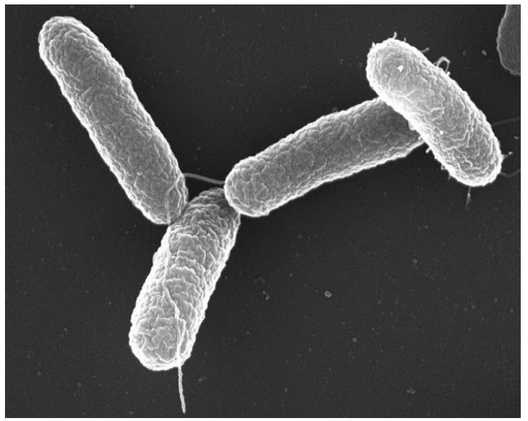
Recent incursion of *Salmonella* Enteritidis affecting humans, animals and poultry

Jo Kingsbury, Kerushini Govender
Sarah Jefferies, Shevaun Paine, Jackie Wright, Joanne Thomas and Kate Thomas

joanne.kingsbury@esr.cri.nz
kerushini.govender@mpi.govt.nz

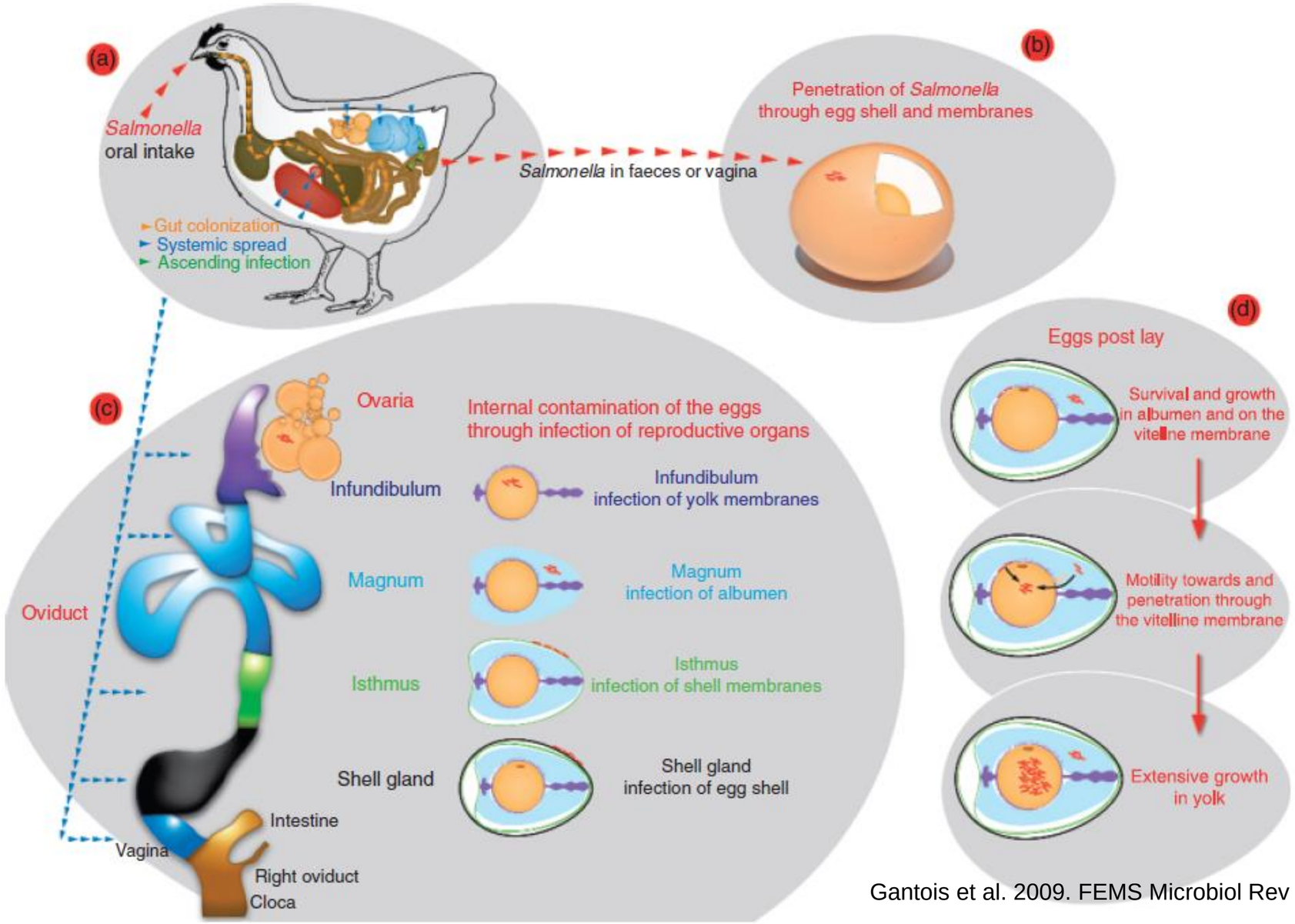
Why are we concerned with SE in poultry?



