Surveillance and control programmes for terrestrial and aquatic animals in Norway
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The surveillance and control programme for *Campylobacter* spp. in broiler flocks in Norway

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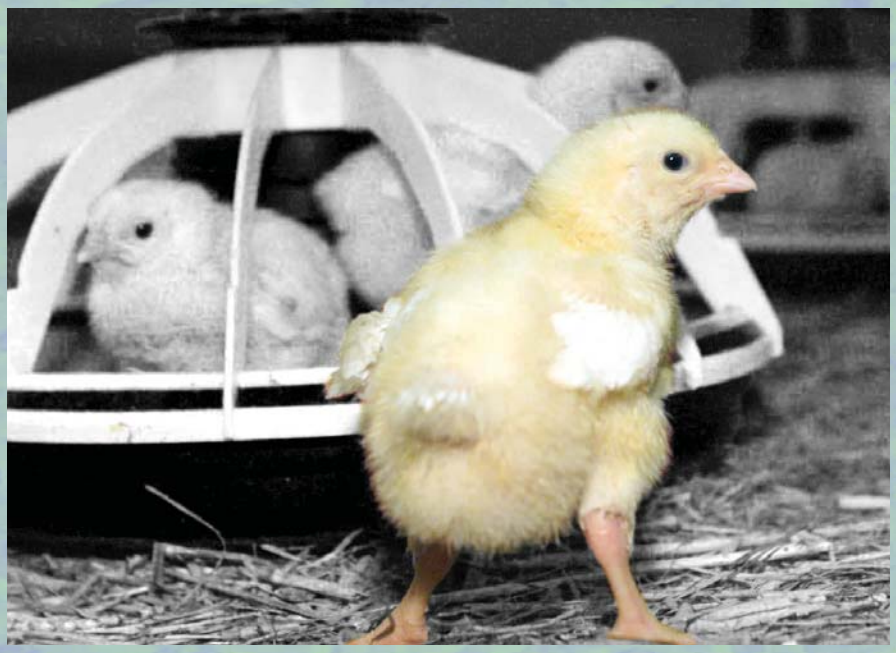

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Introduction

Campylobacteriosis is currently the most commonly reported bacterial infectious disease in the Norwegian human population. In almost half of the cases, the infection is acquired in Norway. Consumption of poultry meat purchased raw has been identified as a significant risk factor together with drinking undisinfected water, eating at barbecues, occupational exposure to animals, and eating undercooked pork (1).

The action plan regarding *Campylobacter* spp. in Norwegian broilers has been running since spring 2001 (2, 3, 4). The action plan is a joint effort involving several stakeholder groups from "stable-to-table". The Norwegian Zoonosis Centre at the National Veterinary Institute coordinates the programme, and is responsible for the collection and analyses of data and the communication of results.

The action plan is updated regularly and the details for 2009 together with other information regarding the action plan can be found at www.vetinst.no.

Aim

The objective is to reduce the human exposure to thermophilic *Campylobacter* spp. through Norwegian broiler meat products.

Materials and methods

In 2009, all Norwegian broiler flocks that were slaughtered before 50 days of age between 1 May and 31 October were sampled by the owner maximum four days before slaughter. The sample consisted of ten pooled swabs from fresh faecal droppings. The samples were submitted to the National Veterinary Institute's laboratory in Trondheim, where they were analysed for *Campylobacter* spp. by real-time PCR. The carcasses from the positive flocks were either heat treated or frozen for a minimum of three weeks before being marketed.

In addition, a few flocks with unknown status at the time of slaughter, were sampled at the slaughter house.

In 2009 a marked change from previous years was implemented when sampling only occurred in the six summer months May – October, and not the whole year through.

Results

In one part of the country (mainly Rogaland), sampling was not done in October.

A total of 1,924 samples (approximately corresponding to number of flocks, although a few flocks might have been sampled more than once) were analysed from a total of 564 farms. A total of 117 (6.1%) of the samples were positive for *Campylobacter* spp. In addition, seven samples from flocks with "unknown status" were collected at slaughter (five of these were also sampled at farm, but the results were not present at slaughter).

The positive samples originated from 93 (16.5%) of the farms. Regional differences in the proportions of positive flocks and farms are shown in Table 1 and Figure 2.

