

Freezing used as a risk-reducing measure;

Predicting optimal freezing time-length for *Campylobacter* infected broilers

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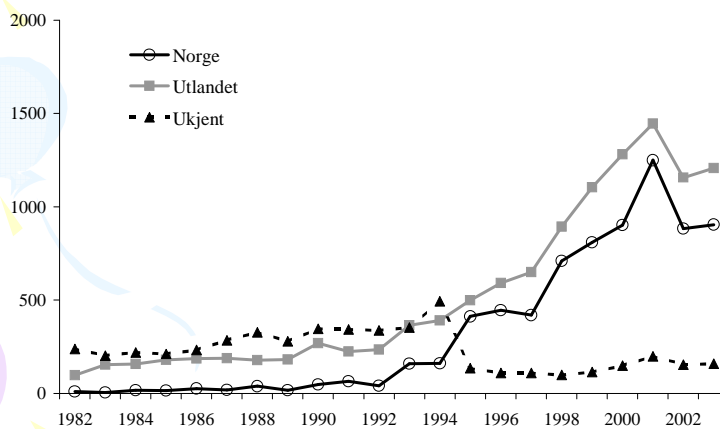


Norwegian School of Veterinary Science

Introduction

Campylobacteriosis

Human cases 1982-2004



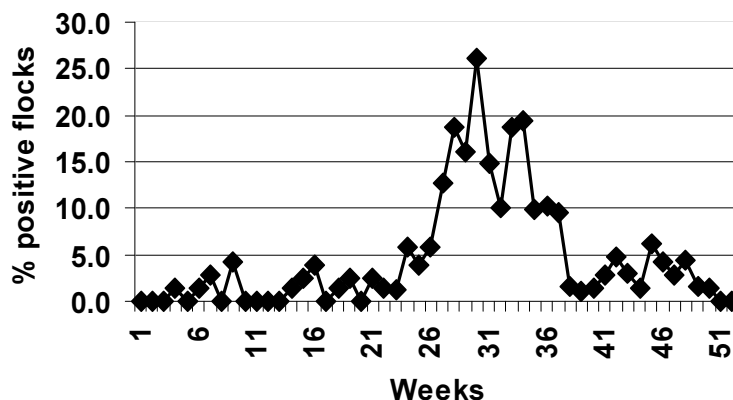
Introduction

The Action Plan against *Campylobacter* includes:

- Pre-slaughter sampling (at farm)
- Slaughter sampling
- Info about biosecurity measures to farmer
- Sampling at retail level
- **Positive carcasses either heat treated or frozen for 5 weeks**

Introduction

Some results from Action Plan 2003



Introduction

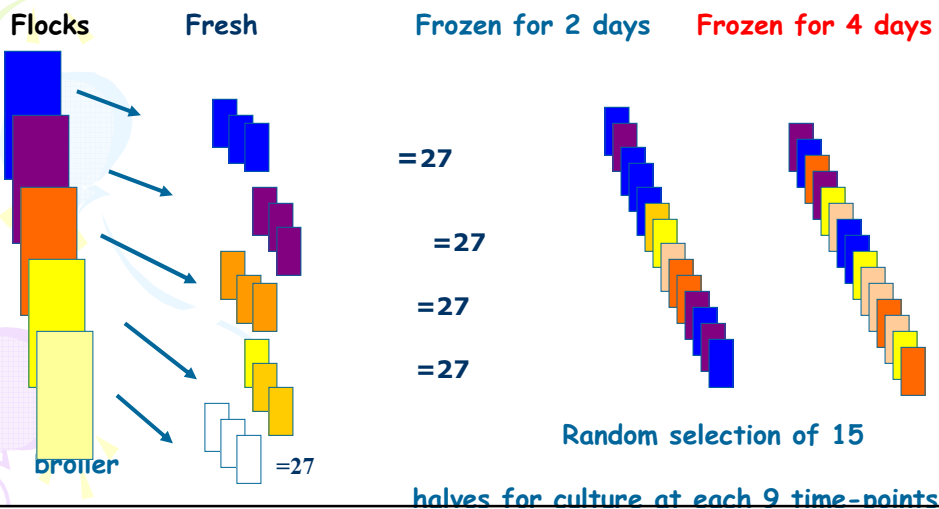
Freezing project

Aim of study:

Estimate the optimal freezing time length for naturally infected broilers in regard to the death of *Campylobacter* by different stat & math models

Materials

Design & culturing

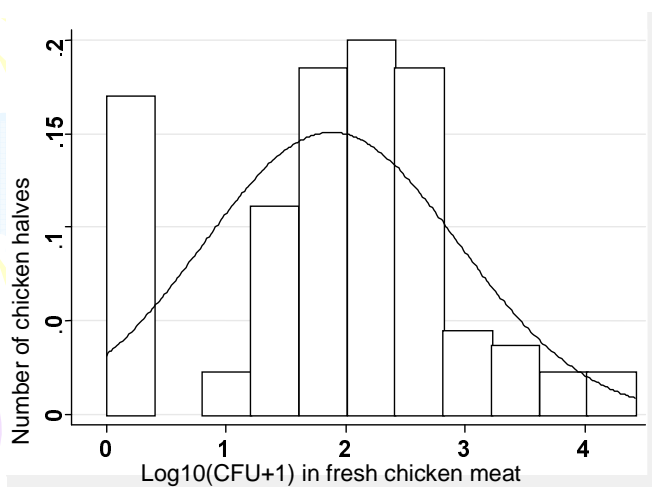


Methods

Non-parametric & parametric analyses

- Non-parametric regression in Stata
- Zero-inflated poisson or negative binomial regression in Stata
- Mixed Bayesian model (excludes zeros)

