Ministry for Primary Industries
Manatū Ahu Matua

The Campylobacter control programme in New Zealand

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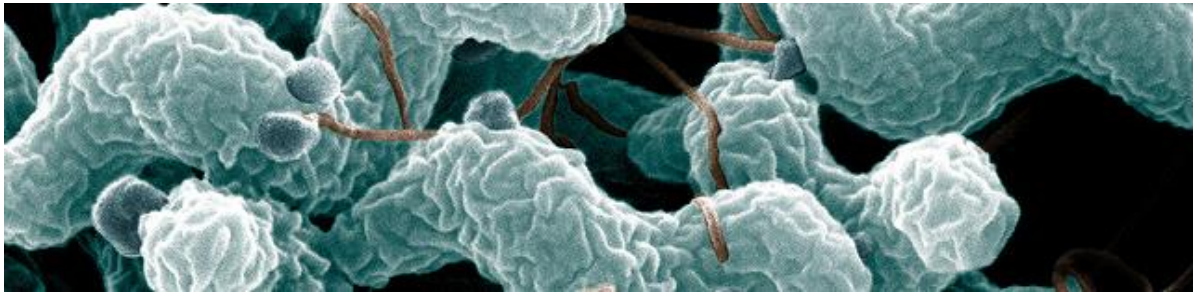
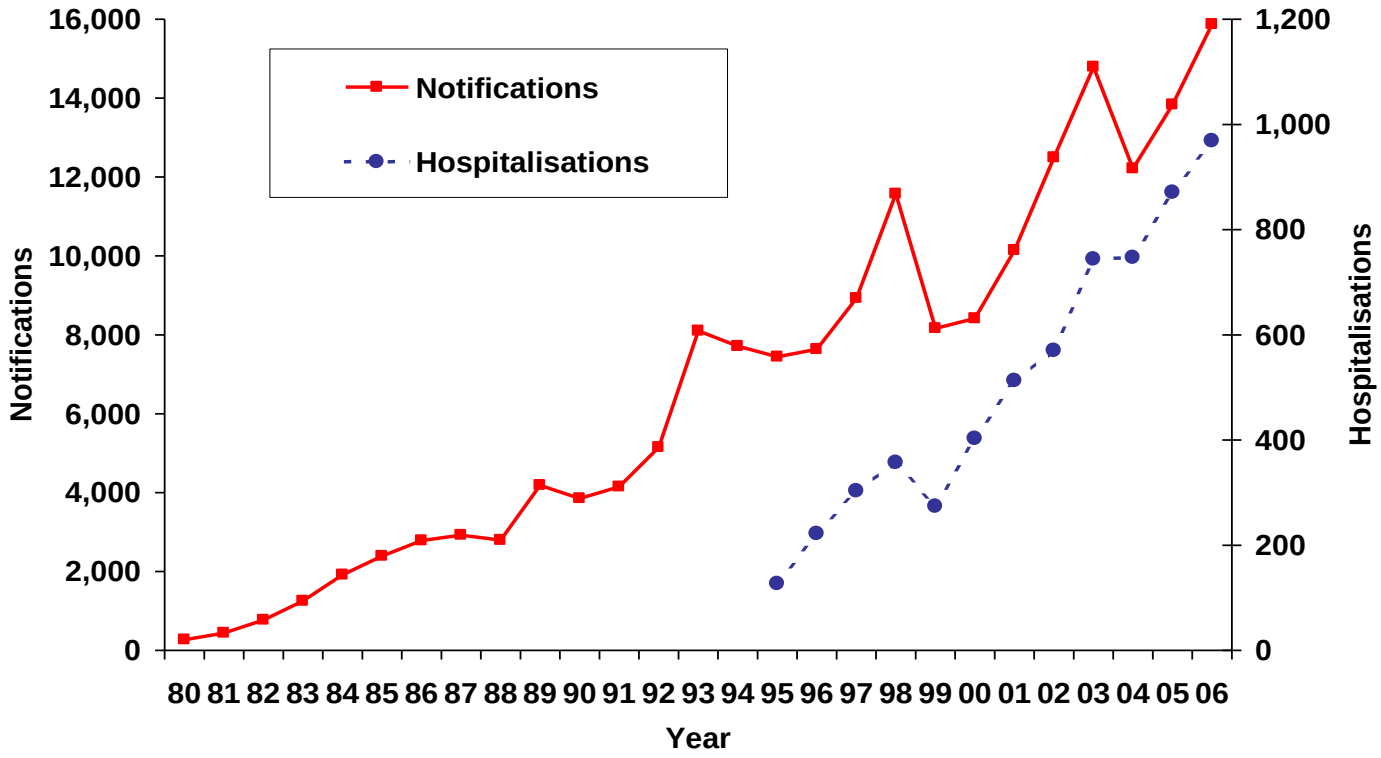
www.mpi.govt.nz

MPI *Campylobacter* team

- Steve Hathaway and Peter van der Logt: Science and risk assessment
- Judi Lee and Sharon Wagener: Standard development
- Gail Duncan: National microbiological database
- Sonja Taege and Catherine Sheerin: Verification
- Sharon Wagener and others: Compliance Response Team
- Craig Thornley: Public health
- Nigel French and Petra Muellner: Source attribution



Campylobacteriosis in New Zealand (all causes) at start of control programme



Cases

= 380 / 100,000 pop.

Campylobacter Risk Management Strategy 2007 -

- Source attribution studies
- Operational research for effectiveness of different interventions e.g. freezing, and data gaps e.g. risk factors at farm level
- Develop Biosecurity Manual (growing farms)
- New code of practice for primary and secondary processing
- Establish National Microbiological Database (NMD) and test different methodologies an monitoring strategies
- Review HACCP-based Risk Management Plans at premises level
- Establish five-year public health goal and reporting
- Develop regulatory performance target and response
- Develop risk assessment models to inform decision-making

Development of the NMD

- 2007: Caecal sampling and carcass sampling; proposal for mandatory target rather than mandatory interventions (good performers should not be penalised!)
- 2008: Performance target with escalating (regulated) responses
- 2009: Caecal sampling ceases as limited value
- 2013: Revised performance target

Testing programme

- Accredited laboratories
- Trained samplers
- Approved methods

- Regulator can see all premises' results
- Each premises can only see own results
- Quarterly ranking and reporting

Microbiological performance target

- Represents an approximate one log reduction in level of hazard control cf. 2007 national 80th percentile baseline (4.08 to 3.08 logs)
- System accredited and verified by MPI
- Moving window, high count limit and quarterly limit
- Moving window failure when seven or more out of 45 samples from three successive processing periods are greater than 3.78 log $_{10}$ cfu/carcass
- Low throughput premises
- Integrated industry and regulator response in case of non-compliance, with possible escalation to premises closure

Subsequent changes to target

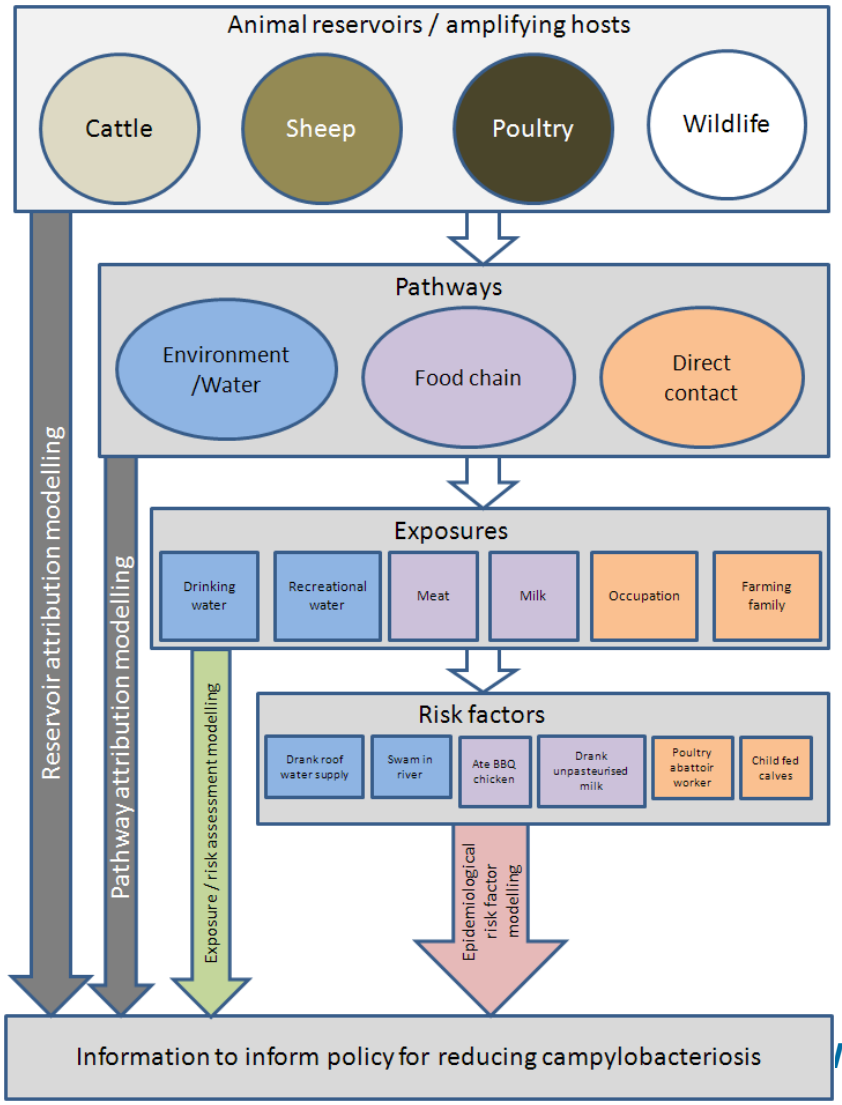
- Moving window failures have effectively managed poor performers ✓ Kept
- Hardly any failures against high count (> 5.88 $\log_{10}$ / rinsate) or quarterly limits ✗ Removed
- Mandatory responses too restrictive:
  - amended to be more flexible
  - increased reporting
- Compliance Response Team visits very effective ✓ Kept