- *Salmonella* causes serious disease in humans. Salmonellosis characterized by diarrhoea, stomach cramping, vomiting; which may require hospitalisation; young, elderly, immunocompromised at greatest risk.
- *S*. Enteritidis (SE) is the second-most notified serotype from cases in NZ (10-12% of cases); historically ~50% cases were travel-associated.
- SE is dominant serotype in America and Europe; contaminated eggs and poultry meat are the main sources of foodborne SE.

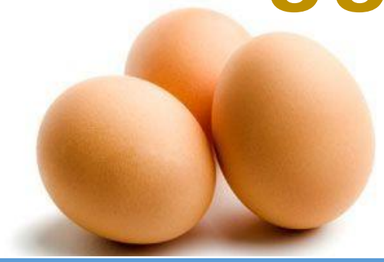
Salmonella contamination of eggs

- Occurs from contaminated eggshells or contents.
  - All serotypes
- Can enter eggs by:
  - Trans-shell transmission during or post-laying.
    - All serotypes
  - Trans-ovarian transmission colonising chicken ovaries, contaminating eggs prior to shell formation.
    - Only *S*. Enteritidis (e.g. PT8)



Gantois et al. 2009. FEMS Microbiol Rev

SE risk from eggs and meat



	Eggs	Chicken meat
On-farm controls	• Some vaccination, biosecurity	• Biosecurity
Processing controls	• Must be visibly clean with no cracks • Some egg washing • Minimal pasteurisation	• Heat treatment, chlorine and ASC washes
Storage	• Refrigerated or room temperature	• Refrigerated or frozen
Food handling and preparation	• Cross-contamination from egg contents or shell • **Often consumed raw (e.g. cake batter, mayonnaise, aioli) or under-cooked (runny eggs)**	• Cross-contamination of uncooked product • Undercooked product

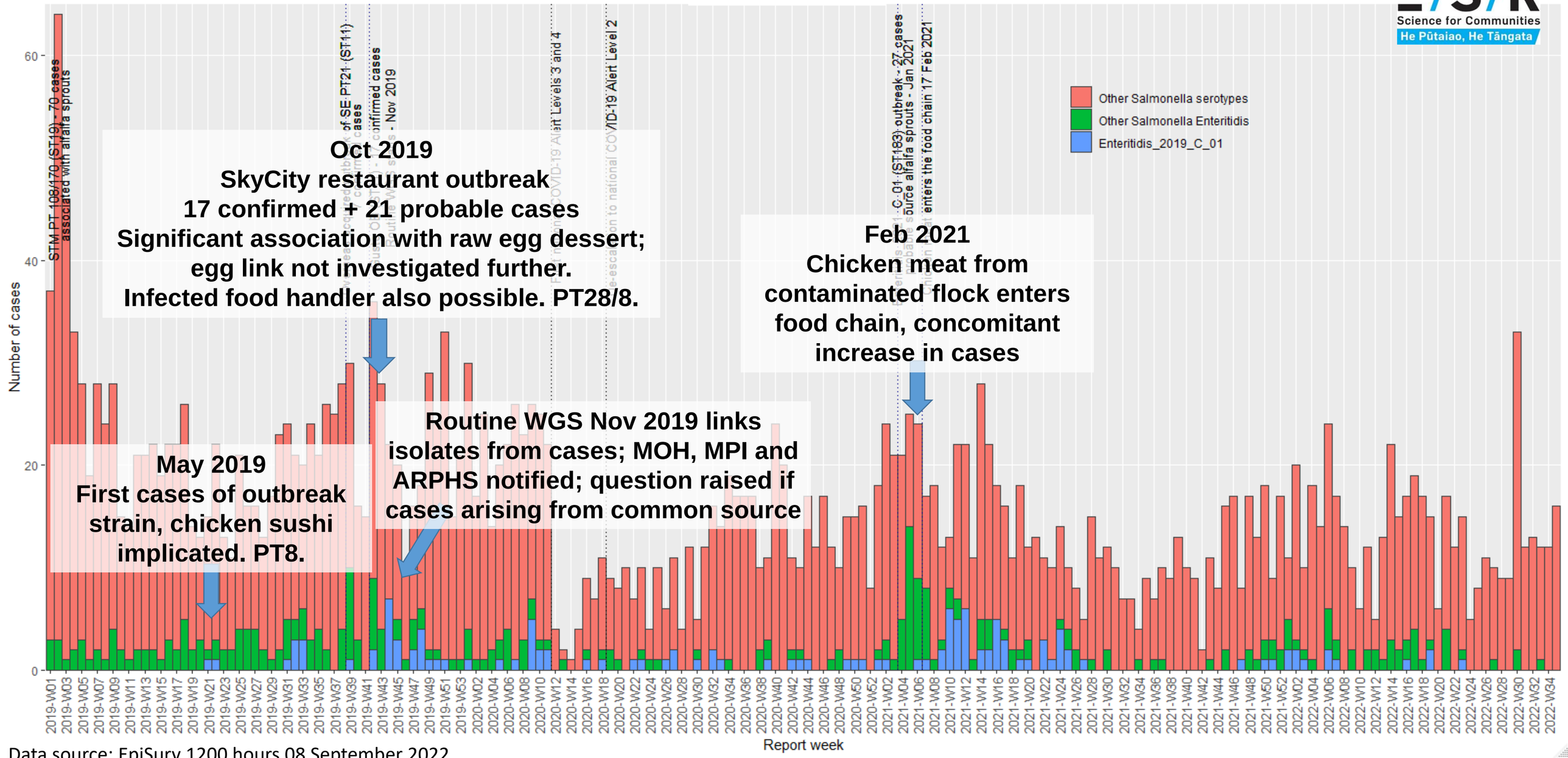
No evidence of SE in NZ poultry industry pre-2019

