



Microbiology of New Zealand Bulk Tank Milk

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Growing and Protecting New Zealand



www.mpi.govt.nz



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Main goal of the study

- **to assist in evaluating the risk of disease due to the consumption of raw milk**

The survey was designed to

- determine the occurrence of selected pathogens in bulk raw milk collected from farm vats
- understand seasonal and geographical patterns (if any)
- establish whether some farms are consistently performing better than other ones
- help to estimate 'true' prevalence of pathogens in NZ raw milk

Selection of farms for the study

MilkTestNZ have a database encompassing 11577 suppliers over the entirety of New Zealand.

The available herd identifiers were placed into a single list and 80 farms selected from this list, by using a randomly generated starting point and then selecting every 145th farm.

Information (herd size, breed, location of the farm, milking practices) pertaining to the 80 farms has been collected from the appropriate Dairy producers.

Background: New Zealand dairy

2011/2012 milking season:

19.1 billion litres of milk

11,798 dairy herds

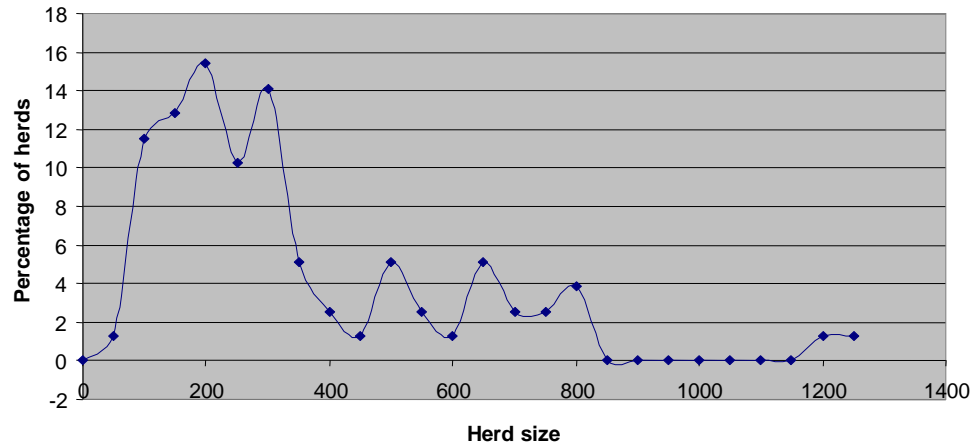
4.6 million cows



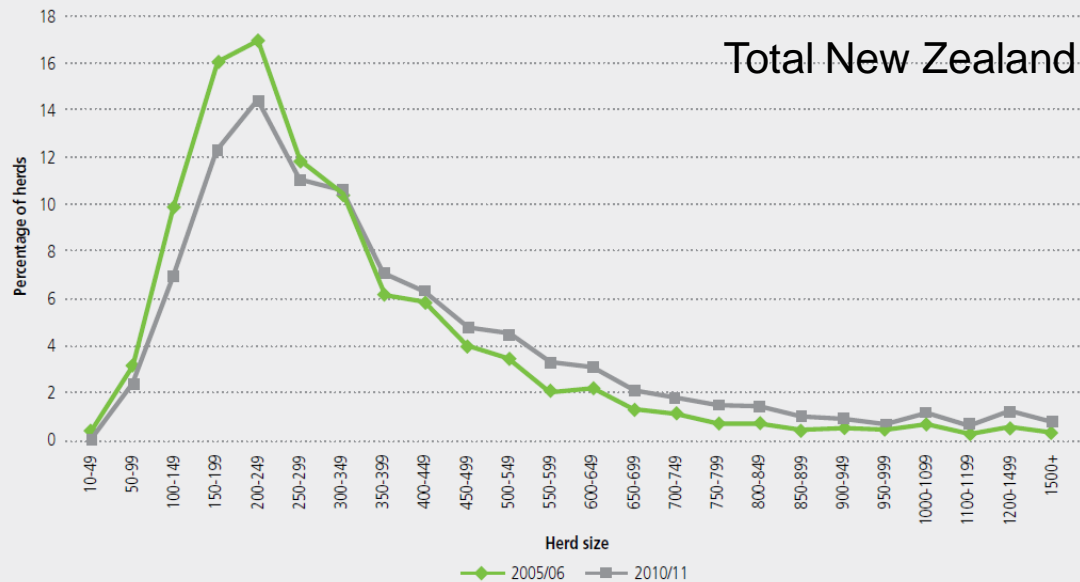
Are selected farms representative?

