What are we aiming for?

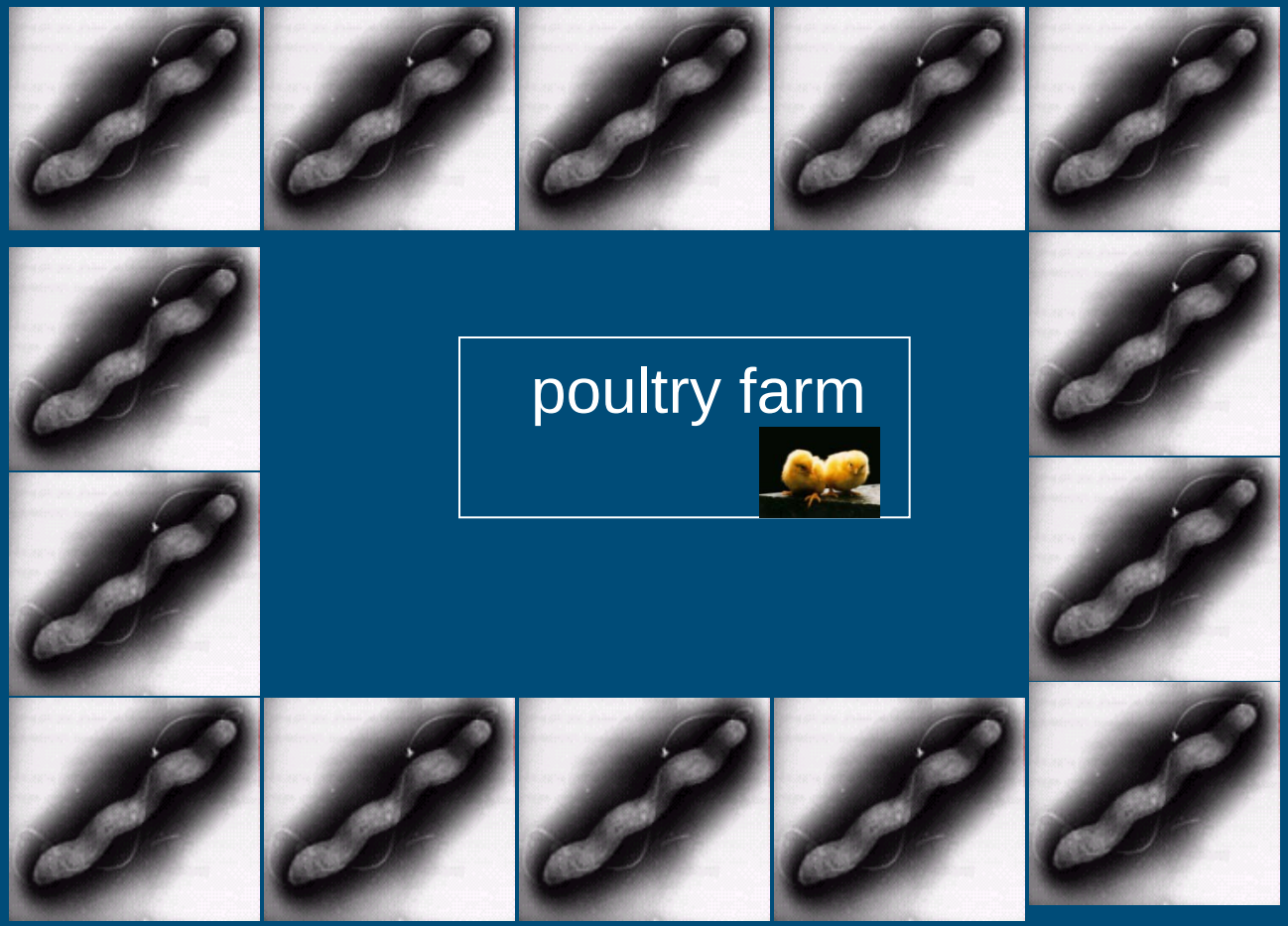
- Preferably absence in flocks, second best: reduced cecal concentration at slaughter
- If colonization cannot be prevented in primary production, the processing plant is in charge
- Eliminate the heavily contaminated carcasses

Quantitative risk assessment models indicate that "*the incidence of campylobacteriosis associated with consumption of chicken meals could be reduced 30 times by introducing a 2 log reduction of the number of Campylobacter on the chicken carcasses*"