The proportion of *Campylobacter* positive flocks and the proportion of flocks testing positive already at the pre-slaughter sample has varied substantially since the action plan was launched (Figure 1). For 2008 and 2009, data exists only from pre-slaughter samples, and for 2009 there's data only for six months. In Figure 2, the number of flocks (in 2008 and 2009; number of samples) positive for *Campylobacter* spp. at the pre-slaughter sample in May – October, are shown.

Table 1. Farms positive for *Campylobacter* spp. by county in May – October 2009.

County	Number of sampled farms	Number of positive farms	%
Østfold	84	11	13
Akershus	15	0	0
Hedmark	108	29	27
Oppland	4	1	25
Buskerud	8	2	25
Telemark	28	3	11
Vestfold	4	1	25
Aust-Agder	5	1	20
Vest-Agder	2	0	0
Rogaland	113	13	12
Hordaland	10	0	0
Møre og Romsdal	2	0	0
Sør-Trøndelag	72	17	24
Nord-Trøndelag	109	15	14
Total	**564**	**93**	**16.5**

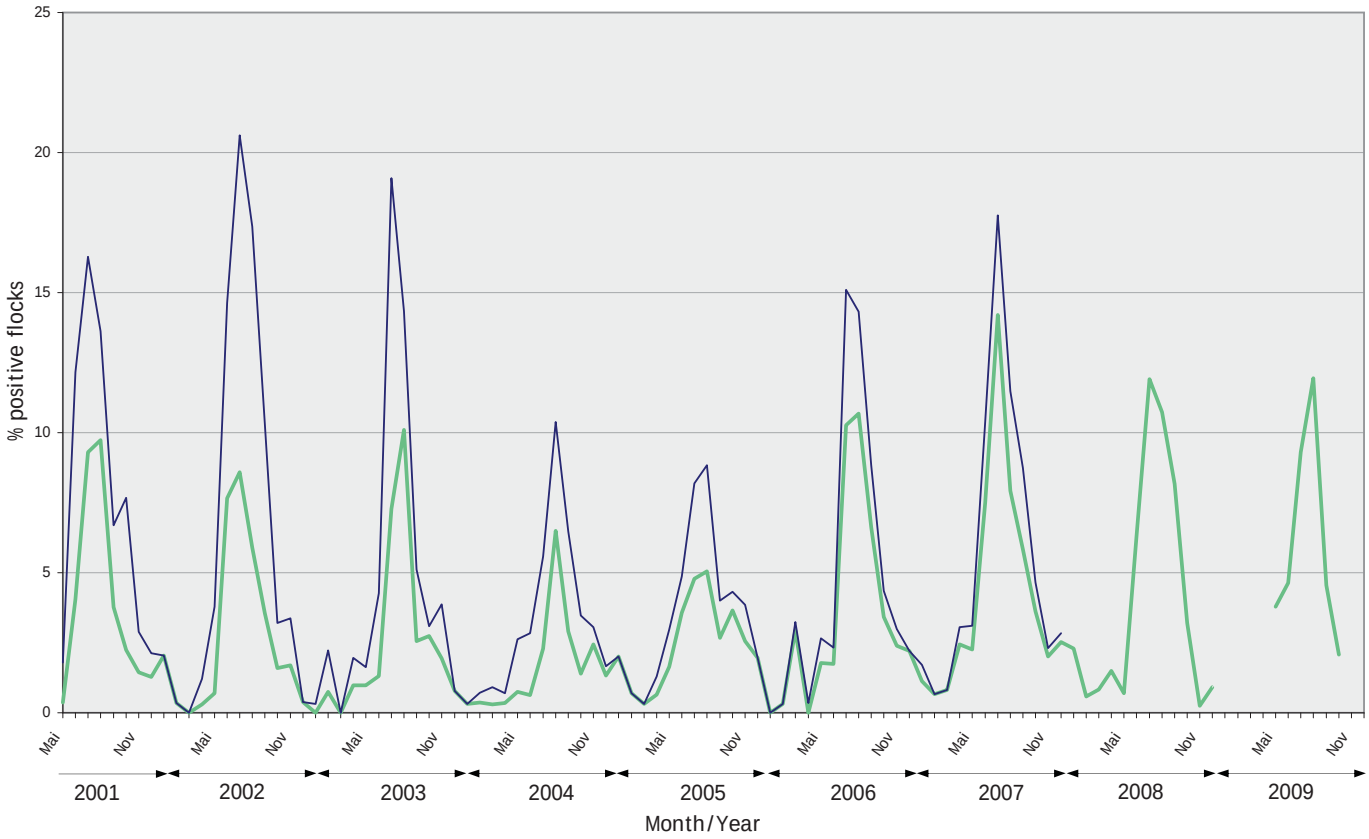

Figure 1. Monthly incidence of *Campylobacter* spp. in slaughtered Norwegian broiler flocks from May 2001 throughout 2009. The blue line represents flocks positive for *Campylobacter* spp. (up to and including 2007 these data are based on two samples; before slaughter and at slaughter). The green line represents flocks (from 2008 onwards samples) positive for *Campylobacter* spp. at the sampling at farm four days before slaughter. No sampling occurred for flocks slaughtered in January – April and November – December 2009.