size

Herd size distribution in the MPI survey



Total New Zealand



Are selected farms representative?

geography

- In the survey 78% of herds were from the North Island with 33% from Waikato region
- New Zealand dairy statistics 2012: 75% of herds are in the North Island with 34% in the Waikato region



Selected pathogens

- *Listeria monocytogenes*
- *Staphylococcus aureus*,
- *Campylobacter* spp.,
 - *Salmonella* spp.
 - *E. coli* O157

Very tempting, but not in this study

- *Yersinia enterocolitica*
- *Mycobacterium bovis*
- Non O157 STEC

Sampling and testing

Samples were taken every 2 months starting in November 2011 and finishing in August 2012 covering various lactational stages.

Enrichment methods in combination with a modified most probable number detection method were used to monitor samples for the presence of *Listeria monocytogenes*, *Campylobacter* spp., *Salmonella* spp. and *E. coli* O157. For *Staphylococcus aureus* the samples were analysed using agar enumeration methods.

Survey results

Microorganism	Prevalence (%)	95% CI
<i>Campylobacter</i> spp.	0.58	0.071-2.10
<i>E.Coli</i> O157:H7	0.28	0.01-1.55
Non-STE ^C O157	0.28	0.01-1.55
<i>Salmonella</i> spp.	0.00	0-1.03
<i>Listeria innocua</i>	10.08	7.2-13.6
<i>Listeria monocytogenes</i>	4.09	2.31-6.65
<i>Staphylococcus aureus</i>	74.10	69.2-78.7