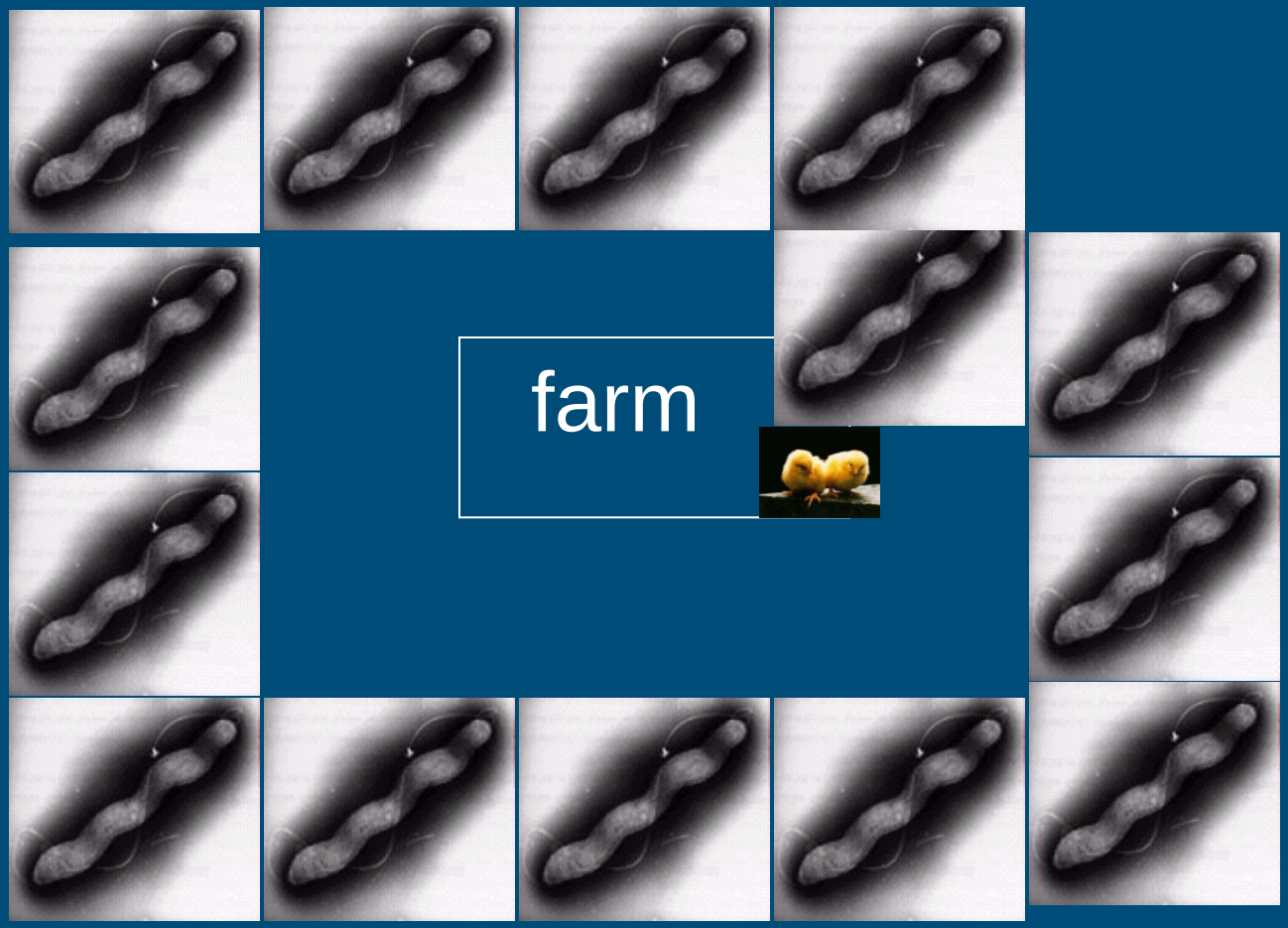
What measures in primary production?

- Prevention of introduction of *Campylobacter* into the broiler houses
  - reduced fraction of positive flocks
- Increased resistance of broilers to become colonized
  - reduced fraction positive flocks and (potentially) decreased *Campylobacter* counts/gram cecal contents
- Decreased concentration of *Campylobacter* in intestines just before slaughter
  - Decreased concentration in gut contents associated with lower carcass counts.

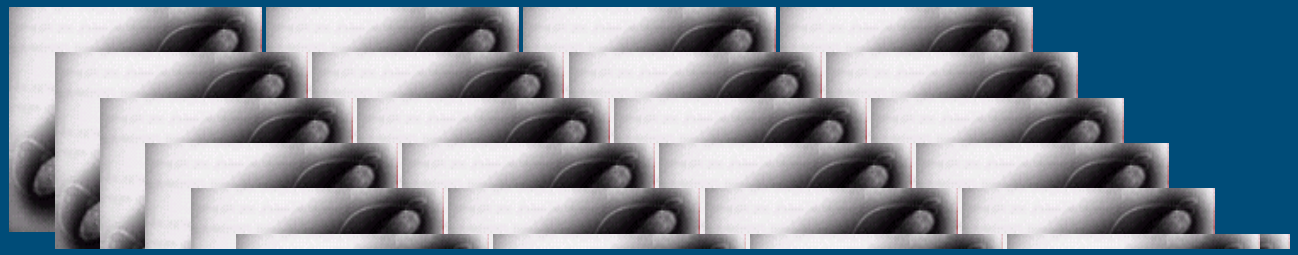
Prevention of introduction of *Campylobacter*: biosecurity



Prevention of introduction of *Campylobacter*



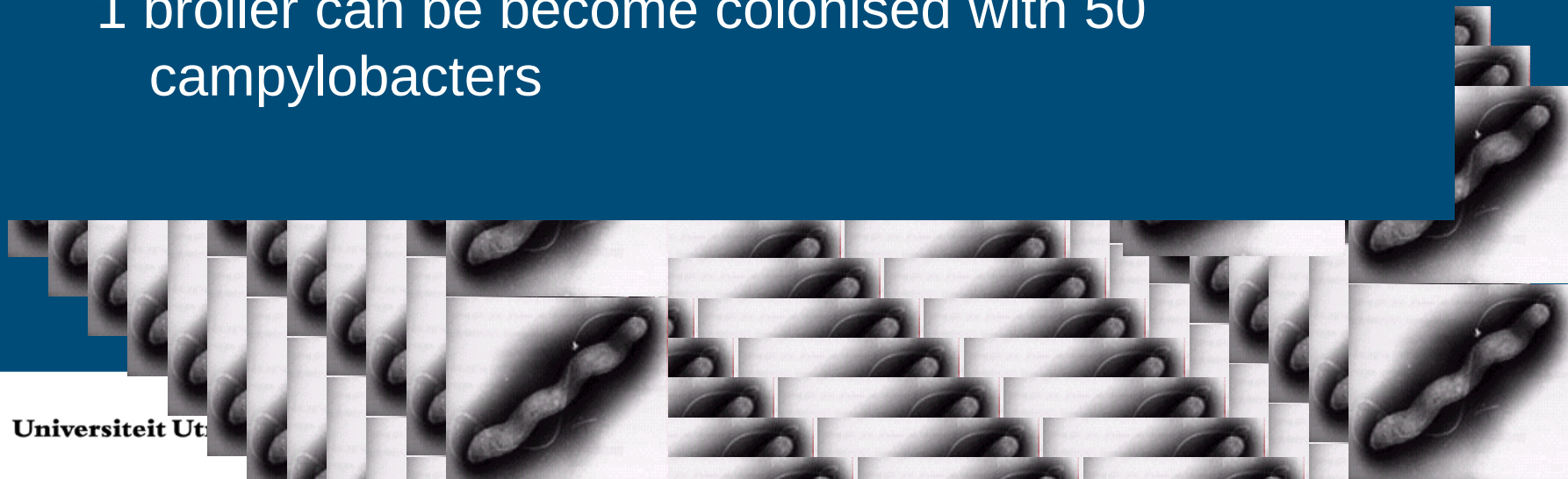
Prevention of introduction of *Campylobacter*