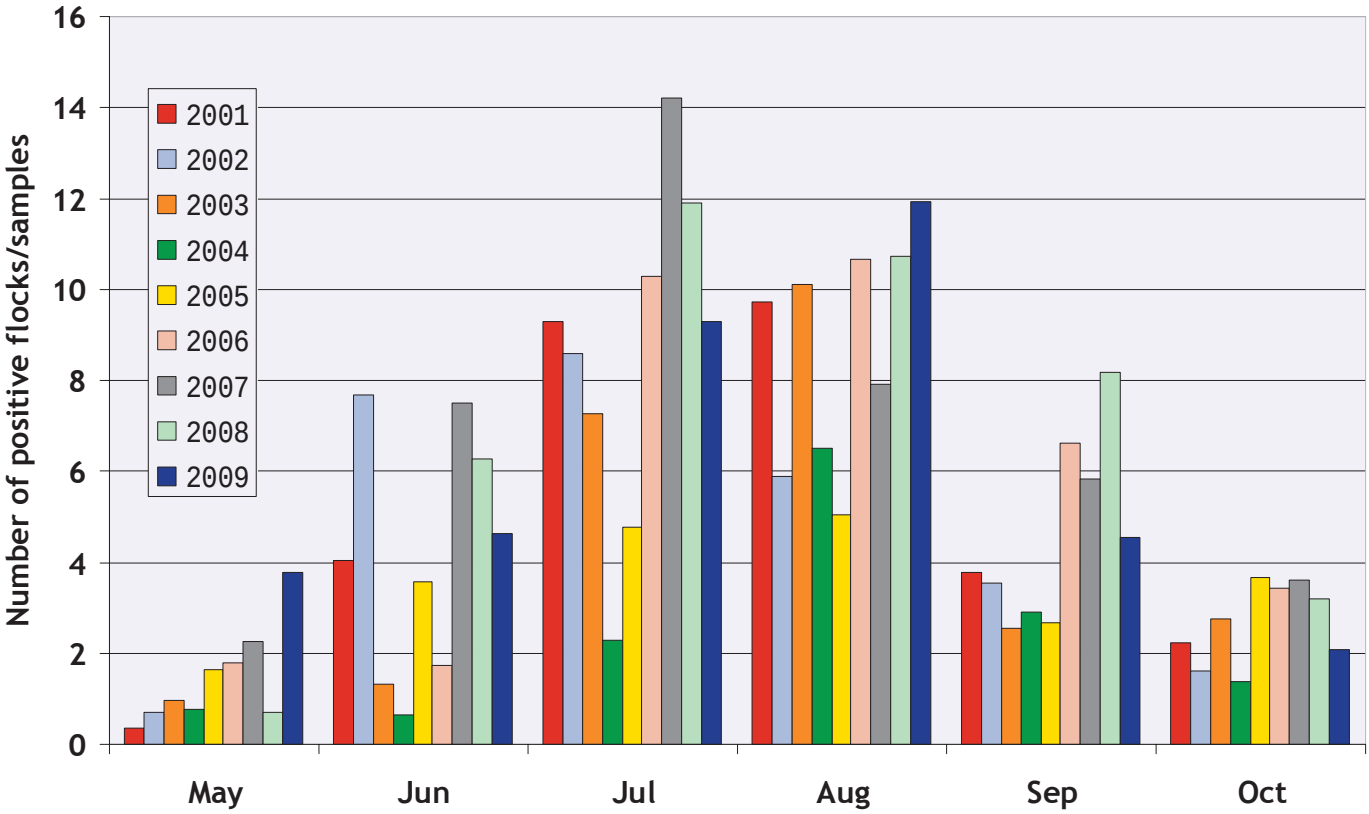

Figure 2. Number of flocks (in 2008 and 2009 number of samples) slaughtered May – October positive for *Campylobacter* spp. in the pre-slaughter sample. Up to and including 2004, this sample was taken approx. one week before slaughter, from 2005 onwards, approx. four days before slaughter.

Table 2. Results from the Action Plan against *Campylobacter* spp. in broilers in the period 2002 - 2007.

Year	Number of sampled flocks	Number (%) of positive flocks	Number of positive flocks discovered at slaughter only*
2002	3627	228 (6,3)	127
2003	3550	175 (4,9)	85
2004	3626	118 (3,3)	58
2005	3652	132 (3,6)	42
2006	3908	190 (4,9)	48
2007	4145	237 (5,7)	58

* This is the maximum number of flocks positive for Campylobacter spp. which had the possibility to reach the market without previous freezing or heat treatment.

Table 3. Estimated results from the Action Plan against *Campylobacter* spp. in broilers in the period 2008 - 2009.

Year	Number of samples*	Est. number (%) of positive flocks	Est. number of positive flocks discovered at slaughter only**
2008	4675	257 (5,5)	64
2009	4000	180 (4,5)	62

* Equals approximately number of slaughtered flocks. In 2009, this is an estimation for the whole year based upon number of salughtered flocks in the period May – October.
** This is the estimated maximum number of flocks positive for Campylobacter spp. which had the possibility to og out on the market without previous freezing or heat treatment.

Discussion

In the period 2002 – 2007, when all flocks were sampled twice, the results were as indicated in Table 2. Up to and including February 2005, t he pre-slaughter samples were taken approximately eight days before slaughter, and approximately 50% of the positive flocks were detected only at slaughter. From 1 March 2005 onwards, all flocks were sampled maximum four days before slaughter, and in 2005, 31.8% of the positive flocks were detected only at slaughter. In 2006 this was further reduced to 25.3%, and in 2007 the corresponding figure was 24.5%.