Source attribution

Approaches to attribution

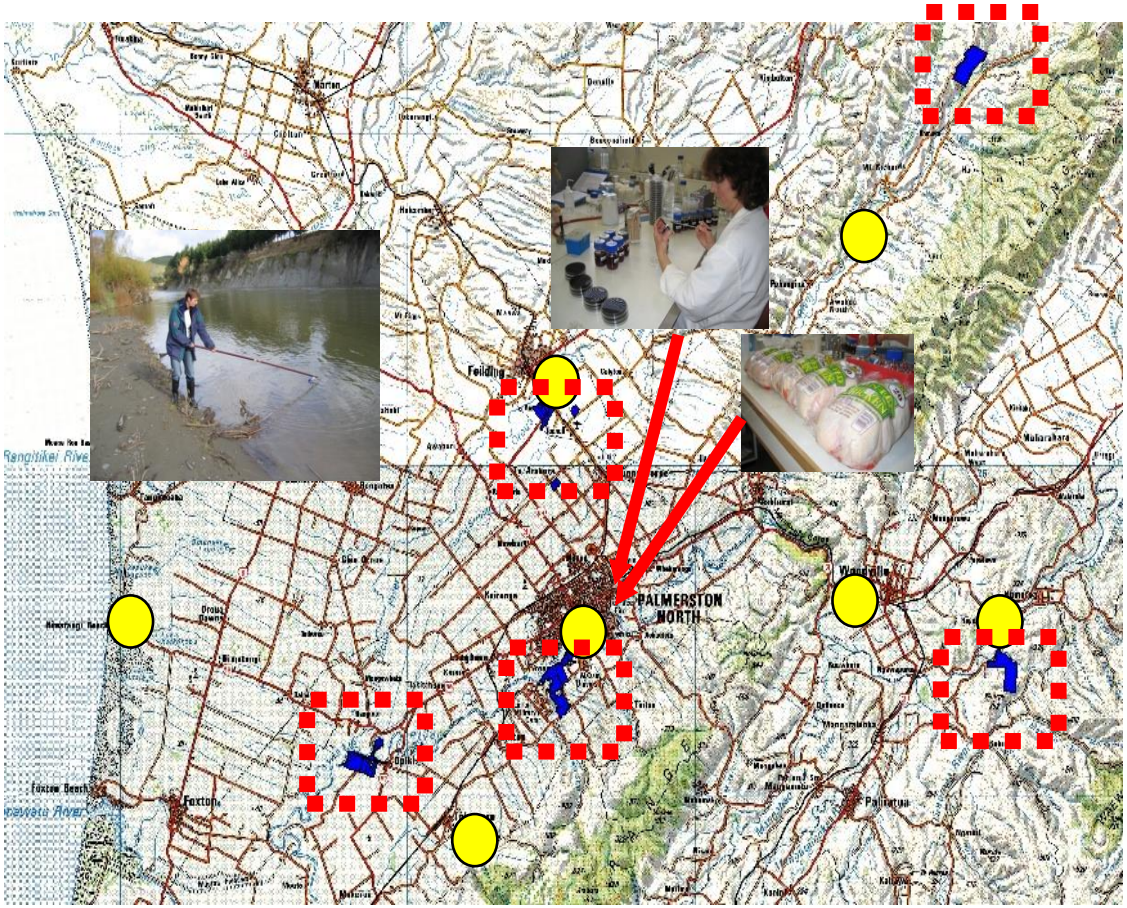
- Analytical epidemiology
- Comparative exposure / risk assessment
- Expert opinion
- Molecular epidemiology
  - microbial subtyping e.g. PCR, source tracking, population genetics and epidemiological modelling add powerful tools
  - rMLST (new generation) uses high throughput sequencing of whole genomes to analyse many more genomic loci

Modelling approach

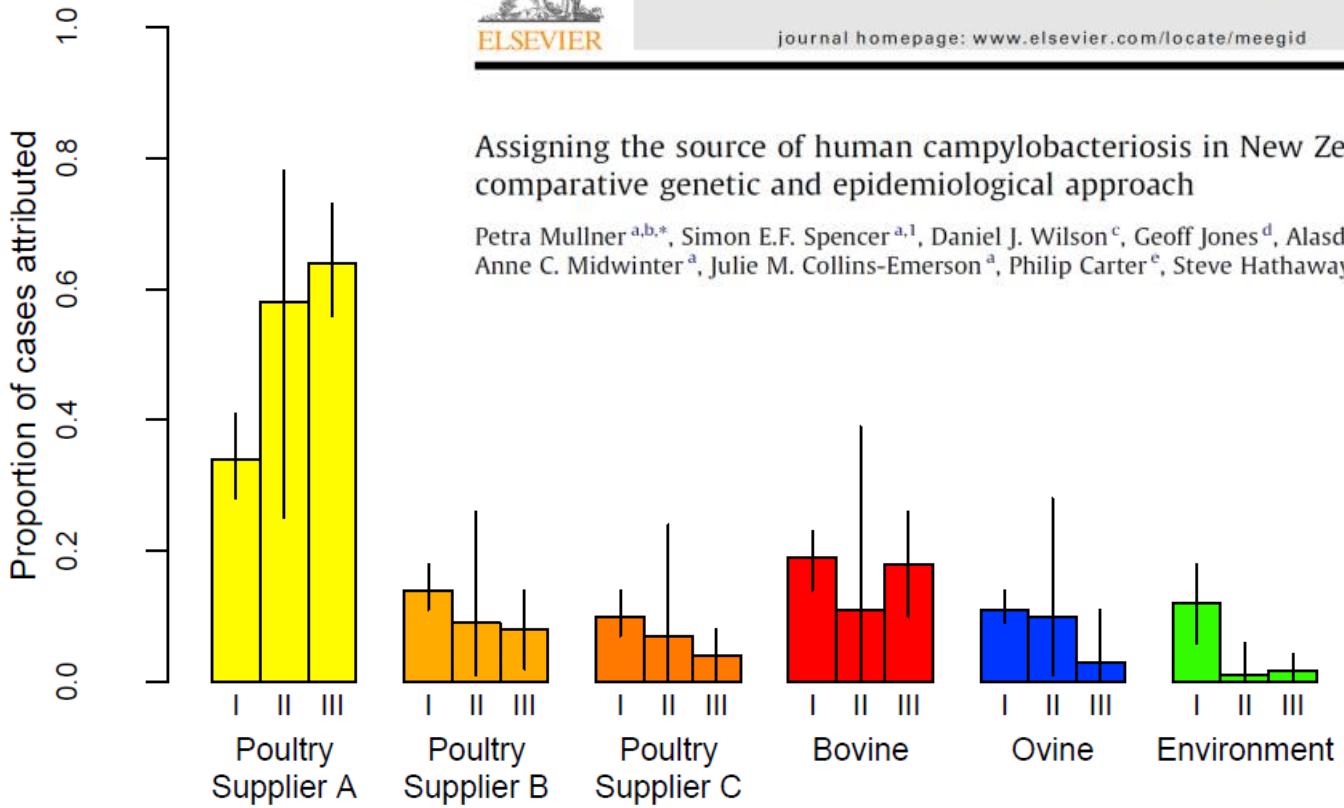


Massey University EpiLab 2005 -

- Manawatu sentinel site
- Identify genotypes common to particular sources



Campylobacter source attribution



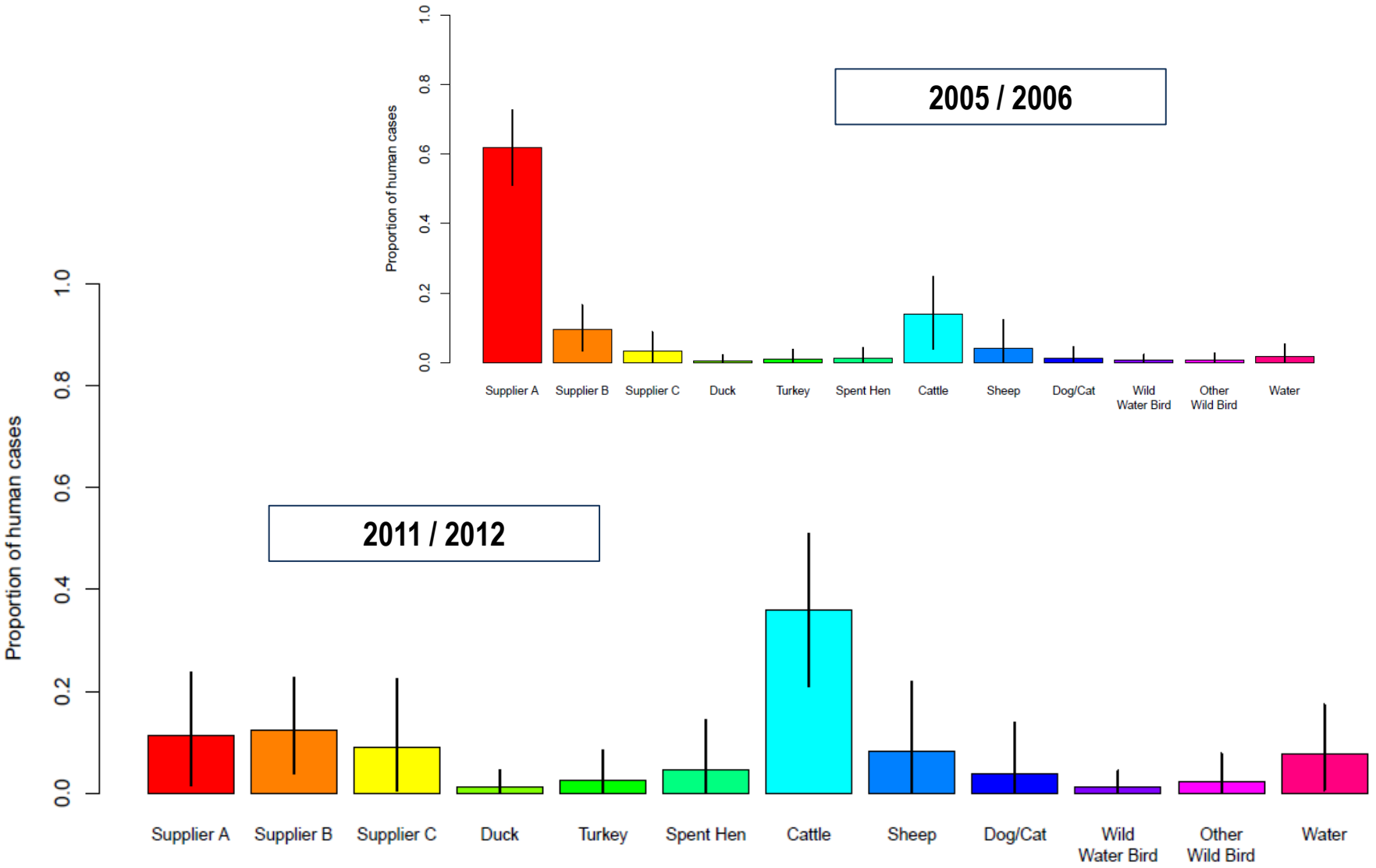
Infection, Genetics and Evolution

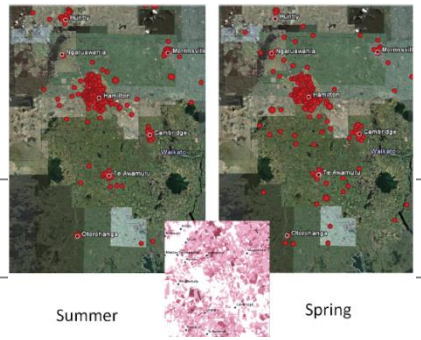
journal homepage: www.elsevier.com/locate/meegid