25 gram cecal content x 10^9 x 50,000 broilers =

10^{15} campylobacters/day

1 broiler can be become colonised with 50 campylobacters



Risk factors for farms to be *Campylobacter* positive

(input for intervention)

Positive association with colonization

- Thinning
- Other animals
- Other poultry houses
- Age
- Water supply

Biosecurity!

Negative association with colonization

- Implementation of biosecurity measures

On-farm interventions

- Biosecurity (including fly screens)
  - Thinning, consistently & rigorously applied, only indoor!
- Feed and water additives (acids, competitive exclusion, probiotics)
- Vaccination
- Phage therapy
- Genetic resistance
- Bacteriocines

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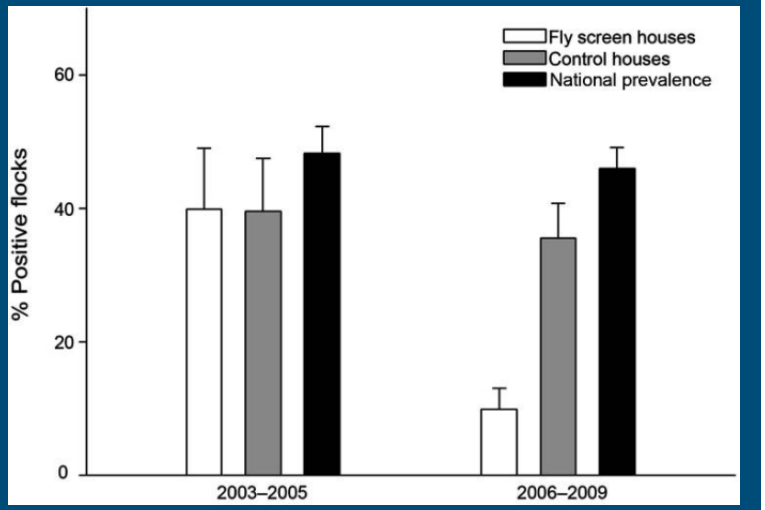

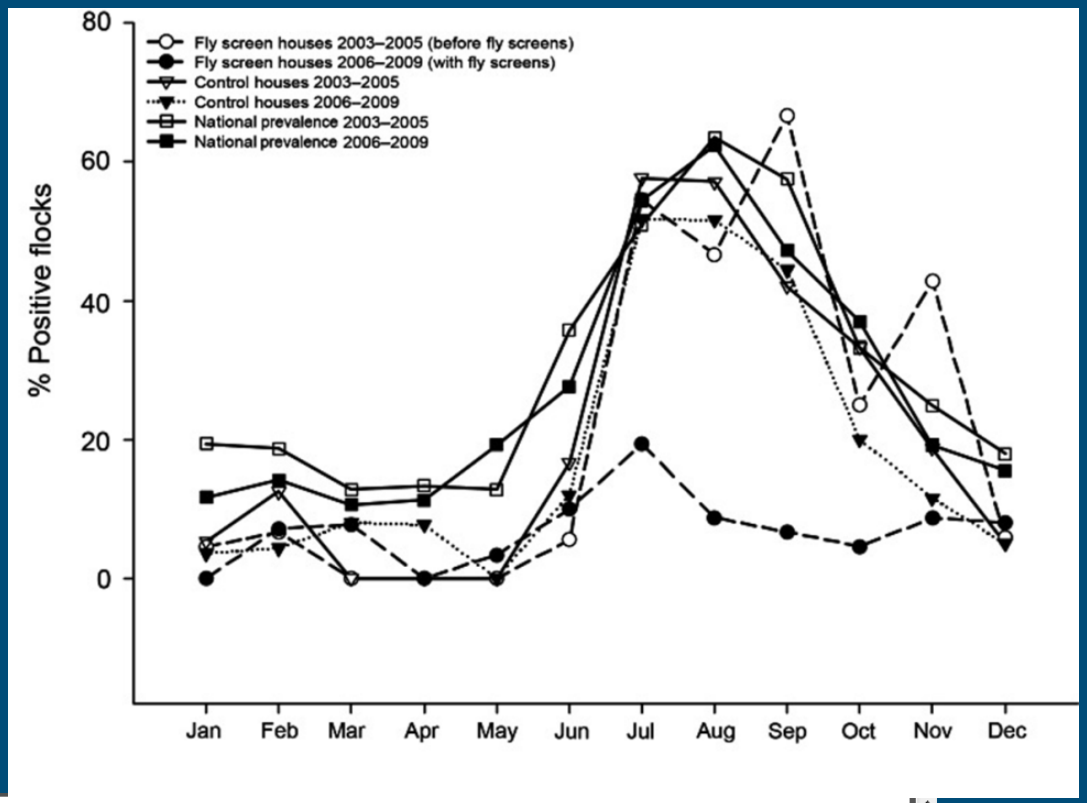

Foodborne Disease Prevention and Broiler Chickens with Reduced *Campylobacter* Infection