From 2008 onwards, the sampling at slaughter was terminated. Comparable data to evaluate the effect of the Action Plan, and to calculate how many flocks positive for *Campylobacter* spp. which were going on the market without freezing or heat treatment are therefore lacking. Still, if one anticipate that 2008 and 2009 were equal to 2007 in respect to the proportion of positive flocks being identified at the pre-slaughter sample, the seasonal distribution and that the number of samples equals the number of flocks, calculations can be made (Table 3):

- In 2008, when 193 pre-slaughter samples were positive, one can assume that a total of approximately 257 flocks were positive. The number of flocks becoming positive the last four days before slaughter, and thereby had the possibility to reach the market without heat treatment or freezing, can be estimated to 64.

- In 2009, when in May – October 1924 pre-slaughter samples were investigated, and 117 (6.1%) were positive, one can assume that approximately 4000 flocks were slaughtered in 2009, and that a total of approximately 180 flocks were positive. The number of flocks becoming positive the last four days before slaughter, and thereby had the possibility to reach the market without heat treatment or freezing, can be estimated to 62.

Regarding the flock prevalence, one can conclude that after some years with a positive development (2002 – 2005), the situation again got worse, but there seems to be some improvement again in 2009.

For the number of flocks positive for *Campylobacter* spp. reaching the market without freezing or heat treatment, improvement was seen 2002 – 2005, and thereafter a negative trend was seen 2006 - 2009.The positive development in the flock prevalence observed in 2009 is not mirrored in the number of flocks positive for *Campylobacter* spp. going untreated out on the market. This is due to the fact that no samples were taken during the six “winter months”, and positive flocks in that period therefore had no possibility of being detected and could as a consequence not be scheduled for heat treatment or freezing.