Assigning the source of human campylobacteriosis in New Zealand: A comparative genetic and epidemiological approach

Petra Mullner [a,b,*], Simon E.F. Spencer [a,1], Daniel J. Wilson [c], Geoff Jones [d], Alasdair D. Noble [d], Anne C. Midwinter [a], Julie M. Collins-Emerson [a], Philip Carter [e], Steve Hathaway [b], Nigel P. French [a]

Campylobacter source attribution





Dynamic changes in source attribution

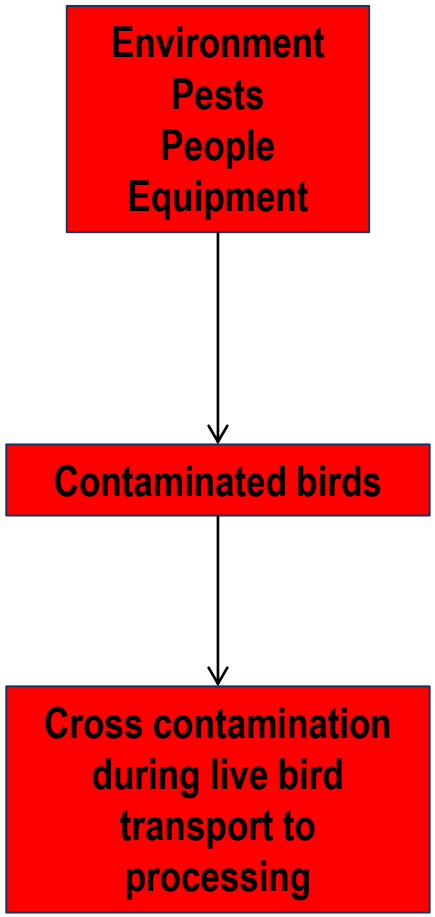
Operational research

Operational research on-farm

- On-farm risk factors for *Campylobacter* infection of broilers under New Zealand conditions
- Potential dissemination of *Campylobacter* by farmers' overalls in broiler farms
- Effect of caprylic acid on *Campylobacter* concentration in broiler caeca

On-farm

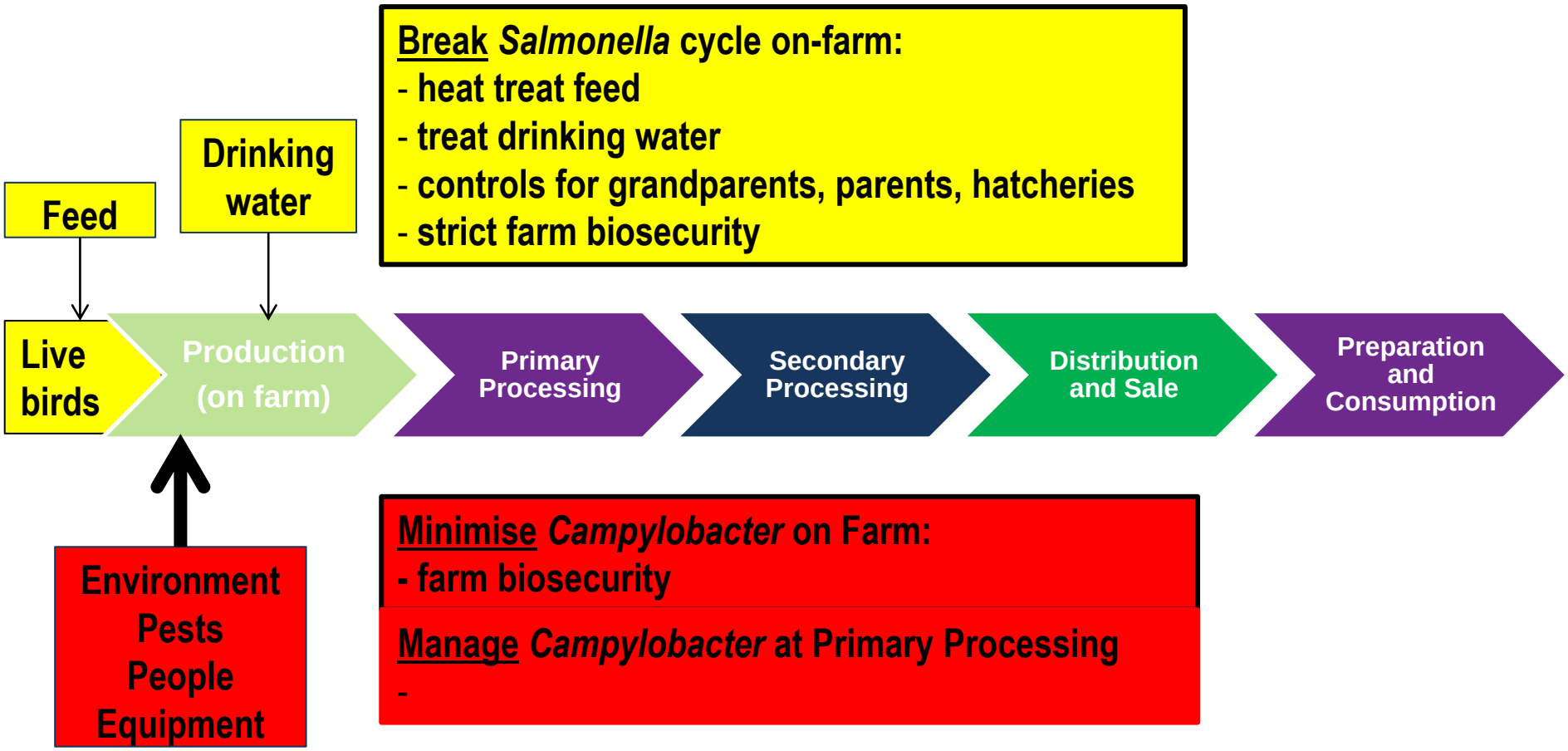
Risk factors



Voluntary Biosecurity Manual

- Environmental hygiene
- Entry procedures
- Minimise partial depopulations
- Catching procedures
- Crate washing, drying and sanitation
- Education and commitment of growers

On-farm biosecurity; *Campylobacter* cf. *Salmonella*



Code of practice for primary processing

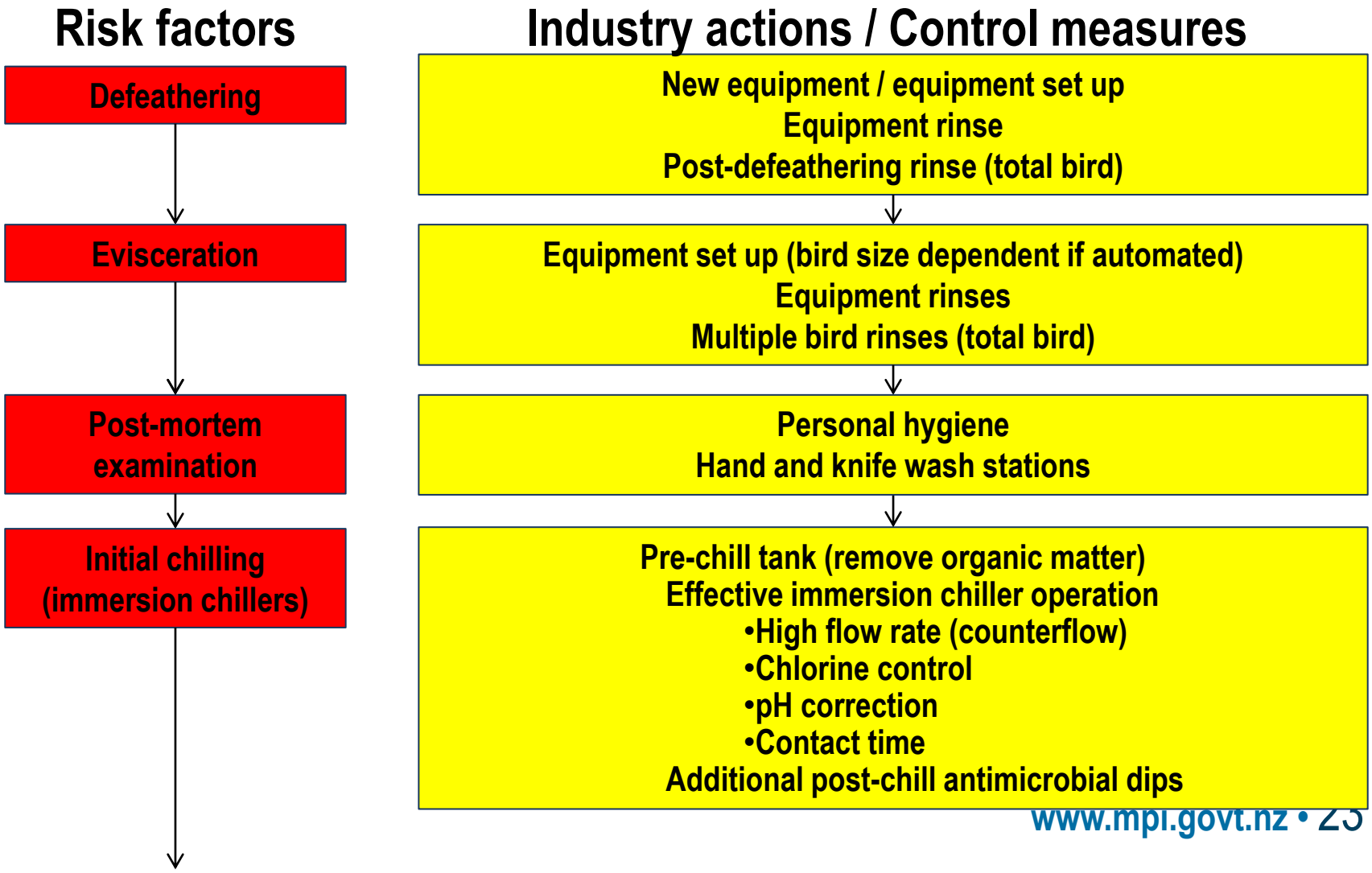
Operational research at primary processing

- Surveys: Broilers, end-of-lay, breeders, turkeys, ducks, free-range poultry
- Quantification of *Campylobacter* from internal and external carcass rinses
- Longitudinal mapping of *Campylobacter* on carcasses
- *Campylobacter* recovery from carcasses
- NMD: Investigation of “Not Detected” rinsates
- Chlorinated compounds formed during chlorine wash of chicken meat
- Immersion chilling: Effect of washing and chlorination

Operational research: Effect of temperature

- Effect of low temperature on *Campylobacter* on poultry meat e.g. crust freezing
- Domestic food practices: Refrigerator survey and meat handling survey
- Domestic food practices: Quantifying the reduction of *Campylobacter* on skin-on chicken breasts frozen and stored up to 10 weeks at -12^{o}C