Simon Bahrndorff, Lena Rangstrup-Christensen, Steen Nordentoft, and Birthe Hald

Universiteit Utrecht

CENTRAL VETERINARY INSTITUTE
WAGENINGEN UR

Dr. Ruff Lowman

Ruff Biosecure Inc.

Universiteit Utrecht

CENTRAL VETERINARY INSTITUTE
WAGENINGEN UR

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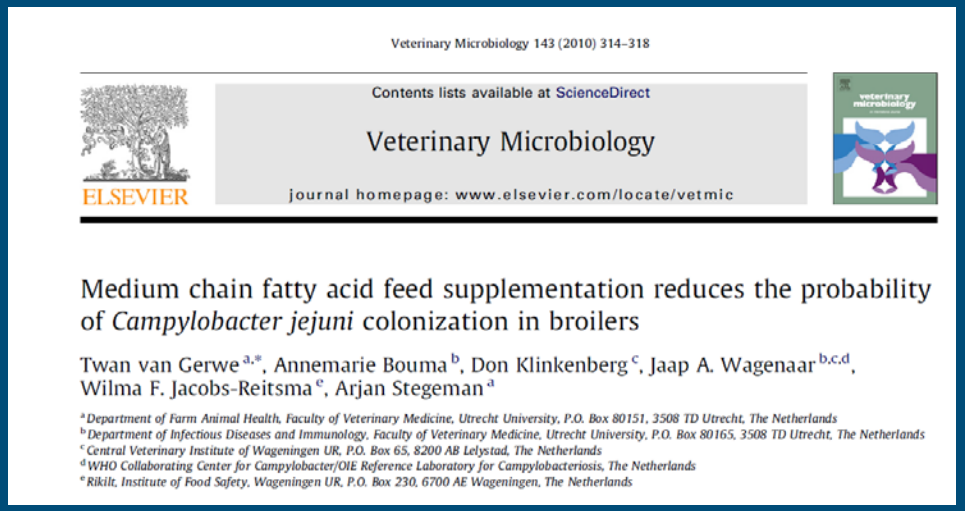

Veterinary Microbiology 143 (2010) 314–318

Contents lists available at ScienceDirect

Veterinary Microbiology

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

ELSEVIER

Medium chain fatty acid feed supplementation reduces the probability of *Campylobacter jejuni* colonization in broilers

Twan van Gerwe[a,*], Annemarie Bouma[b], Don Klinkenberg[c], Jaap A. Wagenaar[b,c,d], Wilma F. Jacobs-Reitsma[e], Arjan Stegeman[a]

[a] Department of Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, P.O. Box 80151, 3508 TD Utrecht, The Netherlands
[b] Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University, P.O. Box 80165, 3508 TD Utrecht, The Netherlands
[c] Central Veterinary Institute of Wageningen UR, P.O. Box 65, 8200 AB Lelystad, The Netherlands
[d] WHO Collaborating Center for Campylobacter/OIE Reference Laboratory for Campylobacteriosis, The Netherlands
[e] Rikilt, Institute of Food Safety, Wageningen UR, P.O. Box 230, 6700 AE Wageningen, The Netherlands

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- Vaccination
- Phage therapy
- Genetic resistance
- Bacteriocines

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Available online at www.sciencedirect.com

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Vaccine 25 (2007) 5548–5557

Vaccine

www.elsevier.com/locate/vaccine

Vaccination of chickens against *Campylobacter*

Marcel R. de Zoete [a,c,d], Jos P.M. van Putten [a,c,d], Jaap A. Wagenaar [a,b,c,d,*]