- SE not detected in the NZ poultry prior to 2019 but no nationally representative surveillance data of farm environments being conducted. Some detection in other animals. (Rivas & King. 2016. Risk Profile).
  - **Egg layer farms**: some environmental testing done on some farms, 2016 MPI/ESR survey of 28 NZ egg layer farms and packhouses detected other *Salmonella* serotypes; no SE (Kingsbury et al. 2019. JFP).
  - **Broiler chickens**: testing of carcass rinsates following primary processing (NMD: 1 carcass per processing day; 0-0.09% *Salmonella* prevalence since 2015).
- Low incidence of egg-associated salmonellosis, no epidemiological association with SE due to egg consumption or poultry meat in NZ.
- However, egg-associated salmonellosis increasing in Australia in recent years; SE outbreak on layer farms in 2018-2019.

First detection of SE in NZ poultry: broiler chicken following processing

- ESR Enteric Reference Laboratory: national reference and surveillance laboratory services for human, animal and environmental *Salmonella* isolates.
- **17 February 2021:** Broiler carcass sampled during routine NMD sampling.
- **24 February 2021:** *Salmonella* isolated by reporting lab; received by ESR for further typing.
- **25 February 2021:** ESR informed reporting lab that isolate was SE; reported in NMD database **3 March 2021.**
- **19 March 2021:** ESR alerted referring lab, producer, following WGS (as requested by producer), the isolate formed a close genomic cluster with ongoing cluster of human cases. ESR requested that MPI be informed. ST11, implicated in egg-associated outbreaks internationally.
- To better understand risk to poultry, MPI requested phage typing of recent SE isolates: PT8.
- Historical investigation: MPI requested WGS of historical PT8 isolates (seen infrequently).

Historical cases: National notifications of salmonellosis, SE and SE_2019_C_01 2019-2022



