Discussion and Conclusion
Within-farm Salmonella seroprevalences were generally low in Finnish fattening pig farms. This reflects the favorable Salmonella situation of pig farms in Finland and is consistent with results from the Finnish National Salmonella Control Program. However, differences between farms were found, so serological monitoring could be used to direct preventive measures at the farms at risk, and to target microbiological sampling. When allocating farms to risk categories, the targets of the programme and corrective actions must be considered. The German and Danish serological sampling programmes are part of their reduction strategies, while Finland is applying an eradication policy. Consequently, the German and Danish categorizations are not directly applicable in the Finnish context. We piloted a modified allocation of farms (Table 3). In category 2, the farmer could be recommended to self-check the biosecurity measures using a specific checklist. If meat juice samples were used, approximately 10% of the farms would fall within this category in the current Finnish situation. Category 3 would indicate an elevated food safety risk, which could result in bacteriological sampling and a biosecurity check at the farm in question. Approximately 2% of farms would fall into this Category 3 in the current Finnish situation. The eradication decision cannot be based only on highly sensitive serological monitoring, because the cost of Salmonella eradication is very high on pig farms (Finnish Food Safety Authority Evira, 2018). In the Finnish context, subsequent procedures for eradicating the pathogen from a farm would follow whenever Salmonella spp. is isolated from animals at the farm. This modified categorization system is only an example, and it would need to be adjusted and optimized after additional data collection. Serological Salmonella monitoring would provide us with large-scale farm-level data which would enable us to follow farm-level trends and detect changes readily and sensitively. However, in Finland this would have only a limited positive impact on food safety, because the current situation is already excellent. Therefore, a cost-benefit analysis should be conducted before applying the method in practice.

References
EFSA (2011): Scientific opinion on the public health hazards to be covered by inspection of meat (swine). The EFSA J., 9, 2351.

Table 3: Serological results from Finnish fattening pig farms allocated according to modified categories using a cut-off value of 0.004

<table>
<thead>
<tr>
<th>Risk category</th>
<th>Meat juice samples (259 farms)</th>
<th>Serum samples (57 farms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1, Negligible, within-farm seroprevalence &lt;20%</td>
<td>88.4% of farms</td>
<td>75.4% of farms</td>
</tr>
<tr>
<td>Category 2, Low, within-farm seroprevalence 20-40%</td>
<td>9.7% of farms</td>
<td>22.8% of farms</td>
</tr>
<tr>
<td>Category 3, Medium/High, within-farm seroprevalence &gt;40%</td>
<td>1.9% of farms</td>
<td>1.8% of farms</td>
</tr>
</tbody>
</table>

P7
Ecology of Salmonella and antimicrobial resistance in a pig slaughterhouse
Bridier A.1, Soumet C.1, Le Grandis P.1, Moreau M.-H.1, Le Roux A.1, Feurer C.2
1ANSES, Antibiotics, Biocides, Residues and Resistance Unit, Fougères, France, 2EFSA-Pig and Pork Institute, Fresh and Processed Meat, Le Rheu, France

Introduction
Salmonella is responsible for a large number of food associated infections. To guarantee food safety, a better understanding of Salmonella ecology and adaptation strategies on the food production chain constitutes a prerequisite. In a One Health perspective, data on Salmonella antibiotic resistance in food environments are also crucial to decipher transmission routes of resistant foodborne pathogens as well as resistance genetic determinants involved, and the role of process and selection pressures underwent in food industries (as cleaning and disinfection) in bacterial adaptation and antimicrobial resistance emergence.

Methods
Occurrence of Salmonella was investigated at six different areas along a pig slaughter chain and through 4 sampling campaigns, each time before and after cleaning and disinfection (C&D) procedures. A total of 48 surface samples were collected. Salmonella strains were characterized using serotyping and pulsotyping to trace persistent strains in the slaughterhouse. Minimal inhibitory concentrations (MIC) were also determined for various relevant antibiotics and for biocides used in the slaughterhouse. In addition, associated indigenous bacterial communities were characterized using 16S rRNA amplicon sequencing.

Results
Salmonella was present at nearly all sampling areas but was not isolated from the neck clipper. Thirty eight strains were isolated and five serotypes were identified: 5,4,12:i:- (50%), Rissen (16%), Typhimurium (16%), Infantis (10%) and Derby (8%). We observed a high prevalence of the monophasic variant of the serotype Typhimurium in the slaughterhouse. Sixteen PFGE types were identified among the 38 strains (Table 1). Some strains were found at different dates and potentially at the same sampling area suggesting that they persisted in the slaughterhouse despite of C&D procedures (data not shown).

