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# Overview of *Salmonella* Enteritidis in Canada

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**Canadian *Salmonella* Enteritidis Control Workshop  
December 1, 2010**

# Outline

- National surveillance programs in Canada
- National trends of human *Salmonella* Enteritidis
  - Case numbers and rates
  - Phage types
  - Outbreaks and Exposures
  - Antimicrobial resistance
- *Salmonella* Enteritidis in exposure sources from integrated surveillance programs
- Summary and Conclusion

# Surveillance Programs in Canada

- **NESP** - National Enteric Surveillance Program
  - Weekly lab-confirmed reports of enteric illness (includes sporadic, outbreak and travel related cases) from provincial public health laboratories.
- **NML** - National Microbiology Laboratory
  - PFGE data via PulseNet Canada and human phage type data –national database of provincial isolates
- **C-EnterNet** (2005-2010)
  - Monitors trends in human enteric disease and in levels of pathogen exposure from retail meats, agriculture, and water sources from sentinel sites
- **CIPARS** - Canadian Integrated Program for Antimicrobial Resistance Surveillance (2003-2010)
  - Monitors trends in antimicrobial use and antimicrobial resistance in bacteria from human and agri-food sectors nationally

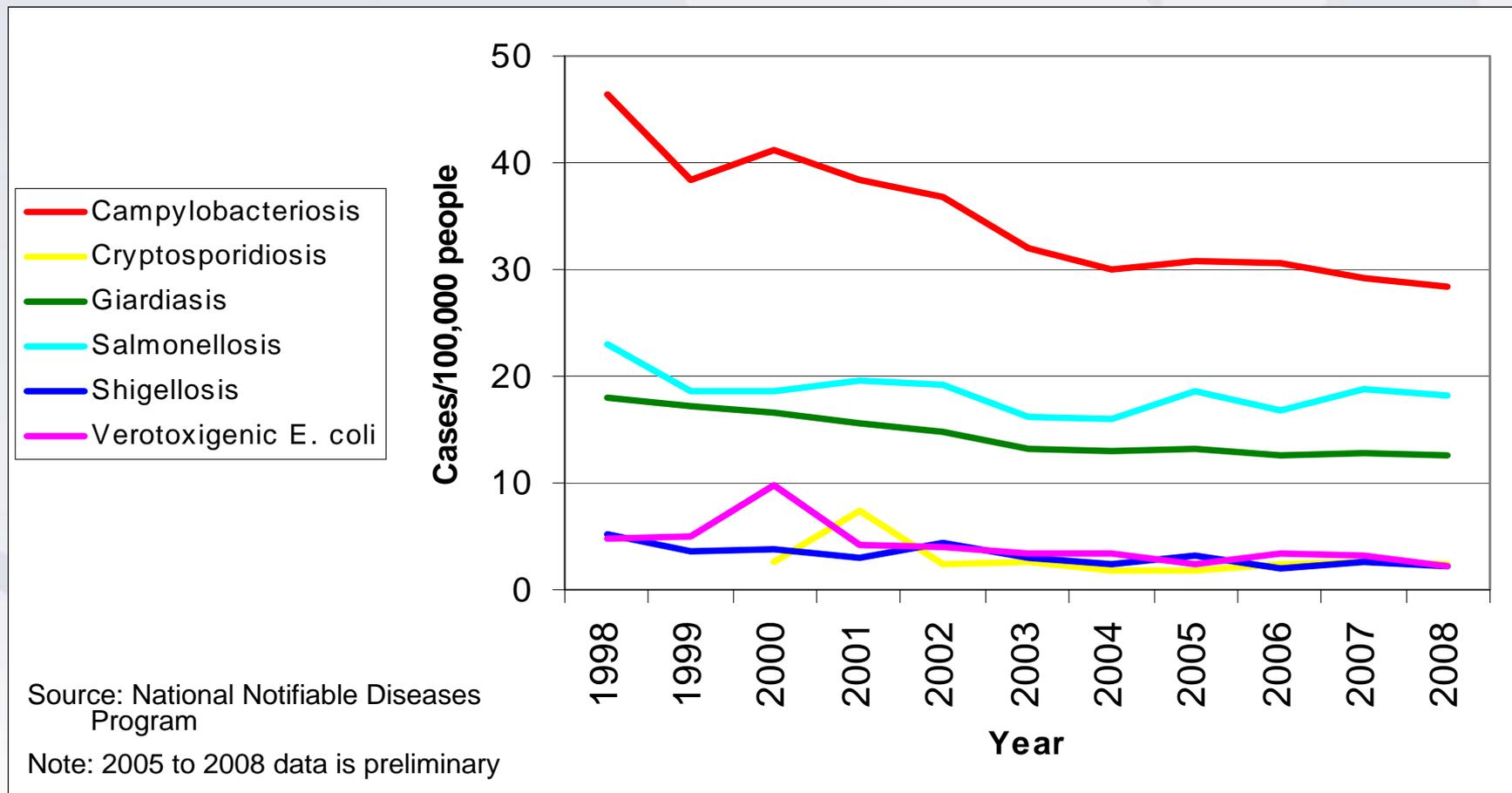
# Laboratory diagnosis and subtyping of human Salmonellosis