Data source: EpiSurv 1200 hours 08 September 2022

Outbreak case numbers and hospitalisations

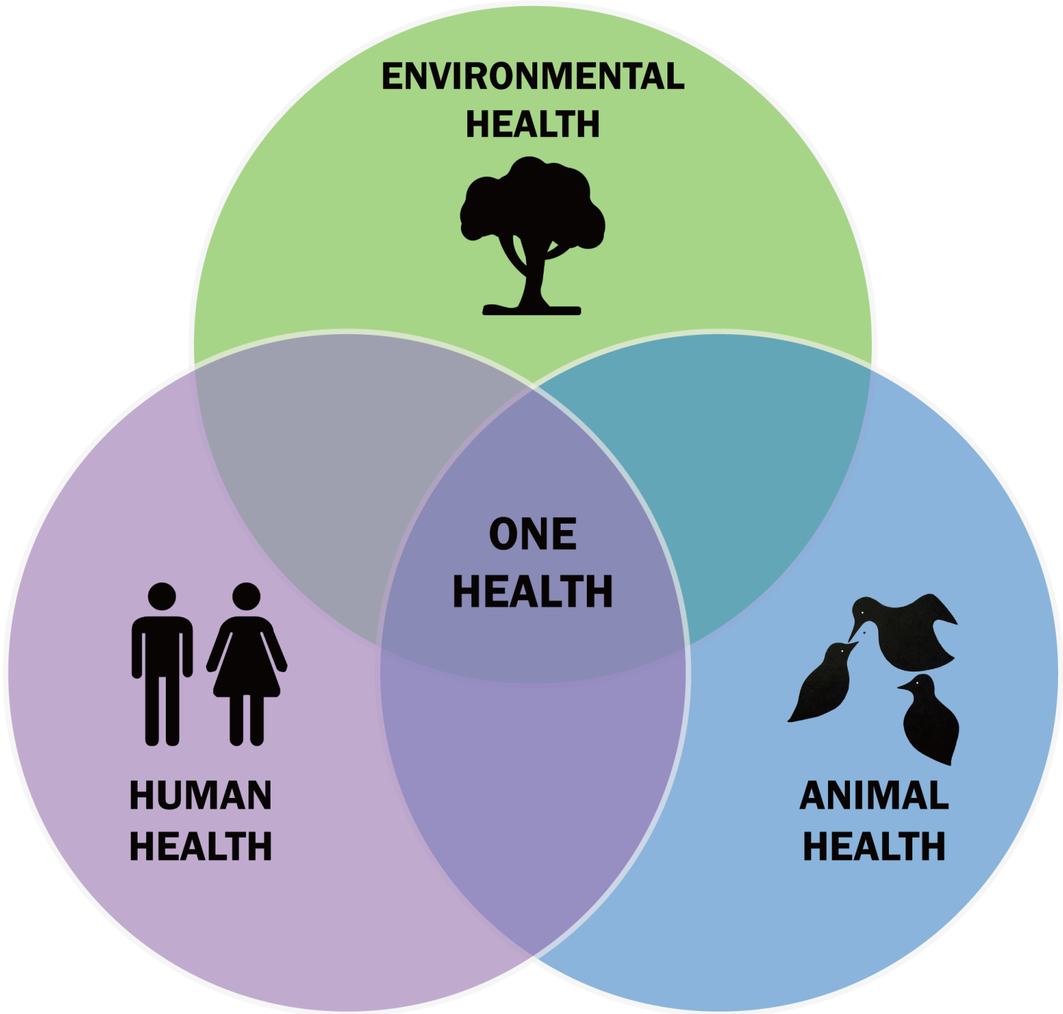
- 124 confirmed outbreak cases (person notified in NZ with SE genomic cluster profile Enteritidis_2019_C_01); 6 additional cases epidemiologically linked.
- 37% of cases hospitalised; higher than for all salmonellosis cases (27%) or total S. Enteritidis cases (28%) over same time period.
- Most recent case: 7 May 2022.
- Eggs and poultry meat are the primary, most likely source of the outbreak based on:
  - Epidemiological investigations and case demographics.
  - Genetic linkage between poultry and human isolates.
  - Outbreak strain later detected from farm that supplied eggs to restaurant involved in 2019 outbreak associated with raw egg dessert.
  - Increase in human cases following NMD-positive raw product distribution for consumption.
  - Outbreak strain is *possibly* transovarian (based on phage type).

S. Jefferies, S. Paine, C. Gilkison, J. Wright. Salmonella Enteritidis (Cluster: Enteritidis_2019_C_01) outbreak intelligence update. Report 13, 2021, ESR.

MPI response: a One Health approach

- In response to the increased human and poultry operator cases, and potential transovarian strain, an MPI investigation was launched (**19 March 2021).**

- Reducing human infections requires the reduction of *Salmonella* in animals and limiting transmission from the environment: One Health approach