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- Bacteriocines

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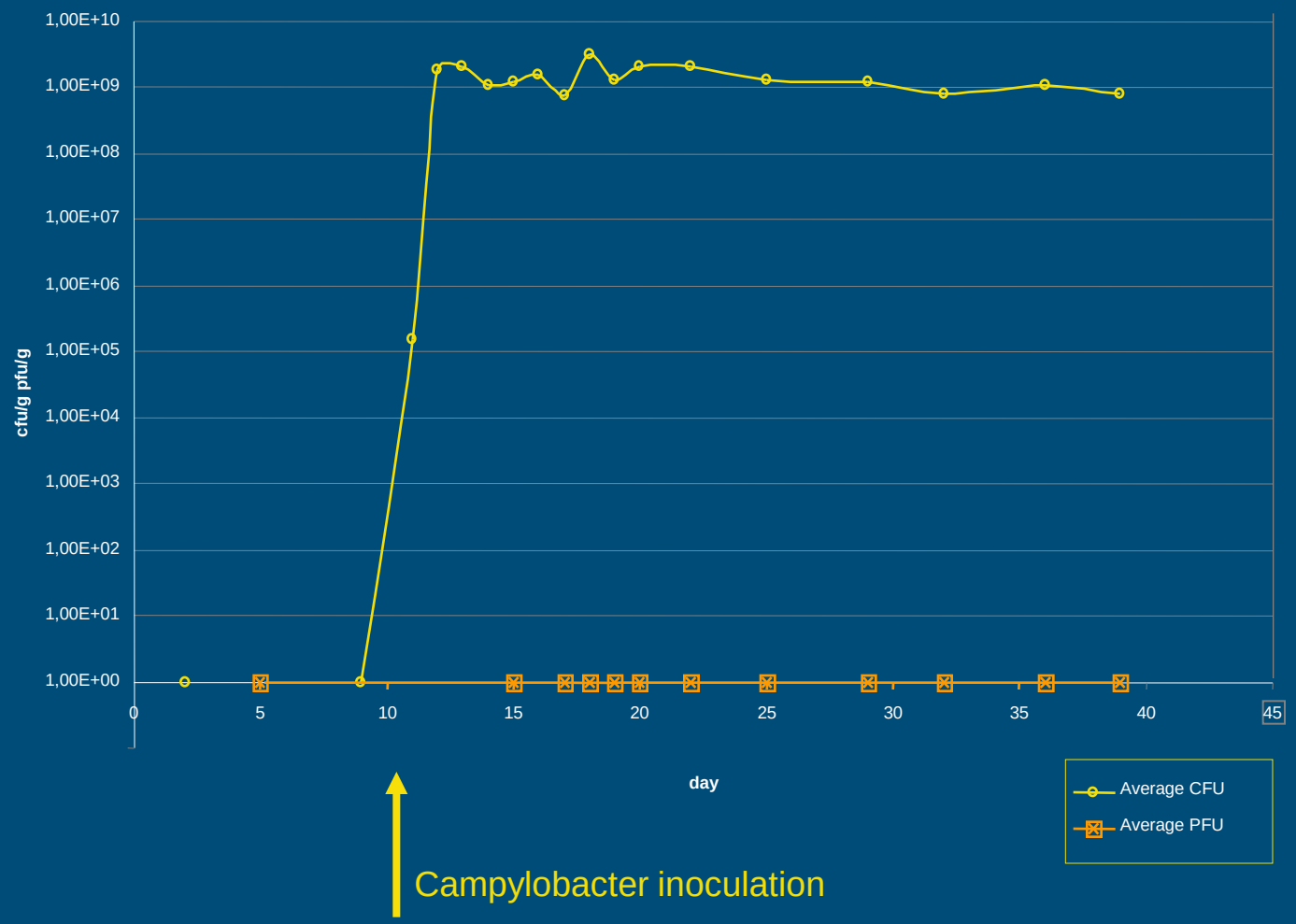
Phage therapy reduces *Campylobacter jejuni* colonization in broilers

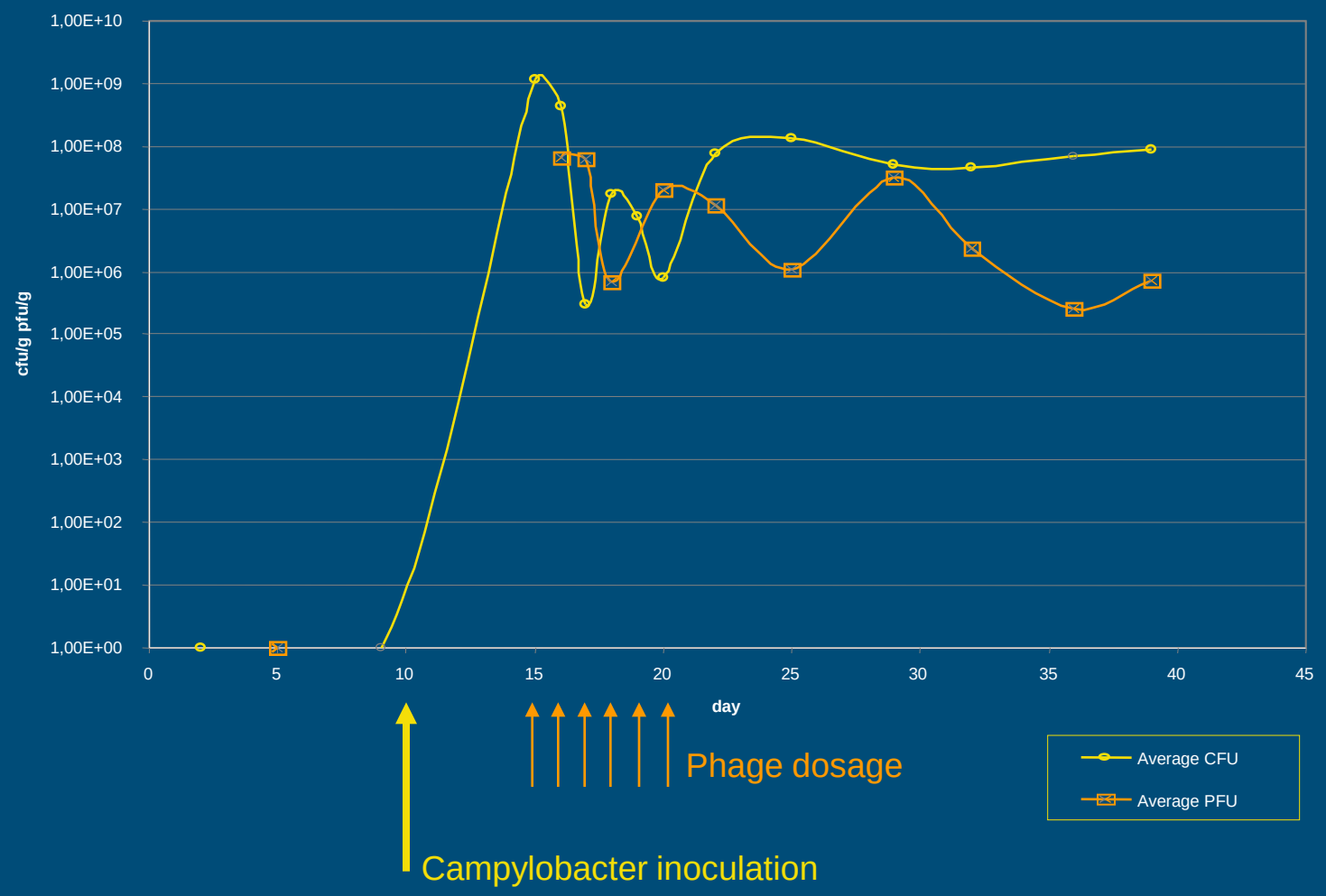
Jaap A. Wagenaar [a,*], Marcel A.P. Van Bergen [a], Mark A. Mueller [b], Trudy M. Wassenaar [c], Richard M. Carlton [b]