Primary processing



Primary processing

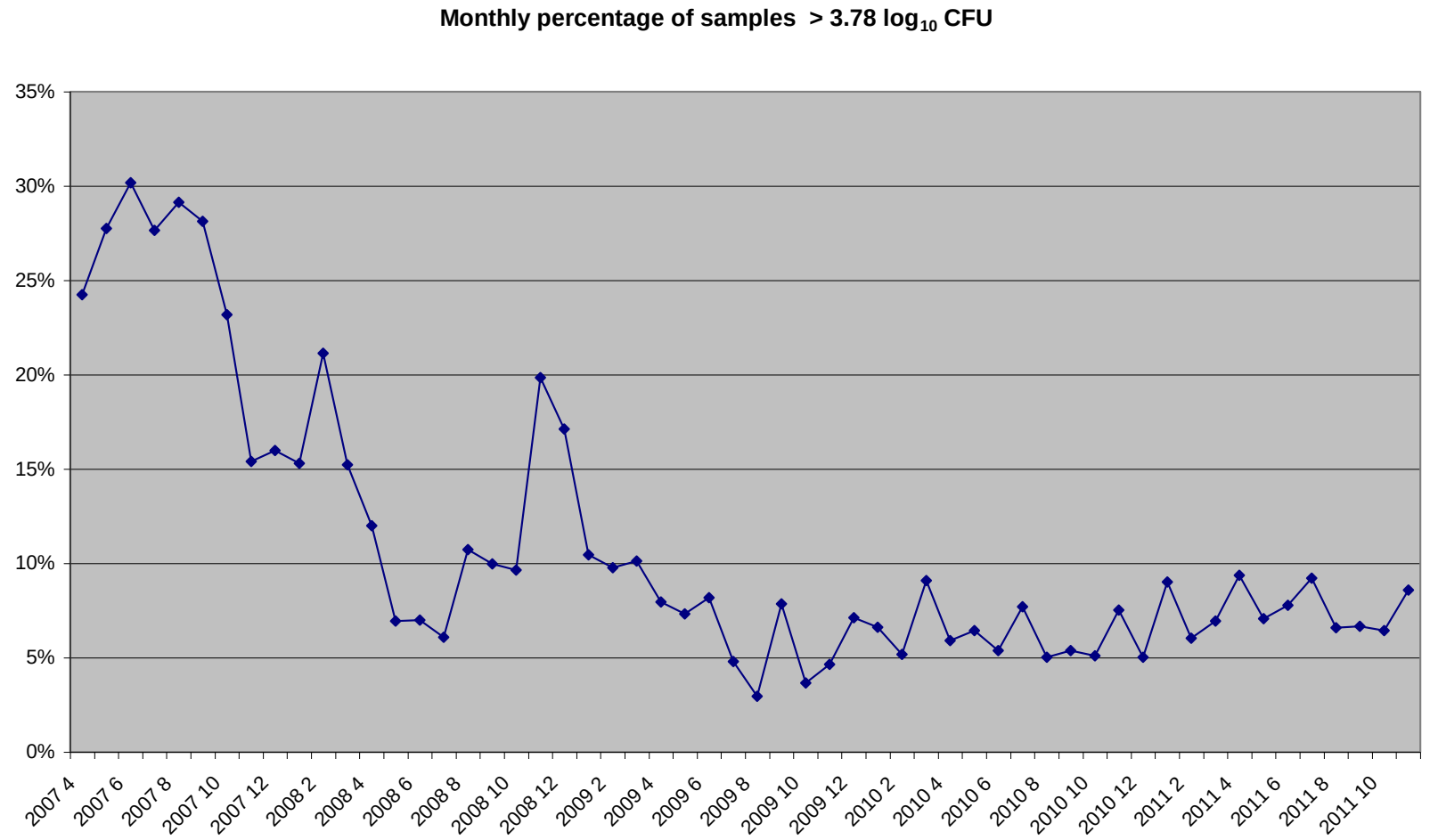
- Free-range birds have higher initial levels of *Campylobacter* than fully housed birds
- In-line washing and immersion washing decreases loads by at least one log
- Chlorine immersion decreases loads by at least a further log
- Higher levels of organic contamination lessens effect of chlorine (value of pre-chill tank wash)

Operational research: Secondary processing and consumer

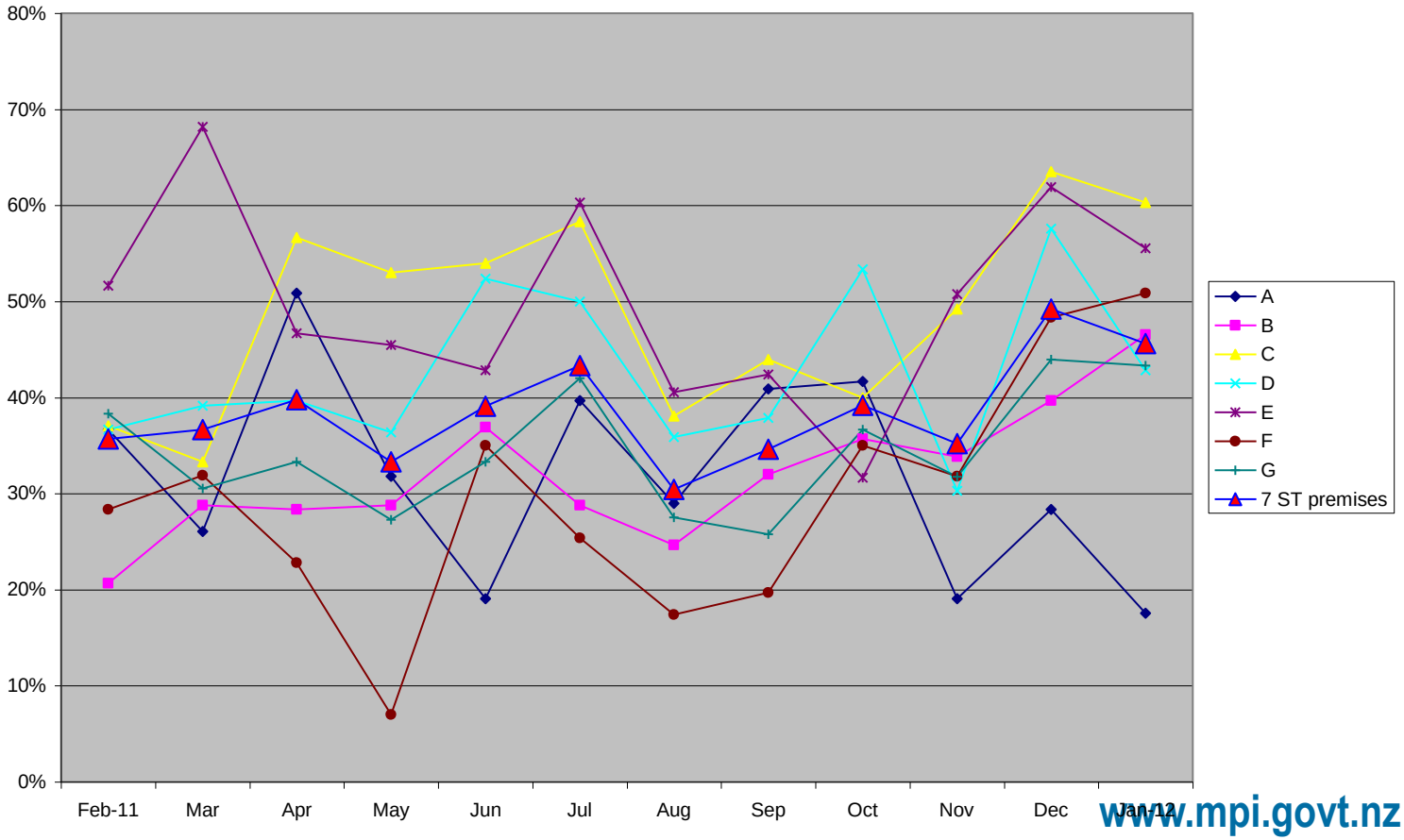
- Effect of secondary processing on contamination
- Contamination of offal and mechanically separated meat products
- Contamination on carcasses and portions at retail
- *Campylobacter* in drips trapped in leak-proof packaged retail poultry
- Burden of disease and cost-benefit

Results

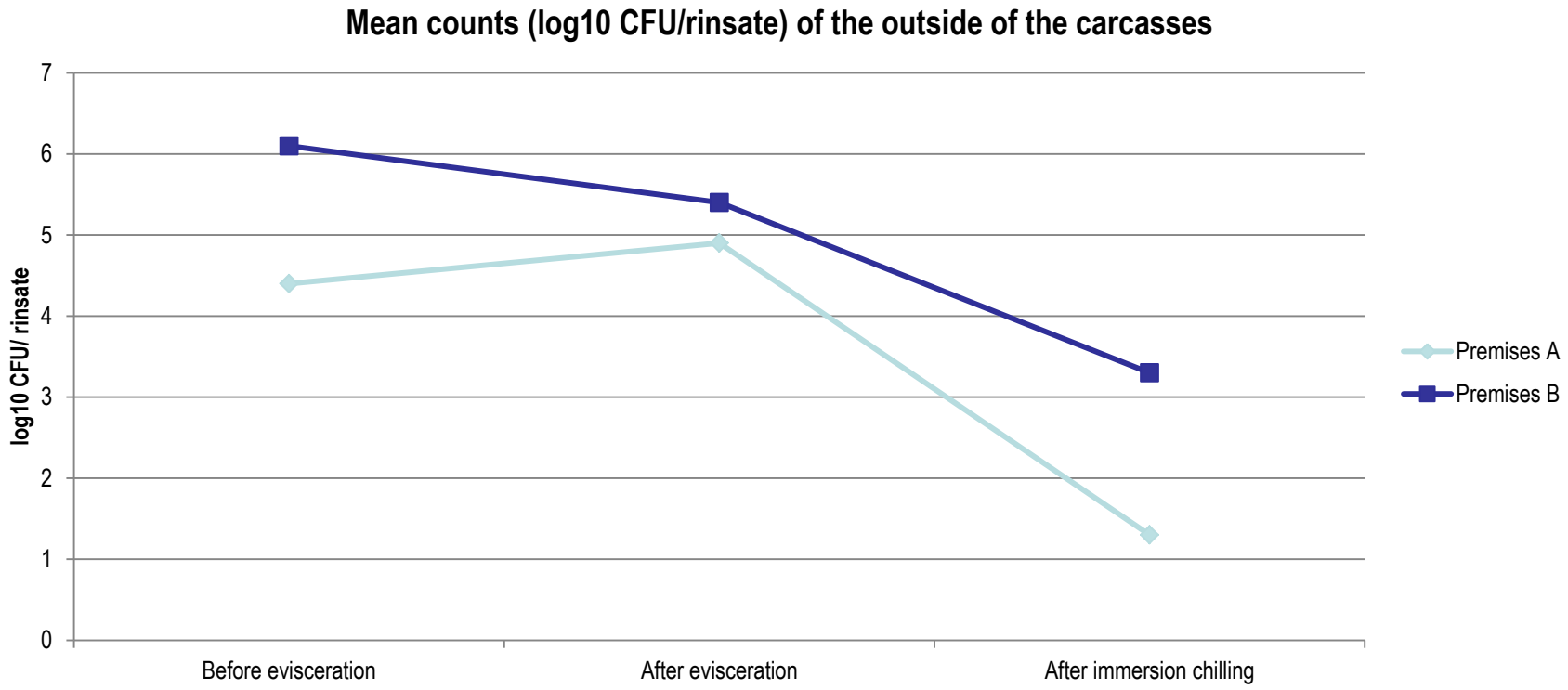
Percentage > 3.78 log $_{10}$ cfu/carcass