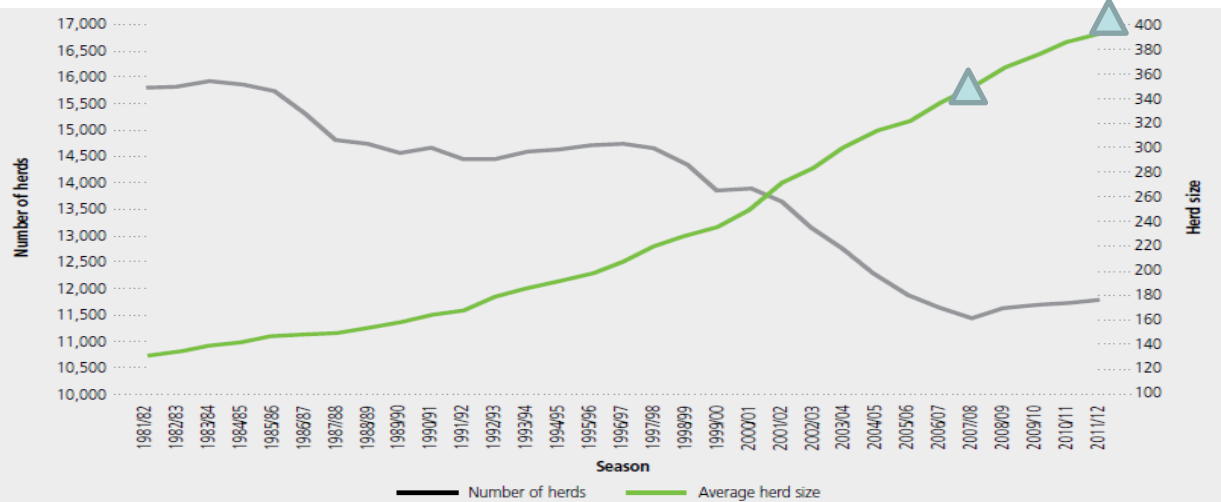
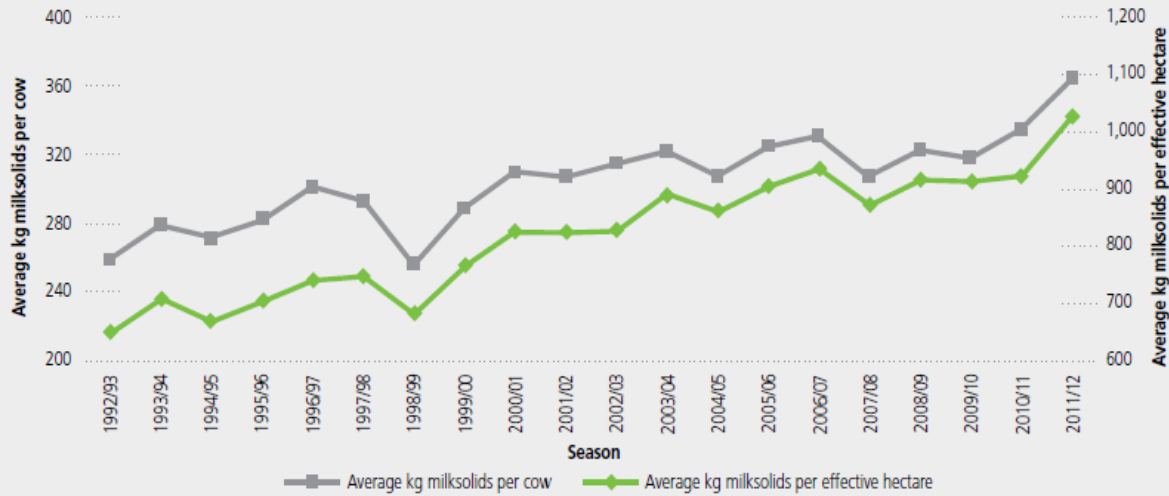
Staphylococcus aureus counts in cfu/ml

	Month					
	Jan	March	May	July-Aug	November	Total
Number of samples	77	80	55	72	60	344
% of positives	51.9	83.8	94.5	79.2	65	74.1
95%CI	40.3-63.5	73.8-91.1	84.9-98.9	68.0-87.8	51.6-76.9	69.2-78.7
Count						
1-10	37.7%	22.5%	14.5%	23.6%	16.7%	23.8%
11-100	13.0%	55.0%	72.7%	45.8%	38.3%	43.6%
101-1000	1.3%	6.3%	7.3%	8.3%	10.0%	6.4%
>1000	0%	0%	0%	1.4%	0%	.3%

Similar study of occurrence of pathogens in New Zealand raw milk was conducted by Fonterra during 2007/2008 milking season

Should we bother with another one ?

We live in a very changeable world



More important:

**Interest among individuals in New Zealand
to consume raw milk is growing fast.**

Sales are becoming widespread

Comparison with 2007-2008 raw milk survey

Microorganism	2011-2012 (MPI study)		2007-2008 (Fonterra study)	
	Prevalence (%)	95% CI	Prevalence(%)	95%CI
<i>Campylobacter</i> spp.	0.58	0.071-2.10	0.34	0.01-1.87
<i>E.Coli</i> O157:H7	0.28	0.01-1.55	0.00	0-1.24
Non-STEC O157	0.28	0.01-1.55	1.01	0.21-2.93
<i>Salmonella</i> spp.	0.00	0-1.03	0.00	0-1.24
<i>Listeria innocua</i>	10.08	7.2-13.6	4.07	2.12-7.00
<i>Listeria monocytogenes</i>	4.09	2.31-6.65	0.68	0.83-2.43
<i>Staphylococcus aureus</i>	74.10	69.2-78.7	79.9	74.8-84.3