[a] *Division of Infectious Diseases, Animal Sciences Group, P.O. Box 65, 8200 AB Lelystad, The Netherlands*
[b] *Exponential Biotherapies Inc., Washington DC, USA*
[c] *Molecular Microbiology and Genomics Consultants, Zotzenheim, Germany*

Campylobacter colonization: bacteria only



Campylobacter colonization: therapeutic treatment



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- Phage therapy
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- Bacteriocines

Review

Bacteriocins to control *Campylobacter* spp. in poultry—A review

E. A. Svetoch* and N. J. Stern†[1]

Quantification of measures

Effect of interventions based on QMRA

(request from EFSA)

- 100% risk reduction can be achieved by irradiation/cooking
- > 90% risk reduction can be achieved by freezing for 2-3 weeks or reduction of the concentration in intestines at slaughter by > 3 log units;
- 50-90% risk reduction can be achieved by freezing for 2-3 days, hot water or chemical carcass decontamination with lactic acid, acidified sodium chlorite or trisodium phosphate
- 50-90% risk reduction by fly screens on farms (based on data from Denmark only)
- Up to 50% risk reduction by modifications of primary production,
  - restriction of slaughter age to a max 28 days (only indoor flocks)
  - discontinued thinning

European Food Safety Authority

EFSA Journal 2011; 9(4):2105

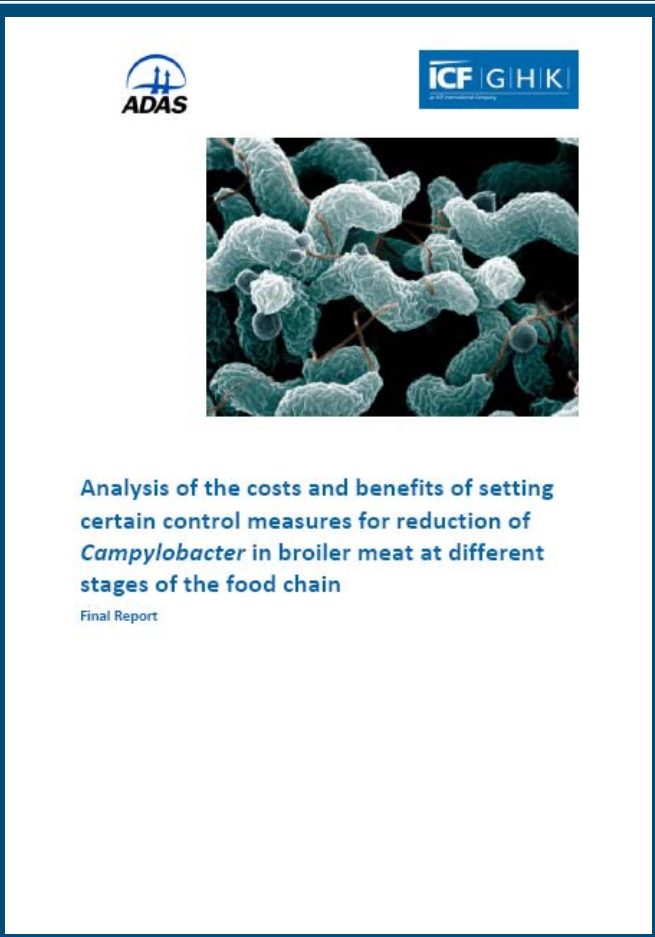
SCIENTIFIC OPINION

Scientific Opinion on *Campylobacter* in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain[1]

EFSA Panel on Biological Hazards (BIOHAZ)[2, 3]

European Food Safety Authority (EFSA), Parma, Italy

Economic aspects


ADAS

ICF GHK

Analysis of the costs and benefits of setting certain control measures for reduction of *Campylobacter* in broiler meat at different stages of the food chain

Final Report

http://ec.europa.eu/food/food/biosafety/salmonella/other_act_en.htm

EUROPA - Food Safety - Biological Safety of Food - Salmonella and Food-borne Diseases - other a - Windows Internet Explorer

http://ec.europa.eu/food/food/biosafety/salmonella/other_act_en.htm

campylobacter_excel_model_en.xls [Read-Only] [Compatibility Mode] - Microsoft Excel