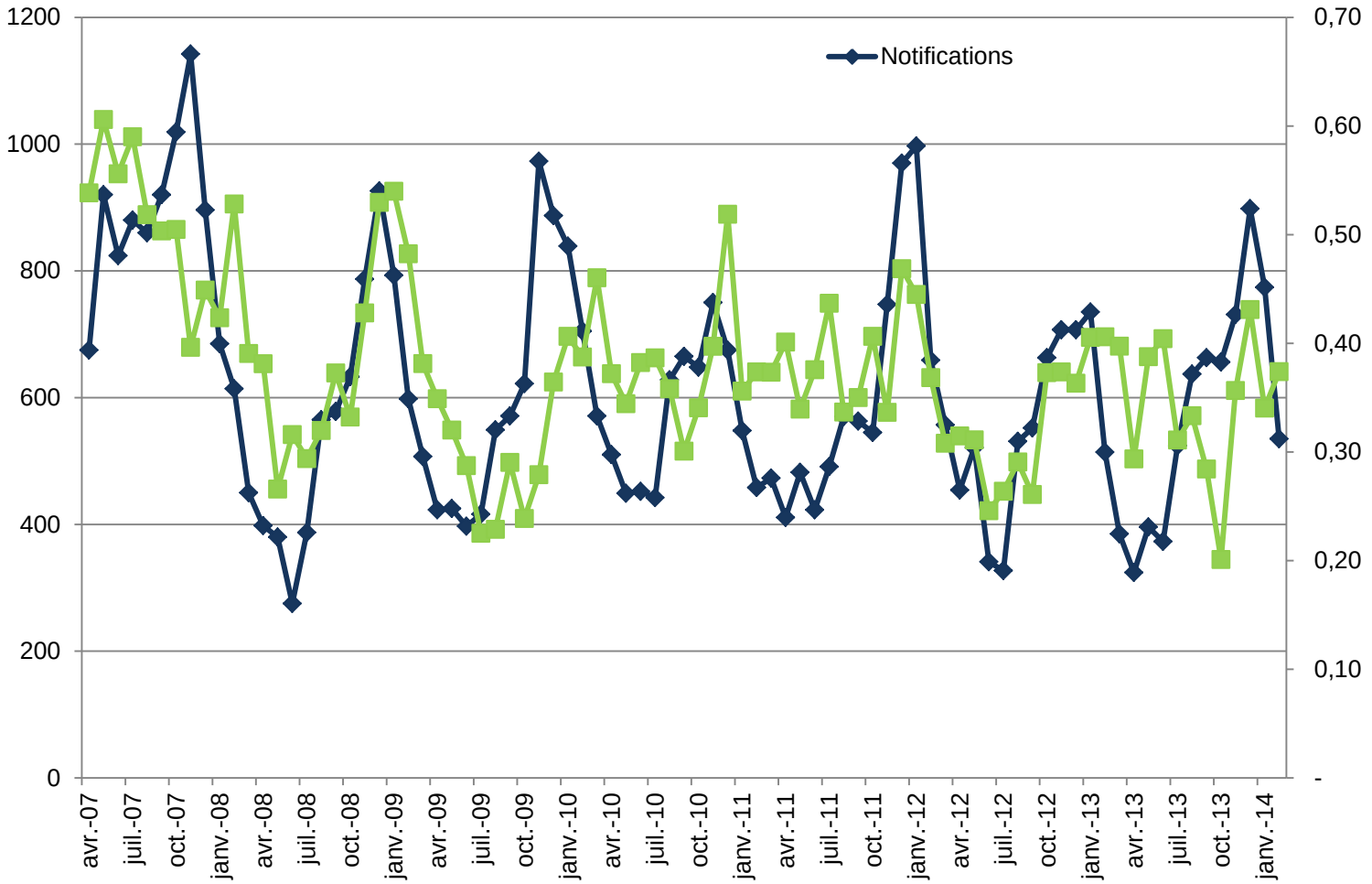
The premises effect: % positive rinsates



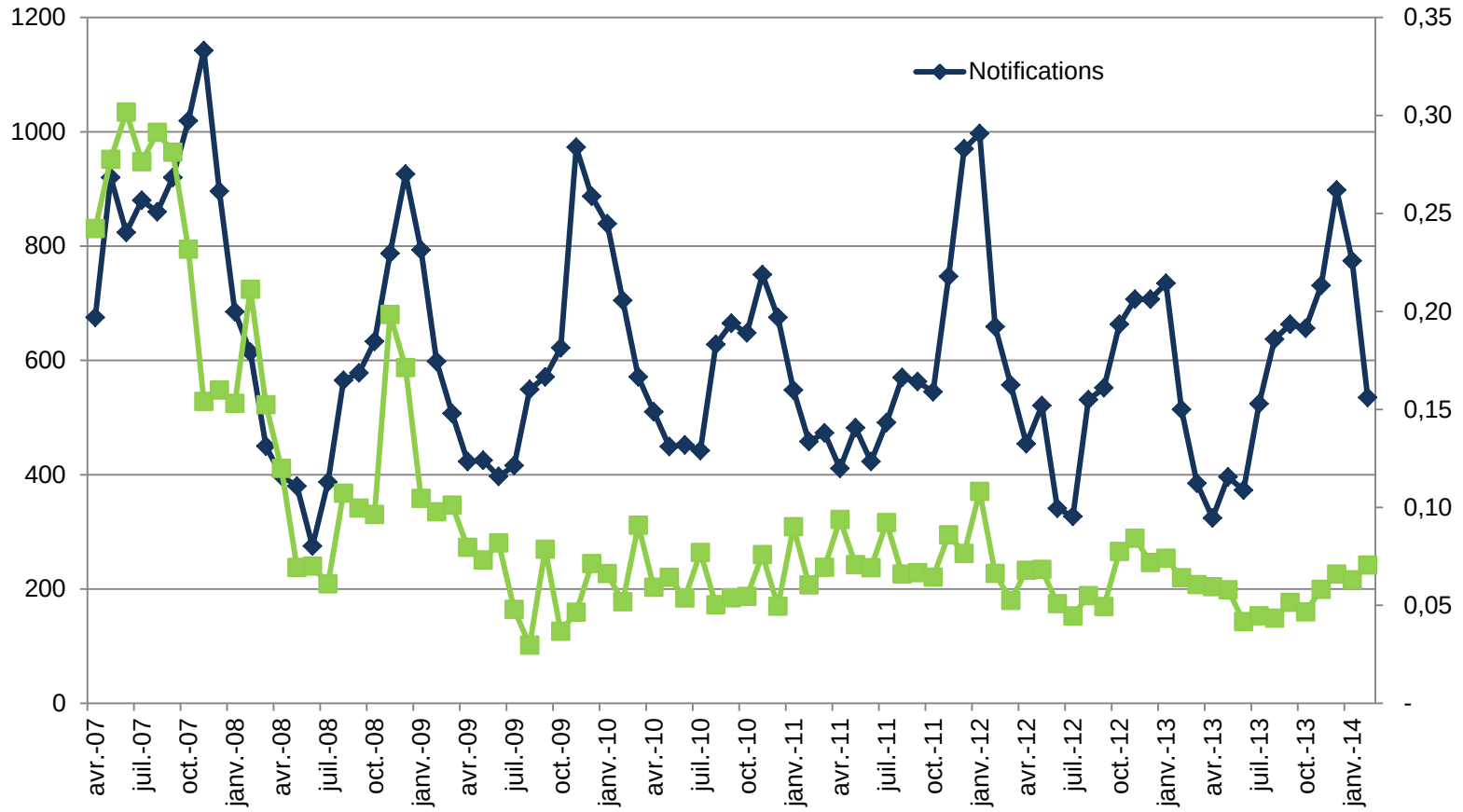
Variable performance at processing steps



Association between human cases and % positive carcasses



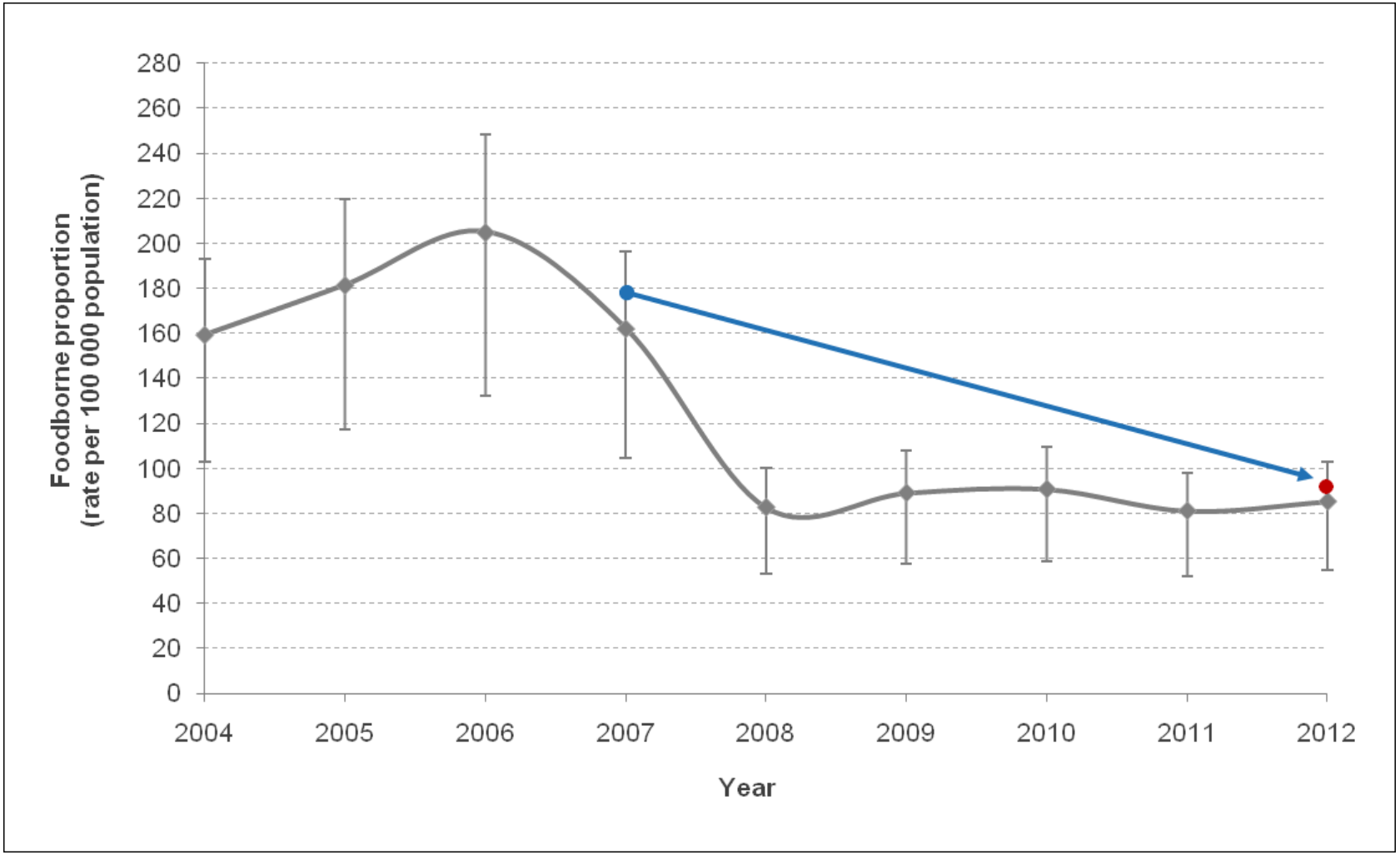
Association between human cases and % > 3.78 log $_{10}$ cfu/carcass