Approximately 70% of isolated Salmonella strains exhibited resistance to ampicillin and sulfamethoxazole, 80% to tetracycline and 30% to chloramphenicol. There was statistically no significant evolution of CMI comparing strains before and after C&D procedures concerning both biocides and antibiotics (Figure 1).

Bacterial diversity analyses showed that populations in the slaughterhouse were highly dominated by y-proteobacteria and especially by the Moraxellaceae family (genus Psychrobacter, Moraxella, Enhydrobacter and Acinetobacter) at the different sampling areas (data not shown). Population compositions were overall stable in time at a given sampling area suggesting that the surface populations were resident populations within the slaughterhouse, rather than populations introduced each week by the new swine batches. C&D procedures tended to reduce bacterial diversity by eliminating the minority species but did not greatly impact the composition of dominant species.

Conclusions
Cleaning and disinfection procedures applied in this slaughterhouse did not appear to affect the biocides and antibiotics resistance of isolated Salmonella strains. Microbial flora diversity analyses showed that populations were resident with persistent Salmonella strains isolated at the same sites over time. Together, such data participate to the construction of a comprehensive view of Salmonella ecology in food environments integrating associated resident microbial flora and the distribution of antimicrobial resistance in relation to processing conditions.

Table 1: Serotype and PFGE-type diversity among the 38 isolated Salmonella strains

<table>
<thead>
<tr>
<th>Serotype (–)</th>
<th>4,5,12:i:-</th>
<th>Typhimurium</th>
<th>Rissen (16%)</th>
<th>Infantis (10%)</th>
<th>Derby (8%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFGE-type</td>
<td>B01, B02, B03, B04, B05, B06, B09, B13, B16</td>
<td>B09</td>
<td>B10, B11, B12</td>
<td>B08, B13, B14</td>
<td></td>
</tr>
</tbody>
</table>
The Zoonoses Monitoring is a joint programme run by the Federal Government and the Länder (Germany’s states) to raise and assess representative data on the occurrence of zoonotic agents and related antimicrobials resistance in food, feed, and live animals. Programme results are published annually by the Federal Office of Consumer Protection and Food Safety (BVL) in its Food Safety Reports. Zoonoses Monitoring is legally founded on the “General Administrative Provisions concerning zoonoses in the food chain” (AVV Zoonosen Lebensmittelkette), which in turn are based on Directive 2003/99/EC on the monitoring of zoonoses and zoonotic agents.

This contribution presents the major findings of tests for Salmonella spp. carried out along the pork food chain in the framework of the Zoonoses Monitoring programmes of the years 2009 to 2017. The test results show that fattening pigs frequently carry Salmonella spp. - about 8% to 9% of the faecal samples were Salmonella-positive - but detection rates continuously decline along the food chain. Pig carcasses were contaminated with Salmonella in about 3% to 4% of samples, while the contamination rate in fresh pork meat was 0.4% to 1.4%. Contamination rates in minced meat ranged between 0.7% and 5%. A trend analysis shows that Salmonella prevalence in pigs has remained roughly the same over the past few years, while it has declined in pig carcasses, fresh meat, and in particular in minced meat. This indicates that slaughter hygiene has improved, given the fact that the input by Salmonella-positive pigs has been the same. The Salmonella detection rate in pigs from farms categorised as category-I (best serological Salmonella status) under the Regulations to control the spread of Salmonella through slaughter pigs (“Schweine-Salmonellen-Verordnung”) was much lower than in pigs from category-III farms (worst serological Salmonella status) (5.7% in category-I-farm pigs versus 20 to 30% in category-III-farm pigs).

So, the monitoring findings support the fact that the serological categorisation of fattening farms pursuant to the above Salmonella control regulations has a correlation with the bacteriological findings in pigs from these farms. At the same time they show that pigs from category-I farms, too, bring about a risk of contamination of the meat during the slaughter process. The findings in breeding sows and young pigs show that colonisation of the animals with Salmonella starts at the level of piglet farms (5.6% positive faecal samples in breeding sows, 10.3% positive faecal samples in young pigs) and highlight the importance of Salmonella control in breeding farms, to the end of preventing introduction of Salmonella in fattening farms through infected piglets. The monitoring programme results show that there are clear differences in the prevalence of Salmonella at the various levels of the pork food chain. Tests at the different stages of production allow tracing the paths of transmission of pathogens along the food chain. Continuous testing over years allow recognising trends and developments in the prevalence of pathogens in live animals and foodstuffs.