MPI SE (2019_C_01) response

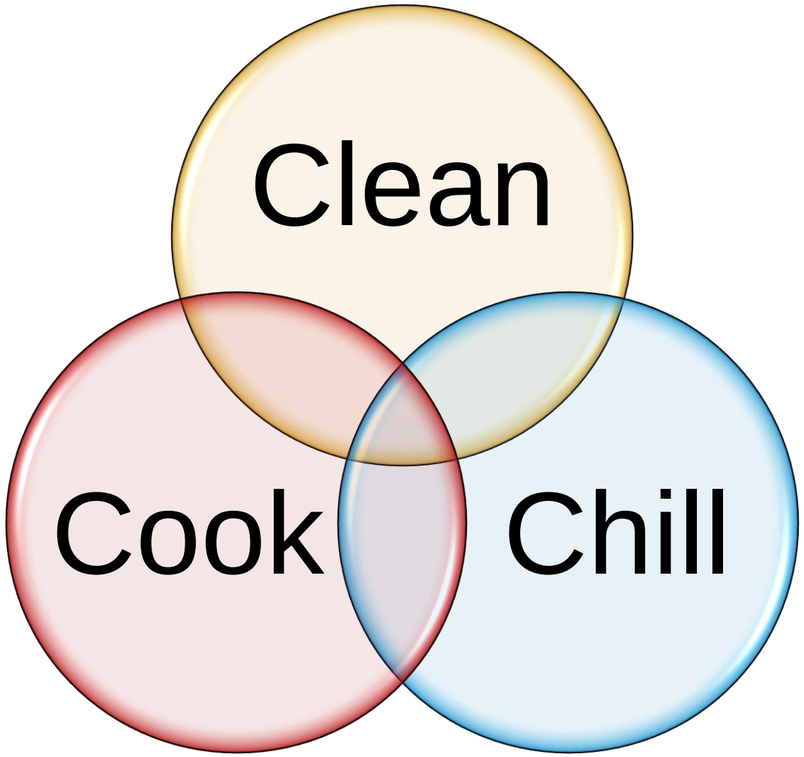
Participants

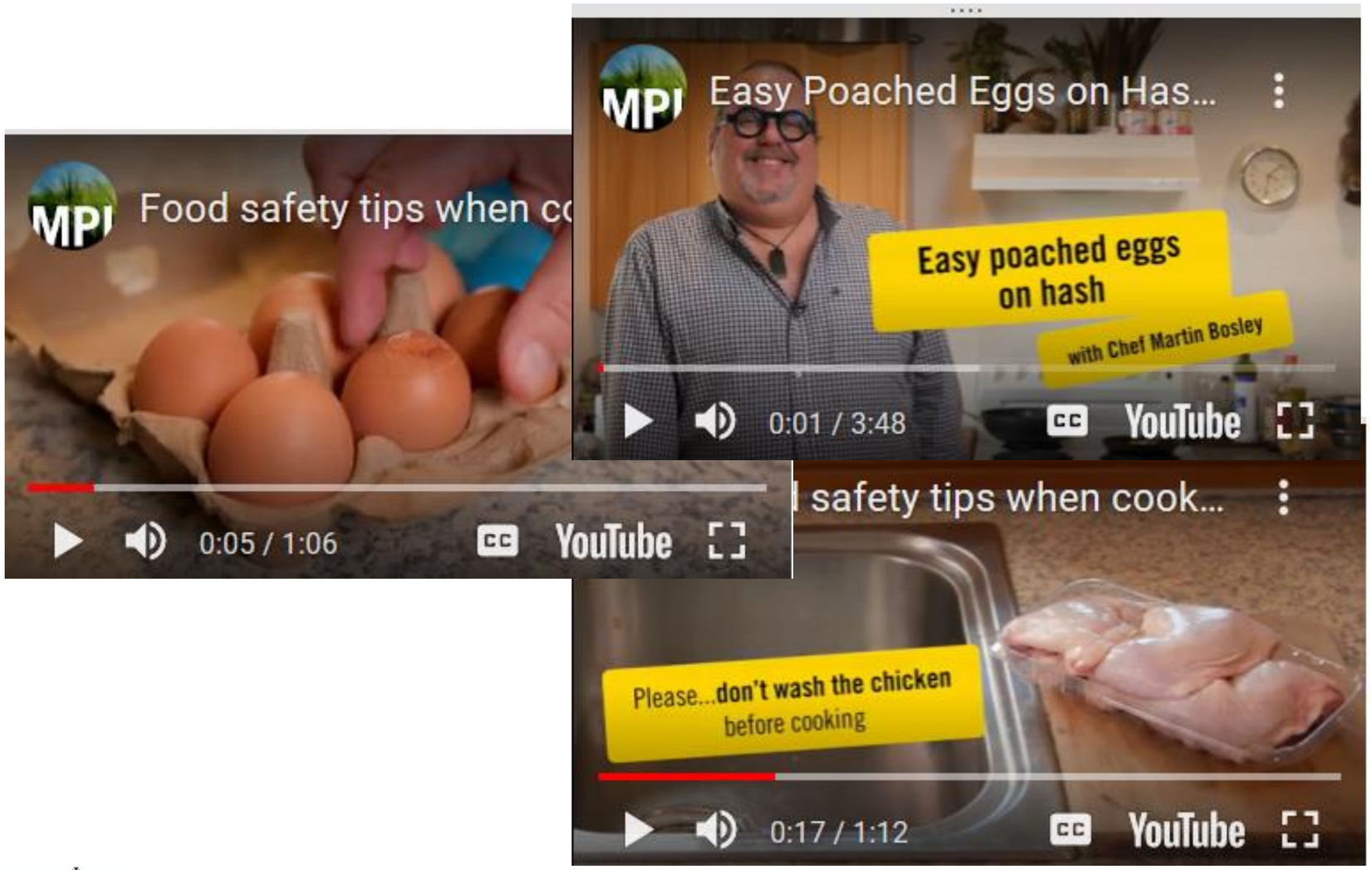
- MPI
  - NZ Food Safety
  - Biosecurity NZ
  - Agriculture & Investment Services
- Ministry of Health
- ESR
- NZ Food Safety Science and Research Centre
- Poultry Industry Association of NZ
- Egg Producers Federation