Examples: Compliance Response Team

Issue	Regulatory action
Higher loading (free range), gut breakage, insufficient carcass washing, sub-optimum management of chemical decontamination steps	Follow up by VA
Large bird contamination (line speeds), sub-optimum management of chemical decontamination steps	Follow up by VA
Poor separation between kill and EV rooms, plucker splatter, organic so needed extra wash steps and use of approved chemical in multiple decontamination steps	CRT visit Direction to freeze product, CRT visit CRT visit
General hygiene issues, line speed too high, lack of staff, poor evisceration equipment set up, lack of washing (post pluck, post EV) /chemical decontamination steps	CRT visit Direction to freeze product Direction to add chemical intervention
General hygiene issues, poor evisceration equipment set up, lack of control of salting, lack of washing (post pluck, post EV) /chemical decontamination steps	CRT visit Direction to freeze product
Insufficient samples, incorrect testing, lack of washing (post pluck, post EV), poor separation between kill and EV rooms, plucker splatter, poor control of chemical decontamination steps	CRT visit

Progress against public health goal



Risk management

Risk management option: Tightening performance target

- Increased stringency could focus on a further improvement in national performance and/or an improvement in poorest performing premises
- Target could incorporate tighter acceptance number, tighter limit etc.
- Risk assessment needed to inform decision but note that a target does not represent actual performance of industry

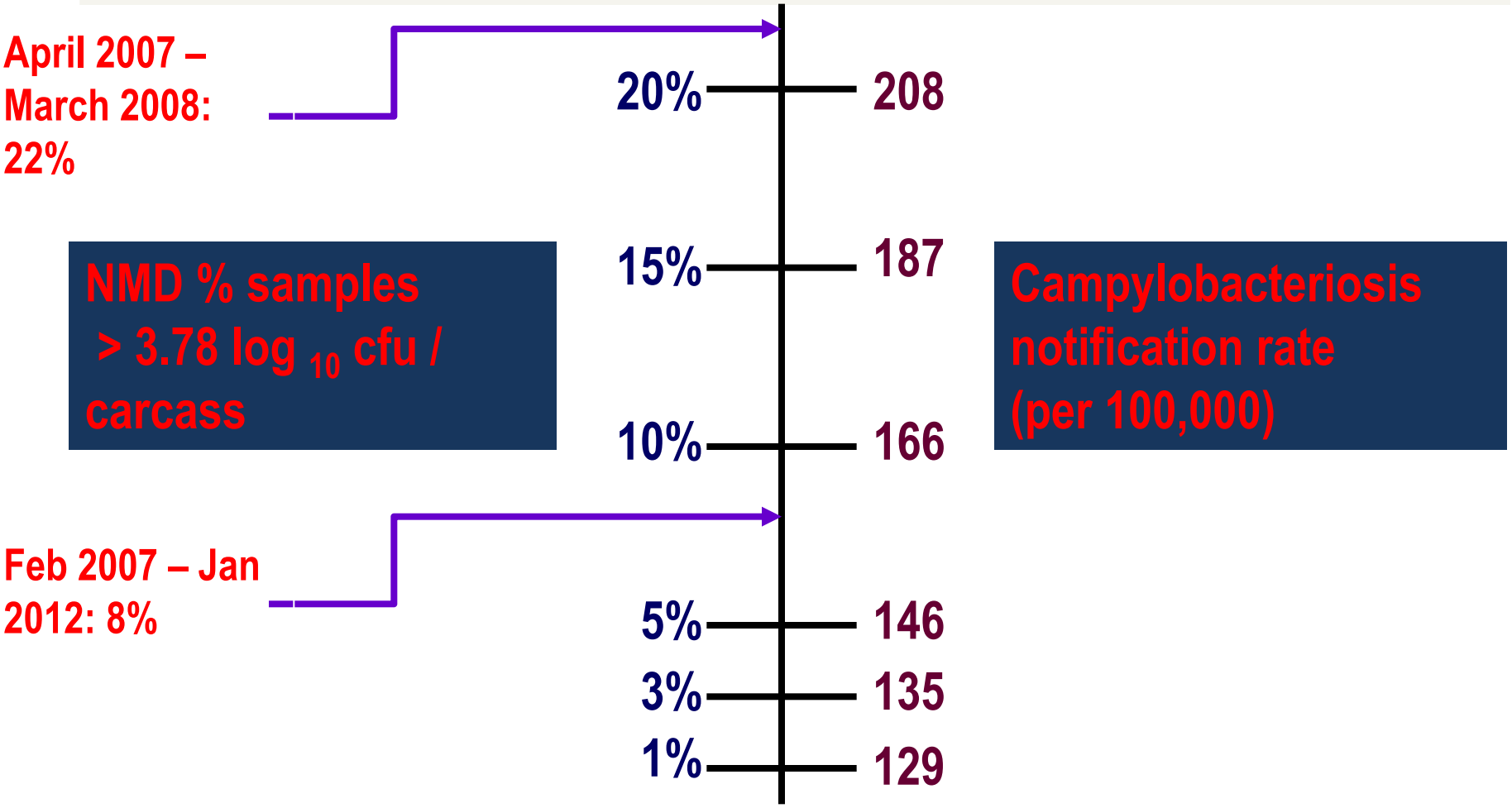
Risk assessment tools

- Simple pathway model: Estimates changes in NMD results with different interventions *at the premises level*
- Simple regression model: Estimates human health risk using NMD data *at national level* (noting that it is not possible to directly model the CPT)
- Alert tool: Simulates alerts and responses for individual premises using retrospective data and different inputs to the CPT)

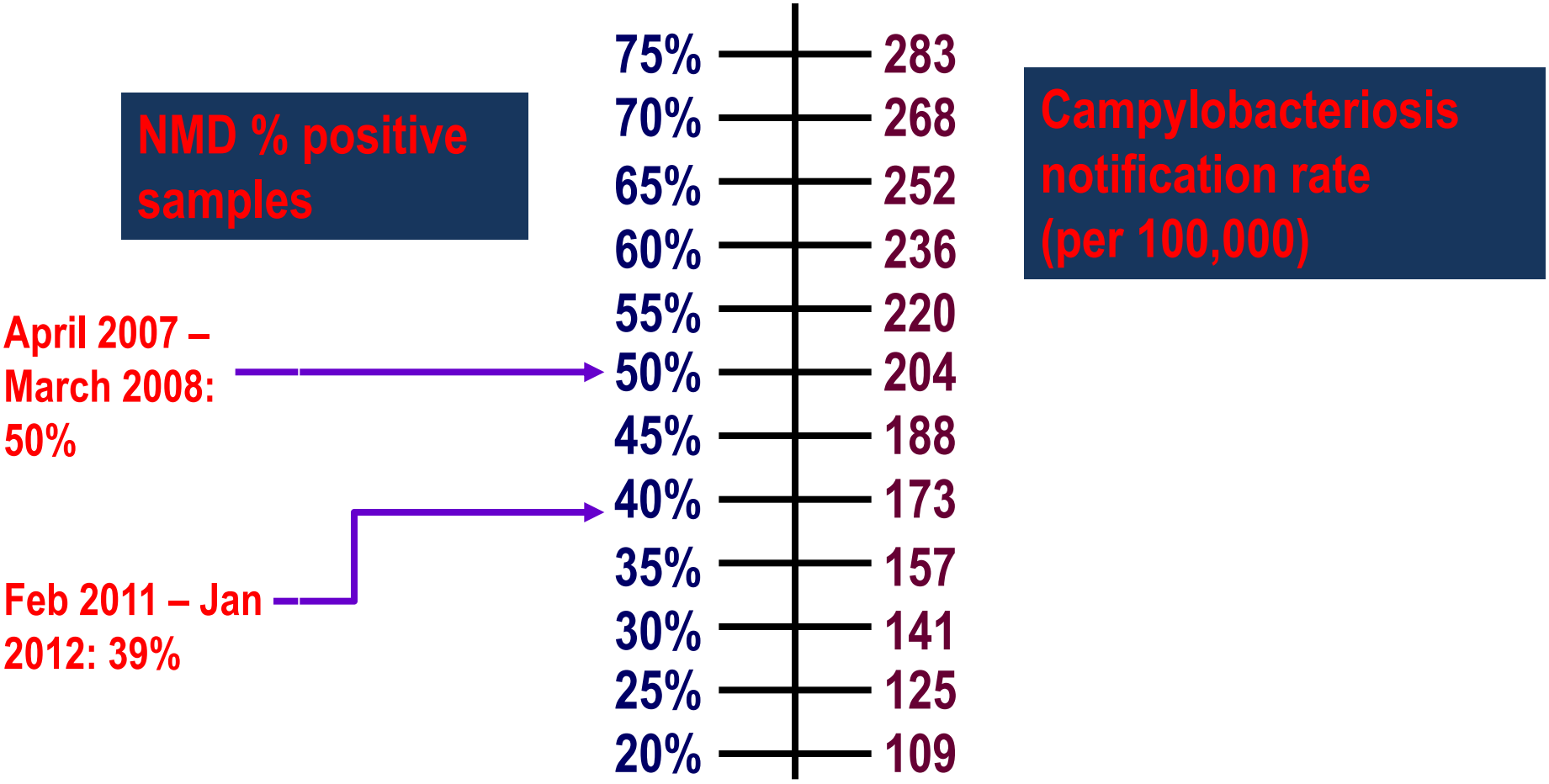
Simple pathway model: Screen shot

	Data entry		
	Changes to routine process		
	Level immediately after processing step		
		Unit	**Distribution**
On farm (Caecal prevalence)	50%	Percentage	
Change			
	50%		
Pre scalding	8.21	CFU $\log_{10}$ \ rinsate	Triangular
Additional Change		CFU $\log_{10}$ \ rinsate	
Scalding and defeathering Effect	-1.67	CFU $\log_{10}$ \ rinsate	Triangular
Additional Change		CFU $\log_{10}$ \ rinsate	
	6.54		
Evisceration Effect	-0.18	CFU $\log_{10}$ \ rinsate	CDF-Based indepen
Additional Change	0.00	CFU $\log_{10}$ \ rinsate	
	6.36		
Spin chilling Effect	-2.71	CFU $\log_{10}$ \ rinsate	CDF-Based indepen
Additional Change		CFU $\log_{10}$ \ rinsate	
	3.65		

