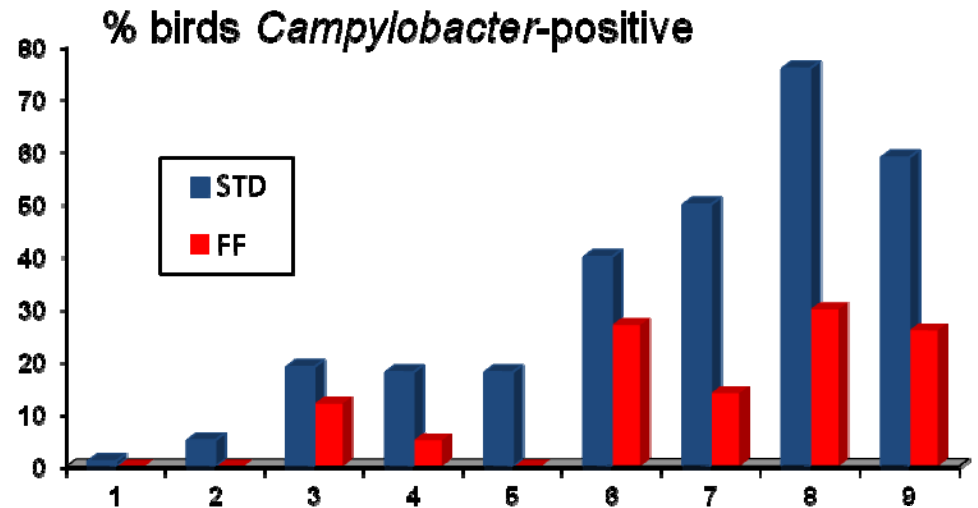
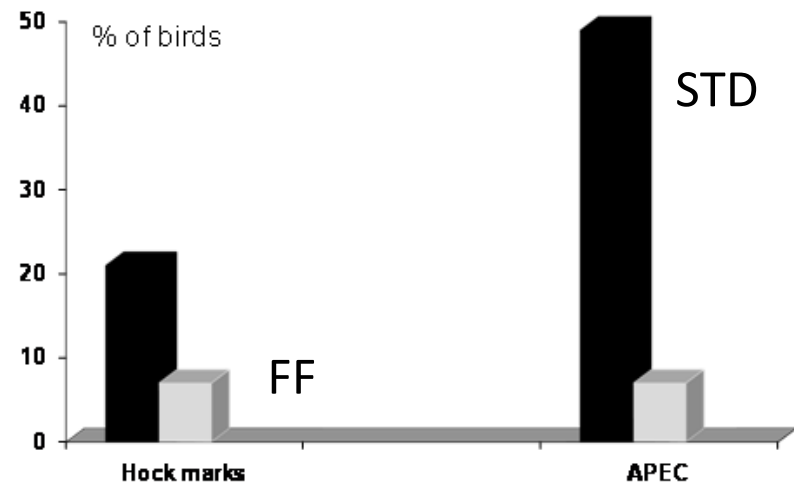
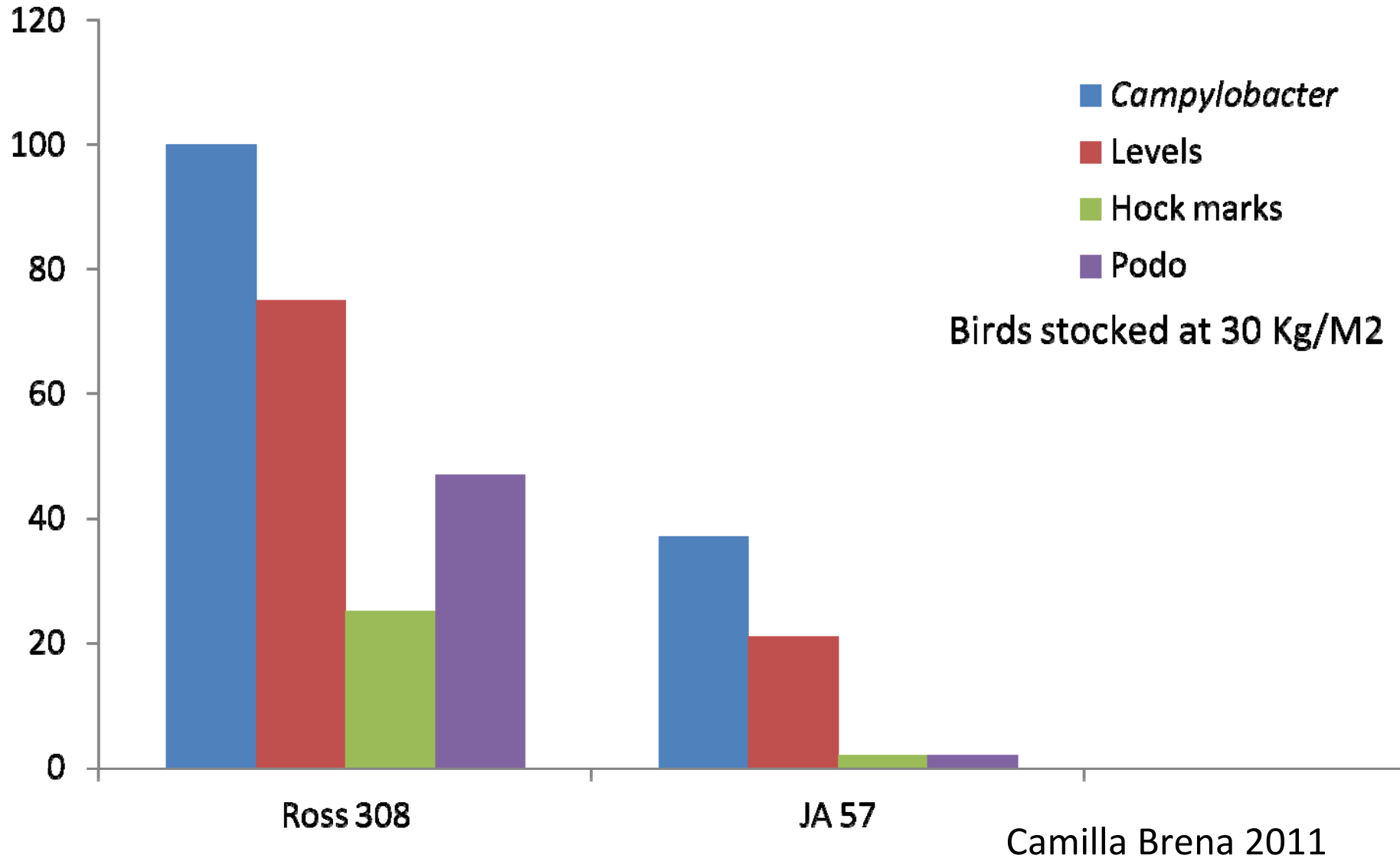


Fig 2: Hock marks and APEC in STD and FF birds



'Fast' (36 days) v 'slow' (56 days) at the same density



The control of *Campylobacter* in poultry production



- **Control cannot and will not be cost-neutral**
- Biosecurity can reduce flock carriage rates
- Other interventions are necessary
- Effects of the production environment on bird health/welfare must be included in the development of host-based controls
- Essential to better understand host-pathogen interaction and what influences this