Activities

- Epidemiological investigations
- Forward and backward tracing
- Targeted sampling and testing
- Delimiting surveillance
- OMAR (Overseas Market Access Requirements) negotiations
- Animal export requirements
- Food safety messaging - 3C’s
- eCS (emergency Control Scheme)

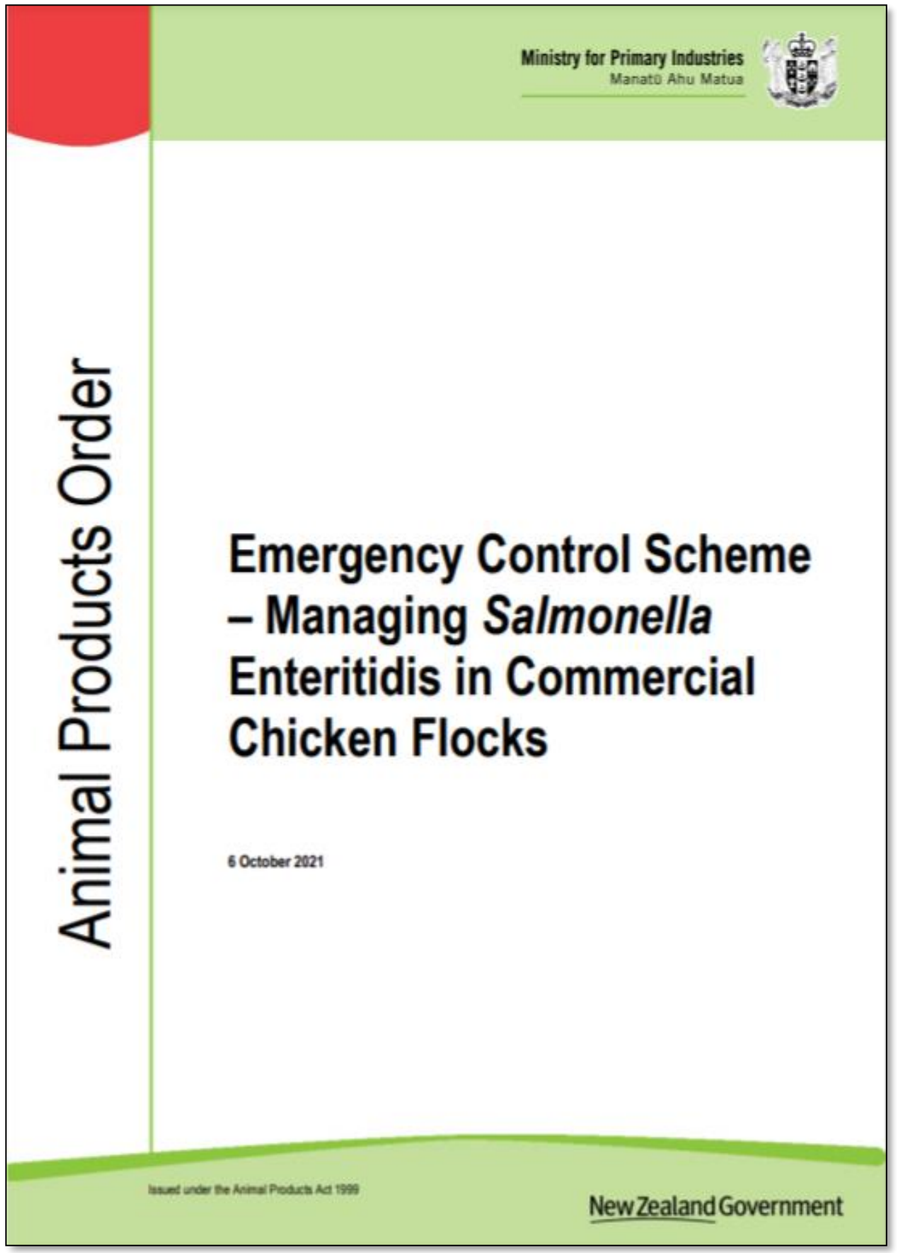
Food safety messaging – 3 C’s





Emergency Control Scheme

- Animal Products Act 1999
- All poultry operators (breeders, hatcheries, rearers, egg laying farms, broiler farms and processors of chicken meat and eggs)
- Integrated approach to SE control:
  - SE sampling regimen
  - Laboratory testing
  - Biosecurity
  - Vaccination
  - Flock and product disposition
  - Cleaning and sanitation



eCS to RMP (Risk Management Programme)

- More permanent framework to manage SE risks
- All commercial chicken producers and primary processors