Back to the 2012 study: milk quality

-somatic cell counts (SCC)

(good indicator of subclinical mastitis),

-viable bacteria counts (TBC)

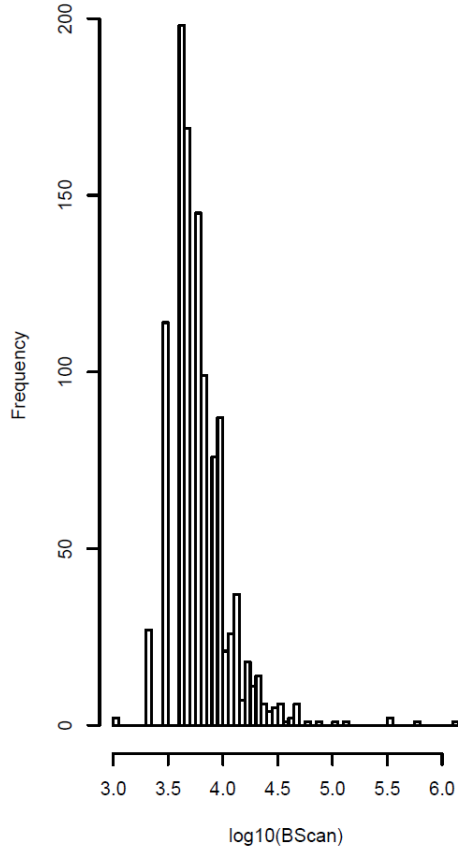
(BactoScan estimates of TBC are a measure of all bacteria present in milk)

-coliform counts

(indicates milk contamination, likely from cows' faeces)