B27 =B25/B24

	A	B	C
1	**Assumptions used for some of these costings**		
2			
3	Please note these numbers are not live, and changing these will not affect the costings. Instead the costings for a measure should be changed on each measures individual worksheet.		
4	See control strategy list for easy access to these.		
5			
6	4% discount rate used for capital		
7			
8	**For farm level costings:**		
9	(Data sourced from industry experts)		
10			
11			
12	Stocking Rate (kg/sqm)	34	
13	Shed size (sq m)	1.820	
14	No of birds per house	23.333	(Assuming no thinning)
15	Weight at 35 days (kg)	2,0	
16	Weight at 42 days (kg)	2,7	
17	Profit per bird at 35 days (EUR)	0,00625	
18	Profit per bird at 42 days (EUR)	0,07250	
19	No. of crops per annum at 42 days	7,0	
20	No. of cropsper annum at 35 days	8,1	
21			
22	**Human health impacts (EFSA Opinion, 2011)**		
23	EC27 cases of human campylobacteriosis per year	9.000.000	
24	No of DALYs	350.000	
25	Associated cost of illness	€ 2.400.000.000	
26	DALY per case	0,0389	
27	Cost of illness associated with a DALY	€ 6.857	

Instructions | Main | Strategy Costs and Benefits | F1 | F2 | F2 - Source | F3 | F3 - Source | F4 | F5 | T1 | S1 | S2 | S3 | S4 | S5 | T2 | Industry Structure | Assumptions | References

Ready

Campylobacter

On request of the Commission EFSA has published the "Scientific Opinion on Campylobacter in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain"

The Commission has asked for an analysis of the costs and benefits of setting control measures for Campylobacter based on the EFSA opinion. The cost model is available in an **easy-to-use excel file** and can be adjusted to Member States´ individual situations."

See also "Implementation of the Directive" for baseline surveys on zoonoses others than *Salmonella*.

Costs and benefits analysis

ID	Name	Reduction in incidence (%)	EU cost of control € million	EU cost of illness saved € million	EU Net cost per DALY averted €
F1	Enhanced Biosecurity	44%	36.7	333.8	-6,102
F2	Early Slaughter	15%	288.1	116.1	10,154
F3	No Thinning	12%	43.6	87.4	-3,438
F4	Vaccination	64%	297.7	478.8	-2,594
F5	Bacteriocins	64%	297.7	478.8	-2,594
S1	Best practice hygiene	23%	54.0	166.1	-4,626
S2	Chemical Decontamination	60%	116.1	442.9	-5,060
S3	Freezing (2-3 weeks)	93%	346.5	682.9	-3,377
S4	Hot Water	70%	272.2	516.8	-3,245
S5	UV Irradiation	100%	341.3	738.2	-3,687

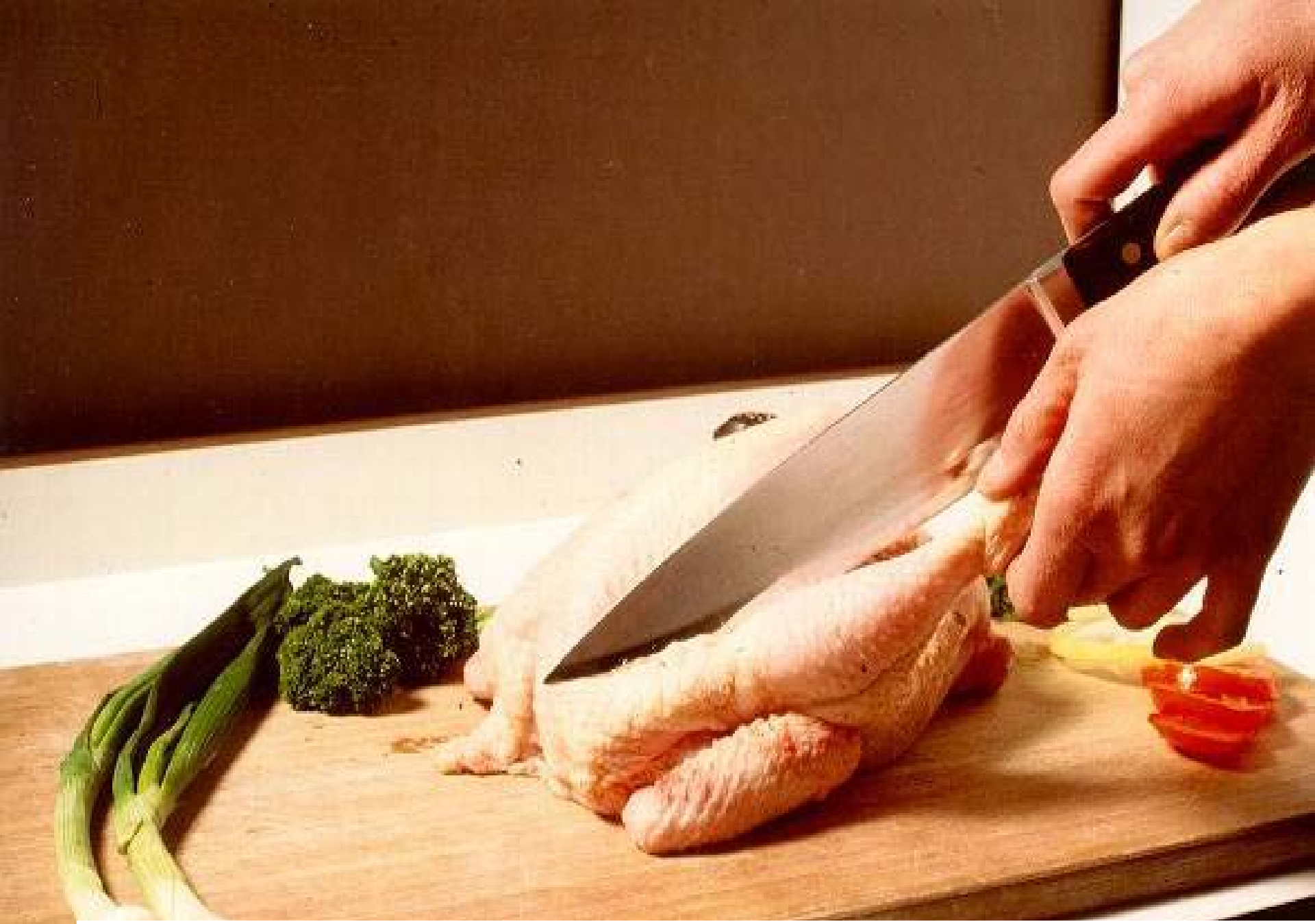
Dutch approach: process hygiene criterion