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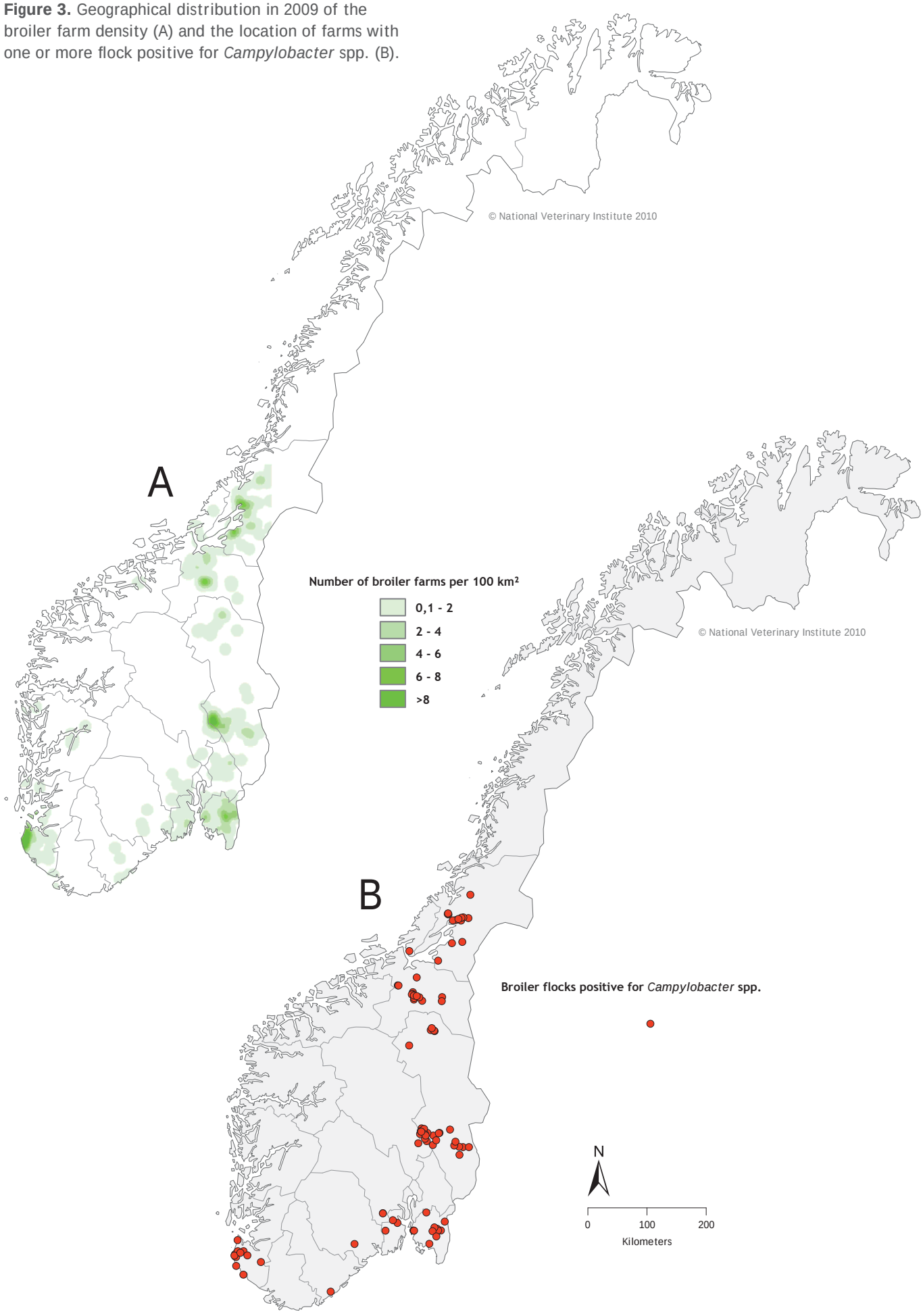
Figure 3. Geographical distribution in 2009 of the broiler farm density (A) and the location of farms with one or more flock positive for *Campylobacter* spp. (B).



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The National Veterinary Institute has its main laboratory in Oslo, with regional laboratories in Sandnes, Bergen, Trondheim, Harstad og Tromsø, with about 360 employees in total.

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