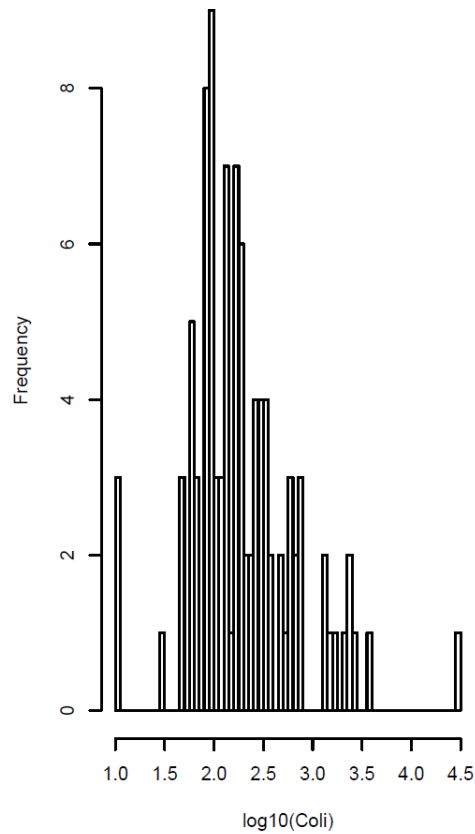
Milk quality information

log10 Bactoscan



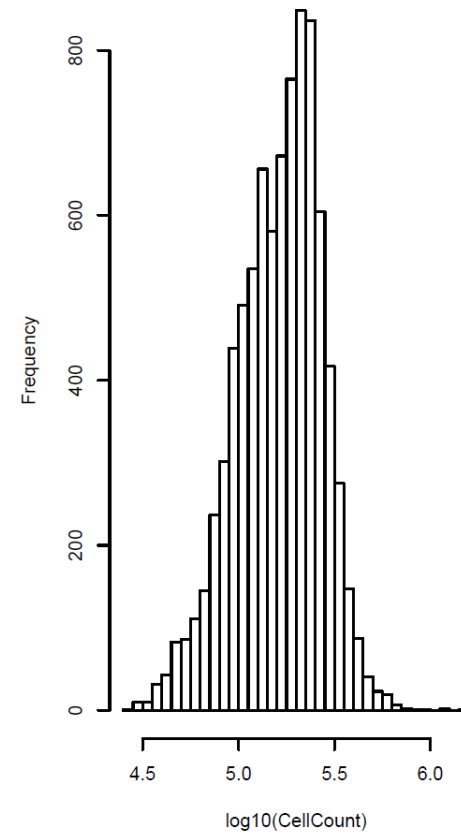
N=1092

log10 Coliform counts



N=807

log10 Somatic Cell Counts



N=8510

Summary of data analysis

- There is a strong and significant effect of farm on TBCs and coliform counts which indicates major differences in the standards of hygiene and/or mastitis control between farms that contribute to the variation in TBCs.
- BactoScan TBCs were negatively correlated with tank volume, which could be a dilution effect.

- TBCs were positively correlated with both coliform counts and somatic cell counts, but the proportion of variation explained was small. The relative contribution of faecal contamination is likely to be greater than the contribution from subclinical mastitis.
- There is significant monthly variation in TBCs and coliform counts: the highest TBCs were observed between March and August, with a peak in the spring calving month of July, whereas the highest coliform counts were observed in November

Statistical analysis of TBCs revealed a mixture-distribution with about 7% of counts belonging to a distribution that is likely to be attributed to faecal contamination from infected cows and 93% of counts coming from the background contamination inevitable in routine milking.

In combination with studies of pathogen prevalence between and within NZ dairy farms this estimate was used to assess true prevalence of pathogens in bulk raw milk.

Examples of estimated prevalence of pathogens in NZ raw milk

Campylobacter

*Probability of
being not present*

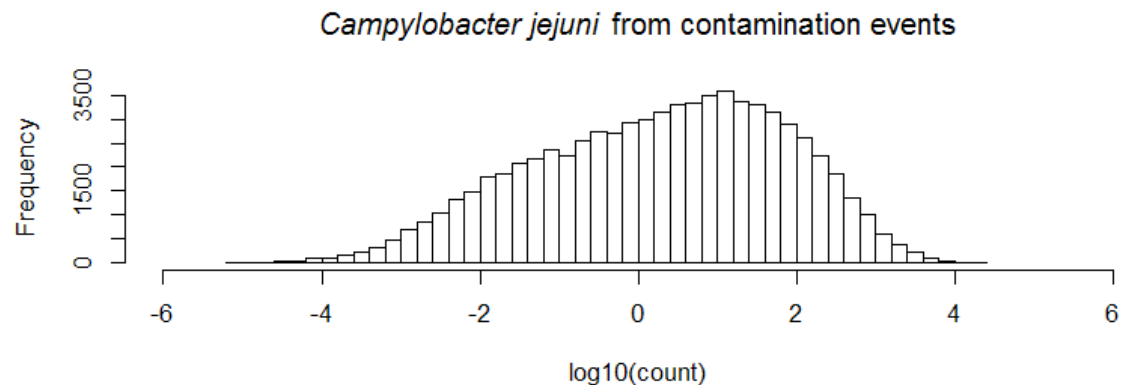
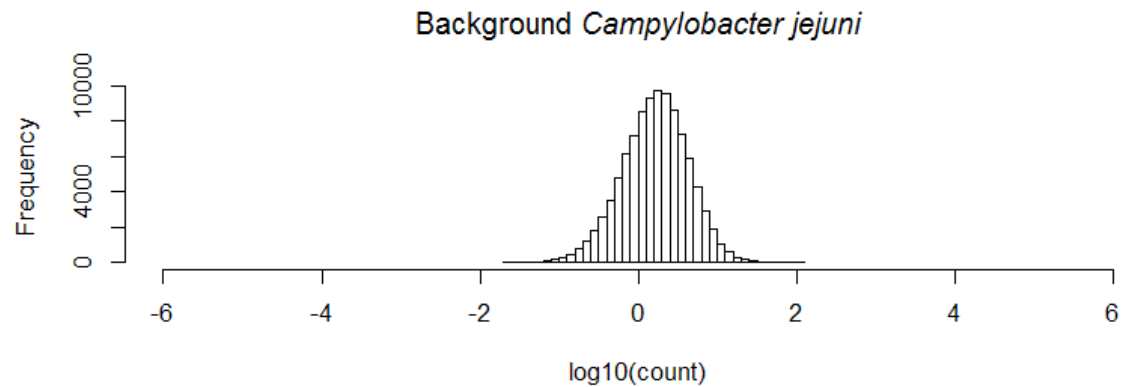
7.6%