- To control contamination of end-products in industrial slaughter plants for broiler chickens (carcasses after chilling)
- Treshold based on risk assessment models
- 1000 cfu/gram neck/breast skin
- Not complying is a sign that hygiene of the slaughter plant should be improved (=> develop and implement a plan for improvement)
- Not complying batches will not withdrawn

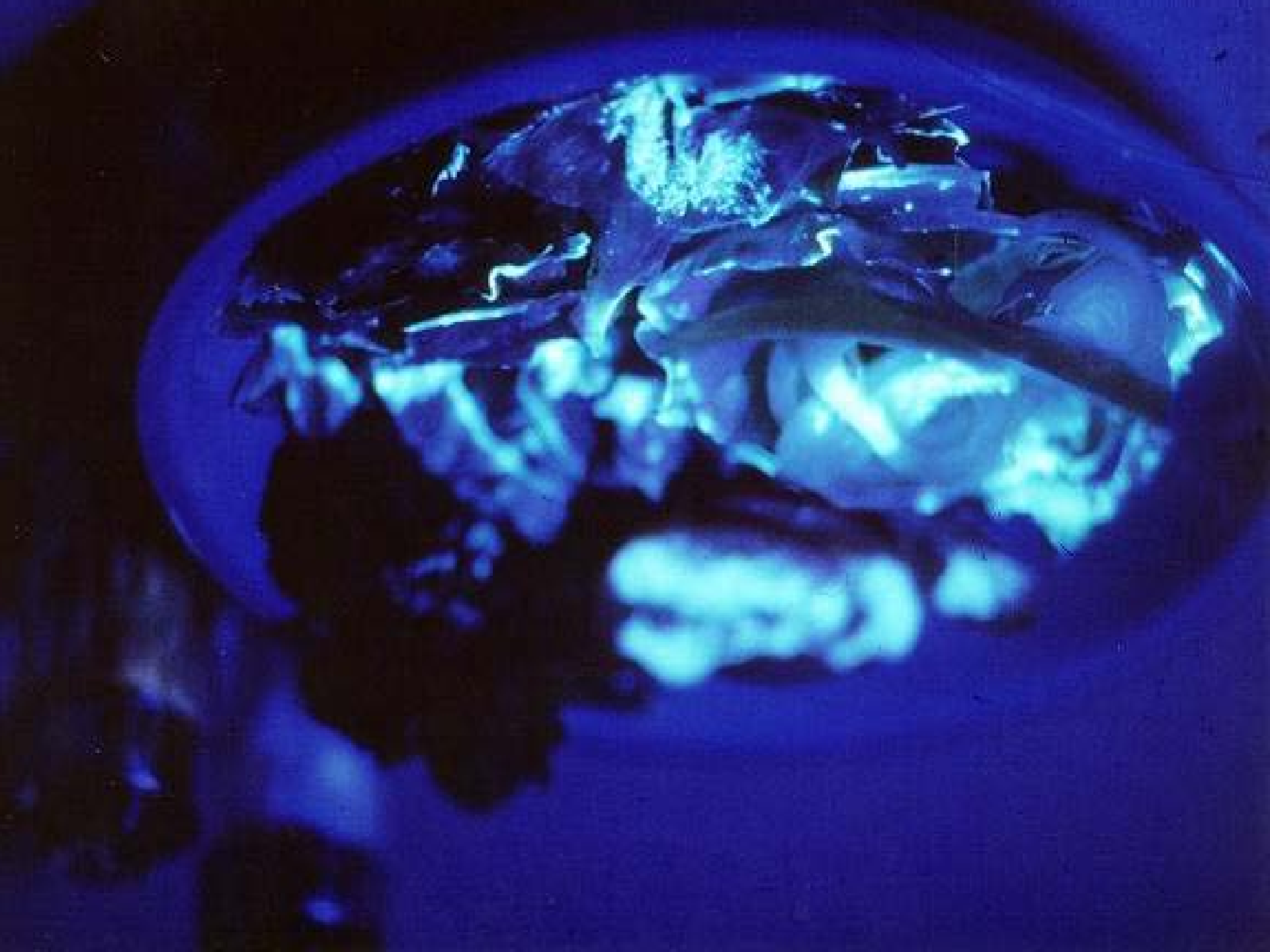
- Discussion about introduction at EU-level

The role of the consumer!!!


BONUS
Kip ovenschotel
4.99
Poulet de Paysanne
Produit exclusif
Hele kip
6.05
Scharrelkip
10.17
Scharrelkip
9.96



Dr. Henk van der Zee, Food Inspectorate, the Netherlands



Take home messages

- Up to 80% of human campylobacteriosis is poultry derived with 20-40% through poultry meat
- Options for intervention in primary production are still (economically) limited and restricted to indoor production (animal welfare conflicting with food safety!)
- Efforts on primary production AND postharvest
- Elimination of the highly contaminated carcasses reduces the human burden considerably
- Potential approach: process hygiene criterium

Thanks to...

Albert de Boer
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Rob Tauxe
Charles Hofacre
Irving Nachamkin
Ruwani Kalupahana
Rob Lake
Patrick McDermott
Shaohua Zhao

WHO Global Food borne Infections Network

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