Regression model for human illness (1)

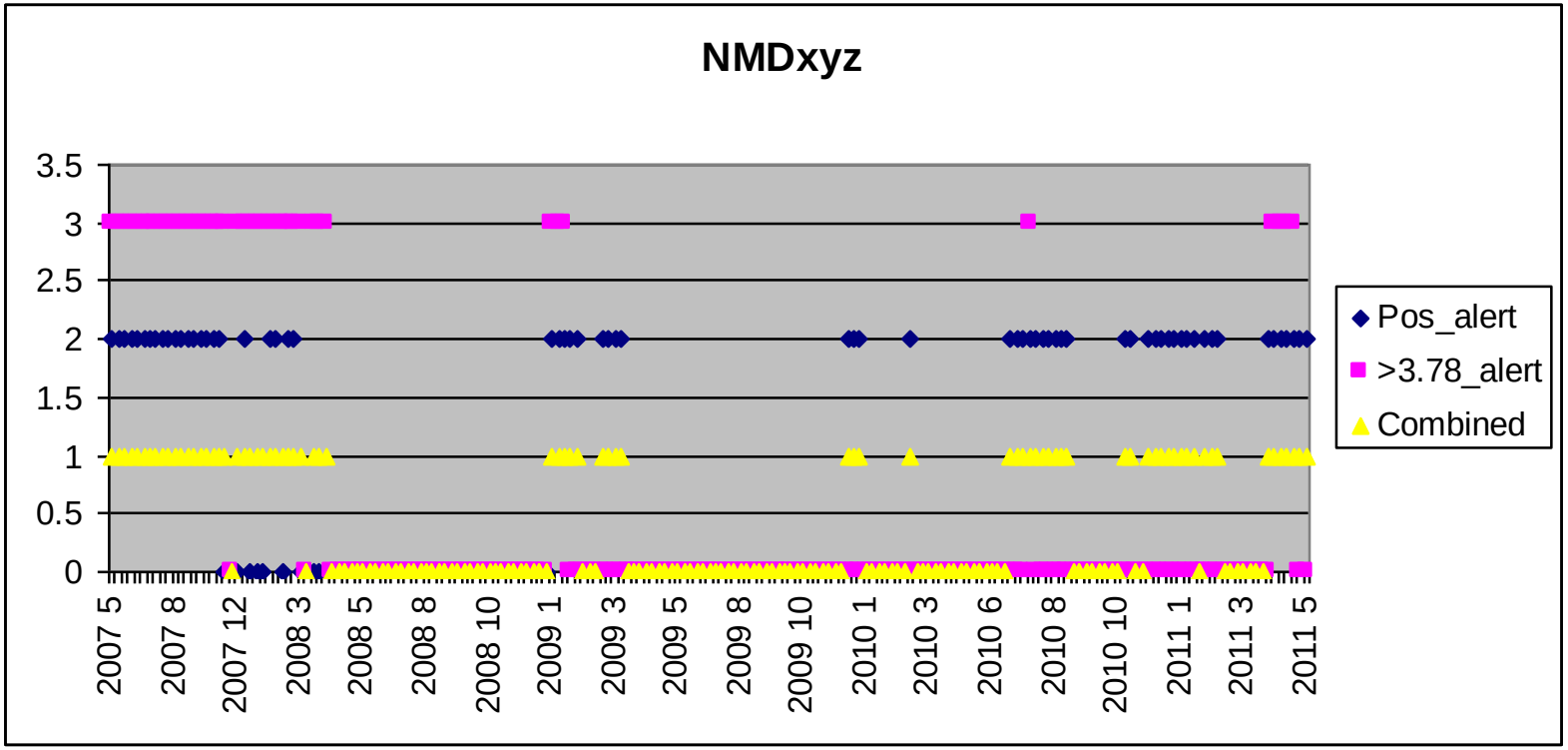


Regression model for human illness (2)



Alert modelling tool: screen shot

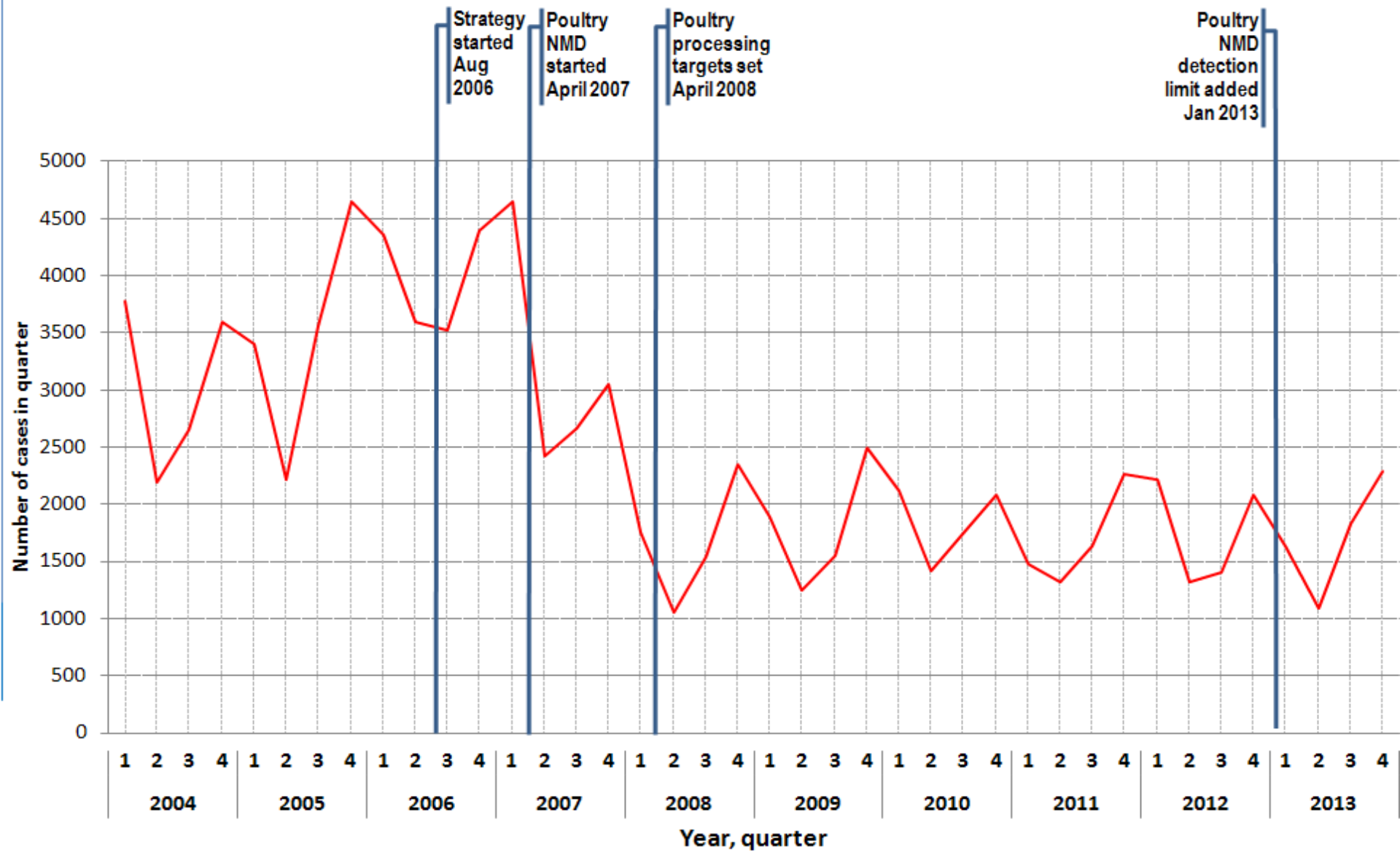
Acceptance number	20	6
	MW_Positives	MW_>3.78



Revised performance standard: 2013 -

Premises	Enumeration Failure (EF)	Detection Failure (DF)	Escalation of Responses	Clearance
ST: > 1,000,000 birds per annum	When **7 or more** out of 45 samples are > 3.78 log_{10}CFU/ carcass	When **30 or more** out of 45 samples are ≥ 2.30 log_{10}CFU/ carcass)	If the premises has an EF, a DF or both it is counted as one non-compliant window. Responses escalate according to the number of consecutive non-compliant moving windows.	To clear the non-compliance a moving window without an EF and without a DF is required. The database then resets to zero to show that the premises is compliant.
VLT: All others	When **2 or more** out of 9 samples are > 3.78 log_{10}CFU/ carcass.	When **6 or more** out of 9 samples are ≥ 2.30 log_{10}CFU/ carcass.		