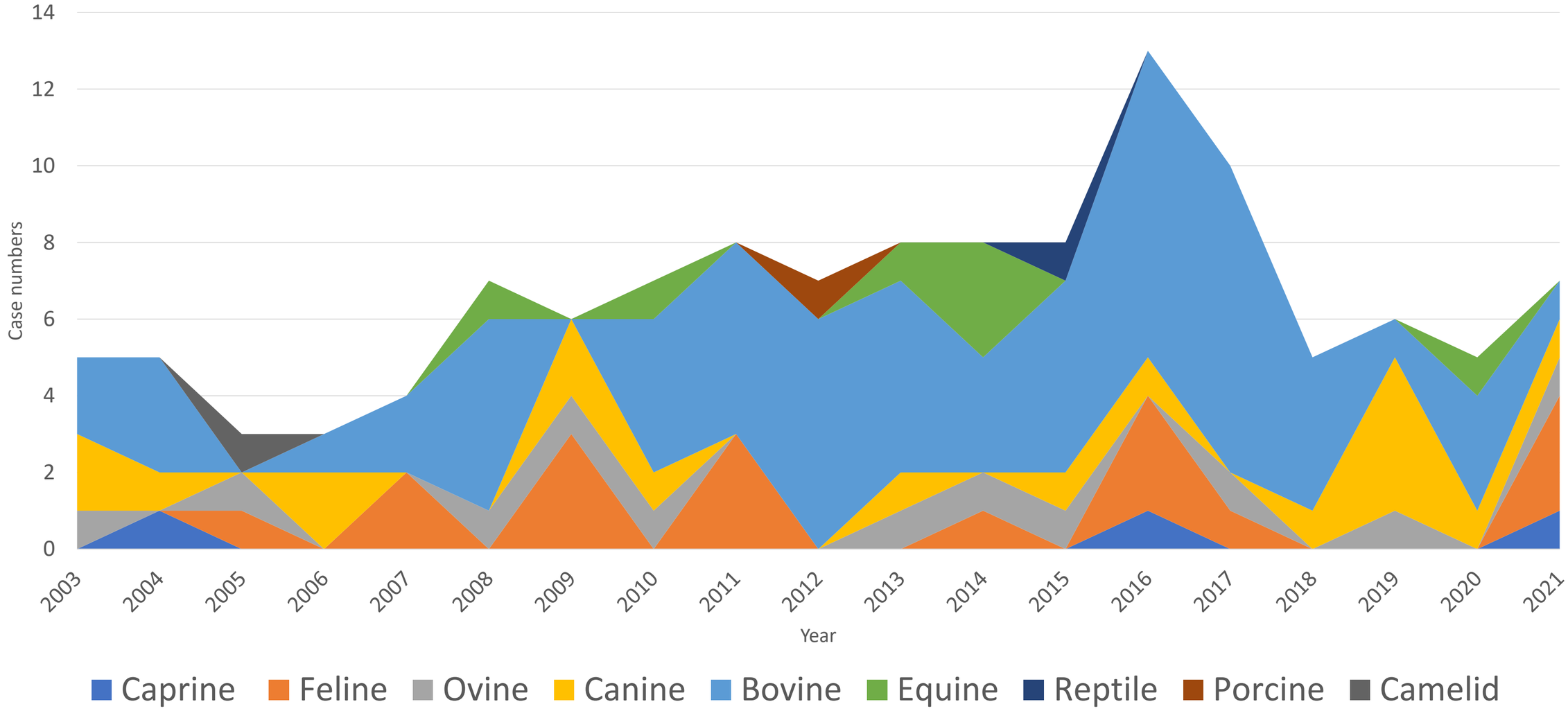
Salmonellosis in poultry (chickens)

- Reservoirs, carrier status, subclinical
- Adult chickens - dependant on strain
  - Slight drop in egg production
  - Mild diarrhoea
- Chicks under 1 week:
  - Pasty vents, depression, ruffled feathers, increased mortality
- Shed SE in faeces intermittently and feather dust

Salmonellosis in animals

- Carrier state is most common
- Young, old or immunocompromised animals – exposed to high infectious dose
- Companion animals - linked to feeding raw meat diets or un- or undercooked eggs
- Clinical disease:
  - systemic septicaemia
  - enteritis – diarrhoea
  - less common clinical presentations include abortion, arthritis, respiratory disease, necrosis of extremities, and meningitis.