*coming from
background contamination*

88.3%

*coming from major
contamination event*

4.1%



Examples of estimated prevalence of pathogens in NZ raw milk

STEC O157

*Probability of
being not present*

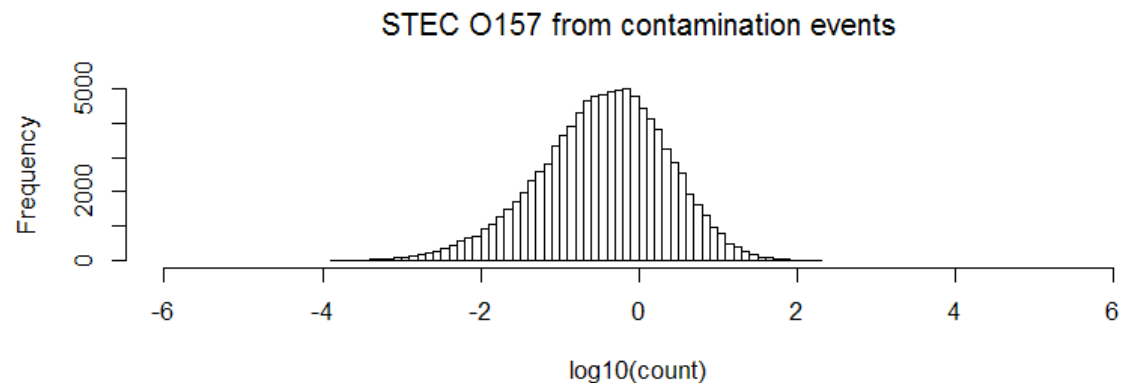
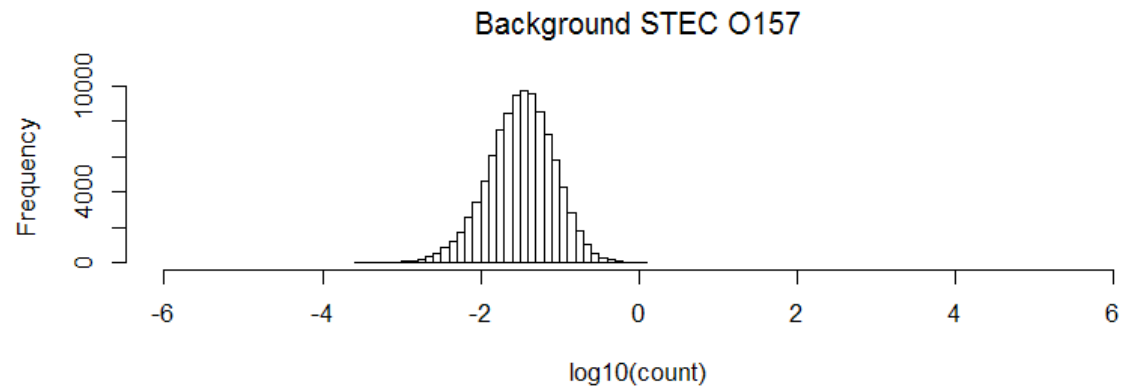
88.6%

*coming from
background contamination*

10.9%

*coming from major
contamination event*

.5%



Conclusion

Even good quality raw milk may contain pathogens

Heat treatment is highly recommended



Questions?