Campylobacteriosis cases per quarter



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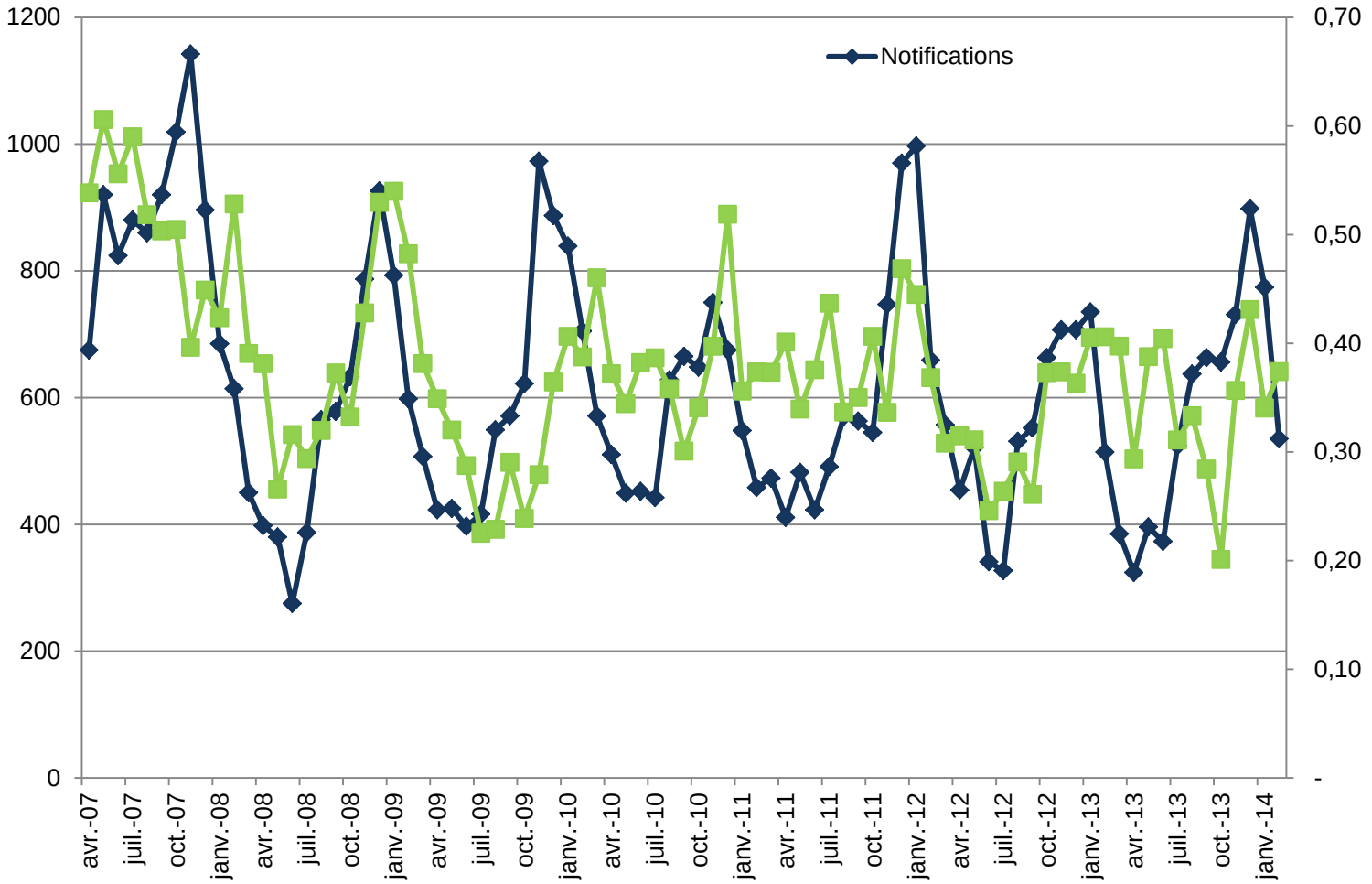
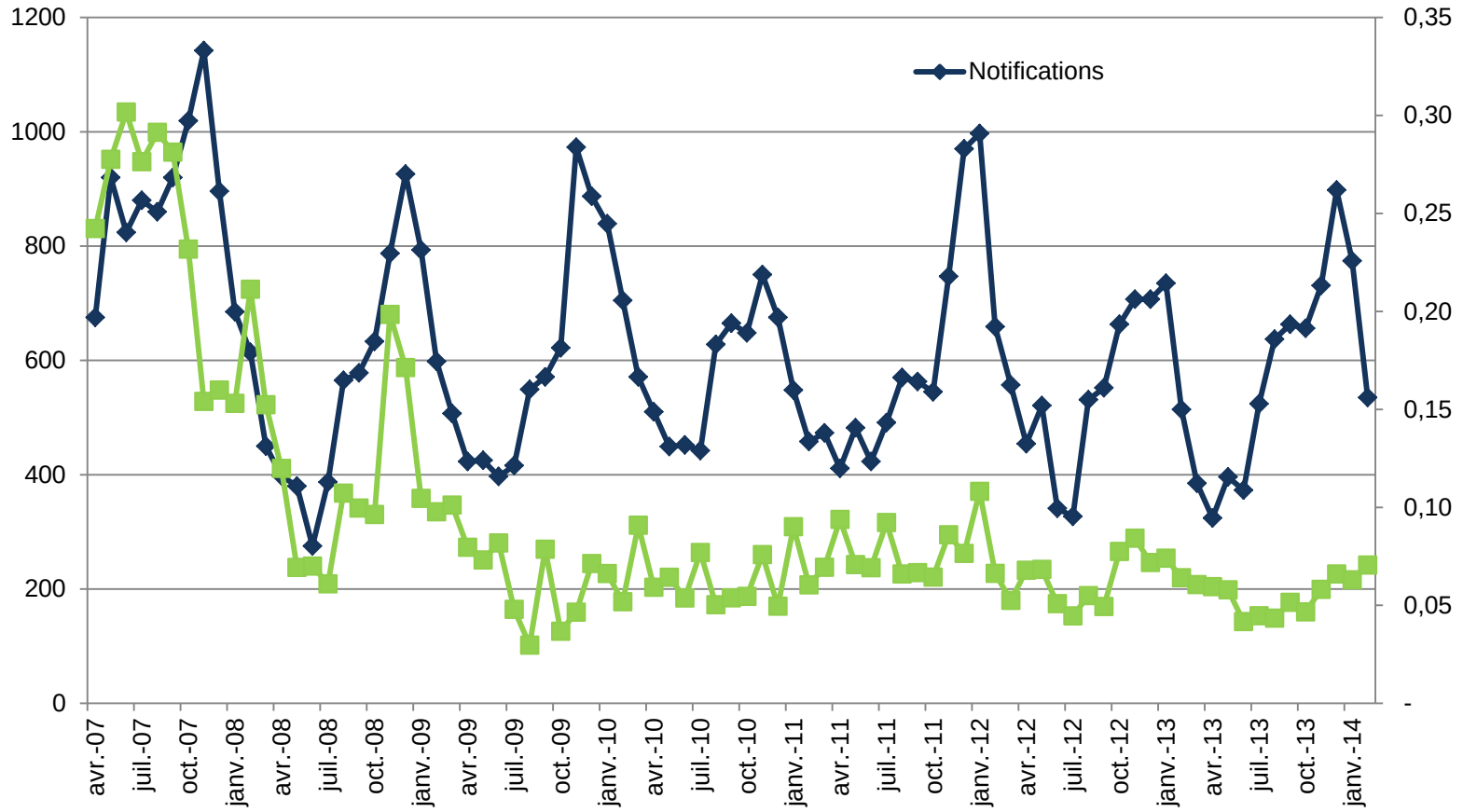
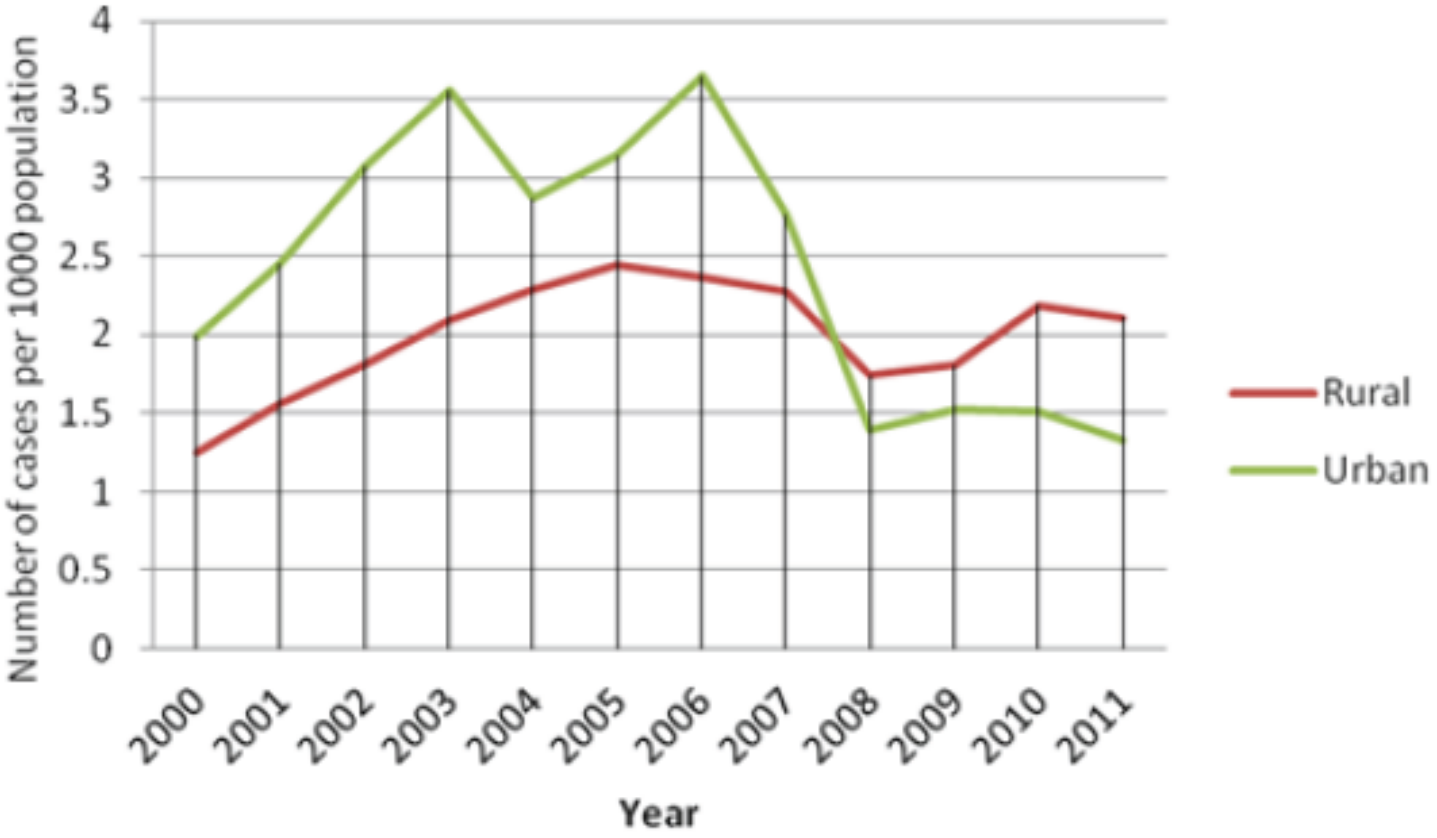


Association between human cases and % > 3.78 log $_{10}$ cfu/carcass



Changing epidemiology presents challenges



Changing epidemiology presents challenges

Discussion

- Achieving gains based on biosecurity is a challenge
- New Zealand control programme focuses strongly on controlling contamination at primary processing by use of a mandated target rather than mandated interventions
- Working closely with industry to improve situation
- Must be a consequence for poor performance
- Washing of carcasses has demonstrable effect and chemical decontamination used where necessary
- Further stringency in performance target must be driven by transparent risk management decisions

Campylobacteriosis: A prime example for a risk-based approach!

Thank you