Descriptive results

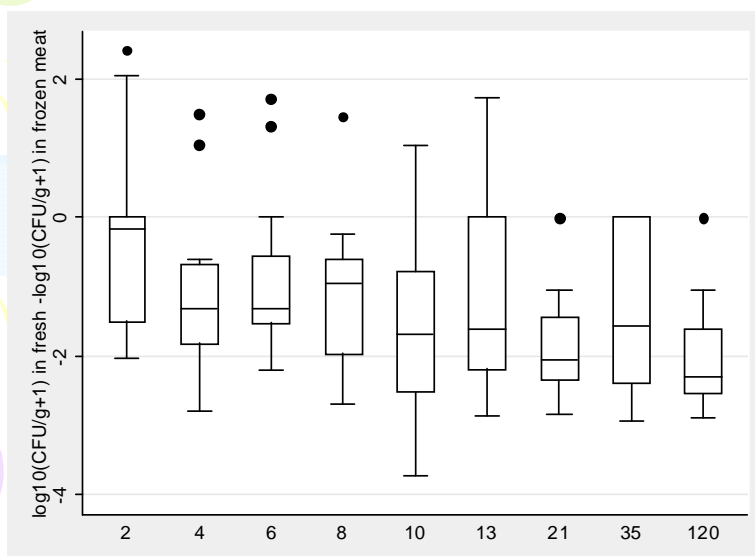


Methods

Median regression

- CFU = an average no of bacteria/g from 4 dilutions
- Definition of dependent variable
 - $CFU_{\text{Day1}} - CFU_{\text{Day2-120}}$
- Independent variables
 - Time (categorical)

Methods - Definition of dependent variable



Results

Median regression

Var	Coeff	Se	p	95% CI	Pseu R2
Time	14.64	8.93	0.00	-3.03, 32.31	0.0008
Cons	50.72	50.32	0.00	-48.83, -150.27	

Methods

Zero inflated negative binomial regression

- CFU from all 4 dilutions & offset included
- Definition of dependent variable
 - $CFU_{Day1-120}$
- Independent variables
 - Time (continuous)
- Population average model
 - Flock, bird, plate no (dilutions)

Results

Zero inflated negative binomial regression

Final model:

Variables	Coefficient	Se	p	95% CI
Neg Bin part				
LogTime	-1.629	0.167	0.000	-1.956, -1.302
Constant	-4.527	0.261	0.000	-5.315, -4.002
Zero inflated part				
Flock	-2.134	0.259	0.000	-2.642, -1.626
Constant	-2.507	0.467	0.000	-1.593, -3.421
Alpha	3.762	0.232		3.334, 4.245

Methods

Mixed Bayesian model 1:

Simple log-linear decay model with bird as a random effect

- 3 parameters;

- mean & SD of initial CFU
- decay rate

- Initial CFU was assumed to follow a log-normal distribution

Methods

Mixed Bayesian models

Outcome:

- Posterior parameter distributions
- Predictions for the remaining CFU/g chicken skin at day 4, 21, 35 & 120

Methods

Mixed Bayesian model 2:

Similar to the first but initial drop in log CFU at the point of freezing

- Assumed to be the same for all birds, and therefore required a single extra parameter

Methods

Mixed Bayesian model 3:

Also similar to the first, except for the inclusion of two bacteria sub-populations: fast decayers and slow decayers

- Required thus two extra outcome parameters;
 - a second decay rate
 - ratio of slow to fast decayers

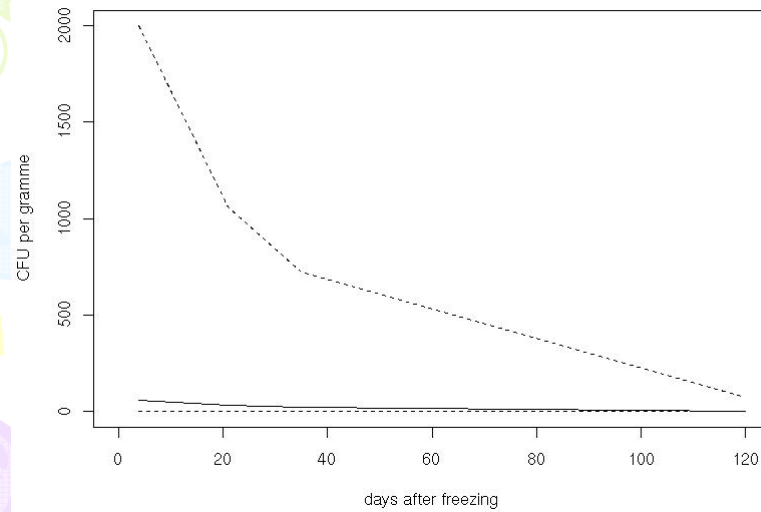
Methods

Mixed Bayesian model 4:

Both an initial drop in CFU/g at freezing and two sub-populations of bacteria

- Thus three extra parameters

Results Bayesian model with 2 pop: fast and slow decayers:



Which model suits data best?

Criteria for selection of model across distributions/or various no of parameters included:

Goodness of fit measures:

- R^2
- Vuongs statistics
- Deviance



Conclusions

- 21 days freezing of carcasses seems optimal in regard to death of *Campylobacter*
- Median & Zero-inflated negative binomial regression includes all data (zeros & negatives) in contrast to the Mixed Bayesian models
- Criteria for selection of Zero-inflated negative binomial and Mixed Bayesian models is non-existing (reliability)



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