NZ animal SE cases



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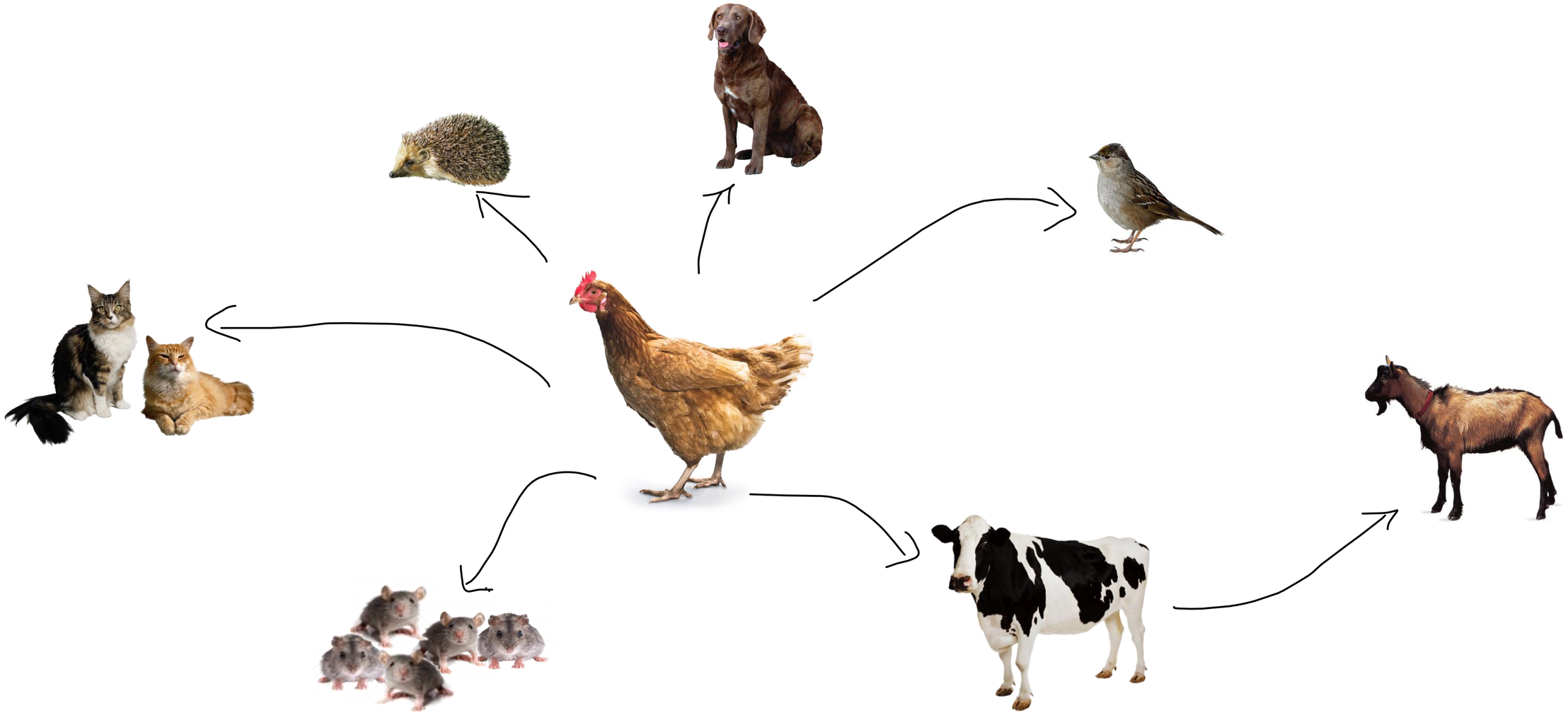
Data source: ESR, Enteric reference laboratory, Non-human salmonella isolates (https://surv.esr.cri.nz/enteric_reference/nonhuman_salmonella.php), Jon Watts (MPI, DSS) – Animal health surveillance data

SE outbreak animal cases - 2021



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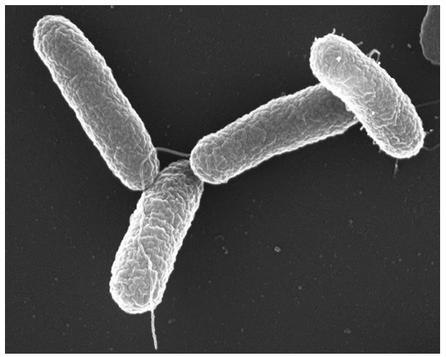
Final thoughts/knowledge gaps

- **Was the transmission to humans from chicken meat or eggs?** Epidemiological evidence for both; outbreak strain not been identified in food consumed by sick cases, but no testing performed.
- **Is the strain transovarian?** Has not been detected in egg contents or in reproductive tract of colonised chickens; testing was performed; would require testing large number of eggs.
- **When did the strain arrive in NZ?** Ancestral dating indicated that the SE incursion likely occurred just before the first human case in 2019 (ESR/NZFSSRC).
- **Where did the strain come from?** A global comparison of SE ST11 genomes supported that the strain was most likely from Europe (ESR/NZFSSRC).



From veterinary and public health perspectives, a collective approach from government agencies, multidisciplinary scientists and industry was paramount to the management of SE and mitigation of human and animal health risks.

Acknowledgements

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- MOH (Tom Kiedrzynski, James Greenwell, Karen Beirne, Harriette Carr)
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- PHUs
- PIANZ/EPF

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