- **Pathogen species** - National Notifiable Disease Program – all Provincial/Territorial Public Health authorities
- **Serotyping** – NESP – all Provincial/Territorial laboratories
- **PFGE** – Some Provincial labs and NML (PulseNet Canada)
- **Phage typing** – NML (C-EnterNet, CIPARS)
- Discriminatory power of genetic typing (ie. phage type and PFGE) is limited
- **Antimicrobial resistance (AMR)** – NML (CIPARS)

# *Salmonella* in Canada

- *Salmonella* is the second leading foodborne illness pathogen in Canada, behind *Campylobacter*, with approximately 5000-6000 cases reported each year.
- **Nationally**, the number of *Salmonella* cases reported per 100,000 people has remained relatively stable over the past ten years.
- However, **provincially** there has been some variability with some provinces showing an increase, notably MB, SK and BC.

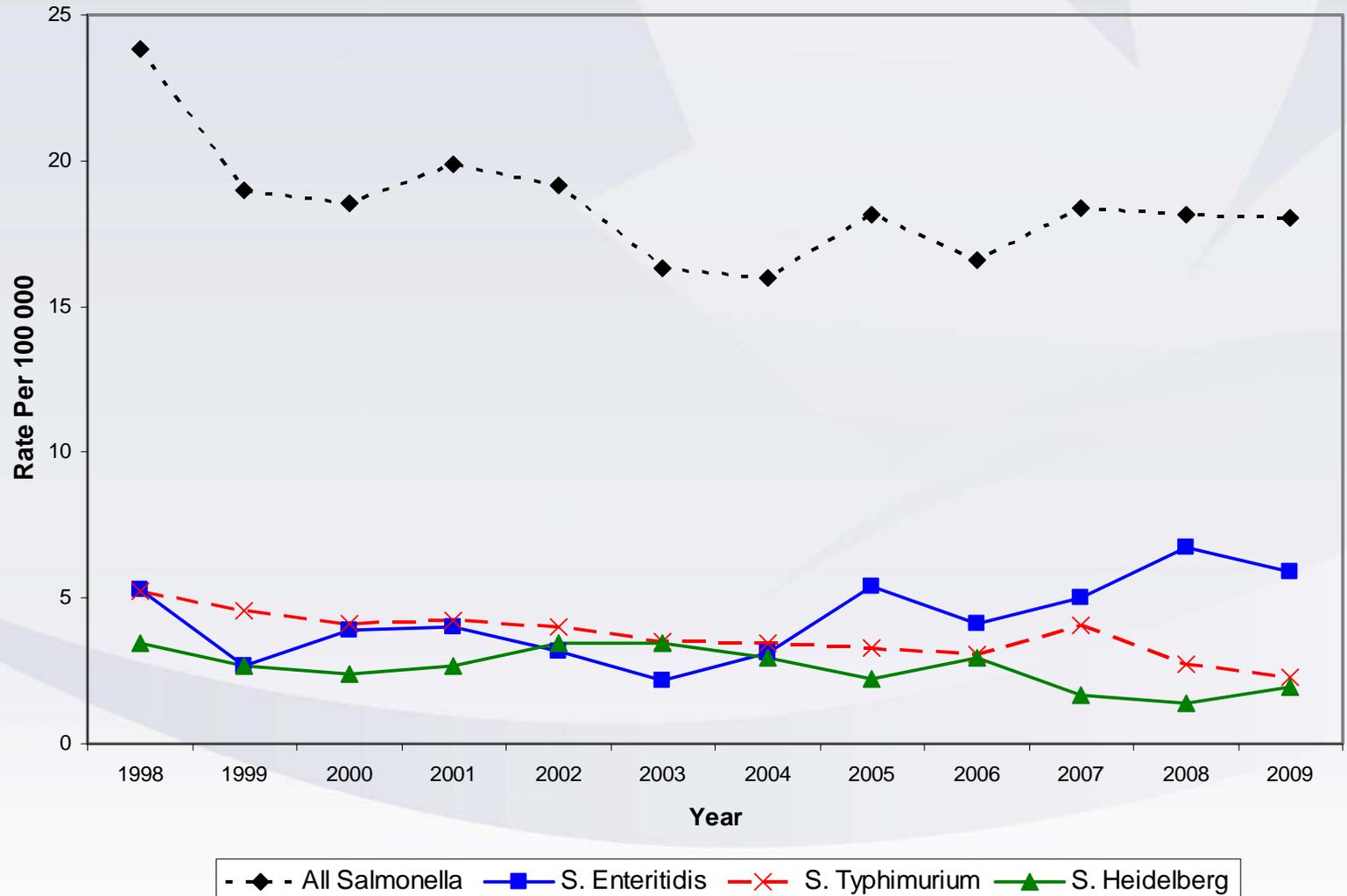
# Leading Pathogens in Canada Resulting in Foodborne Illness (NND)



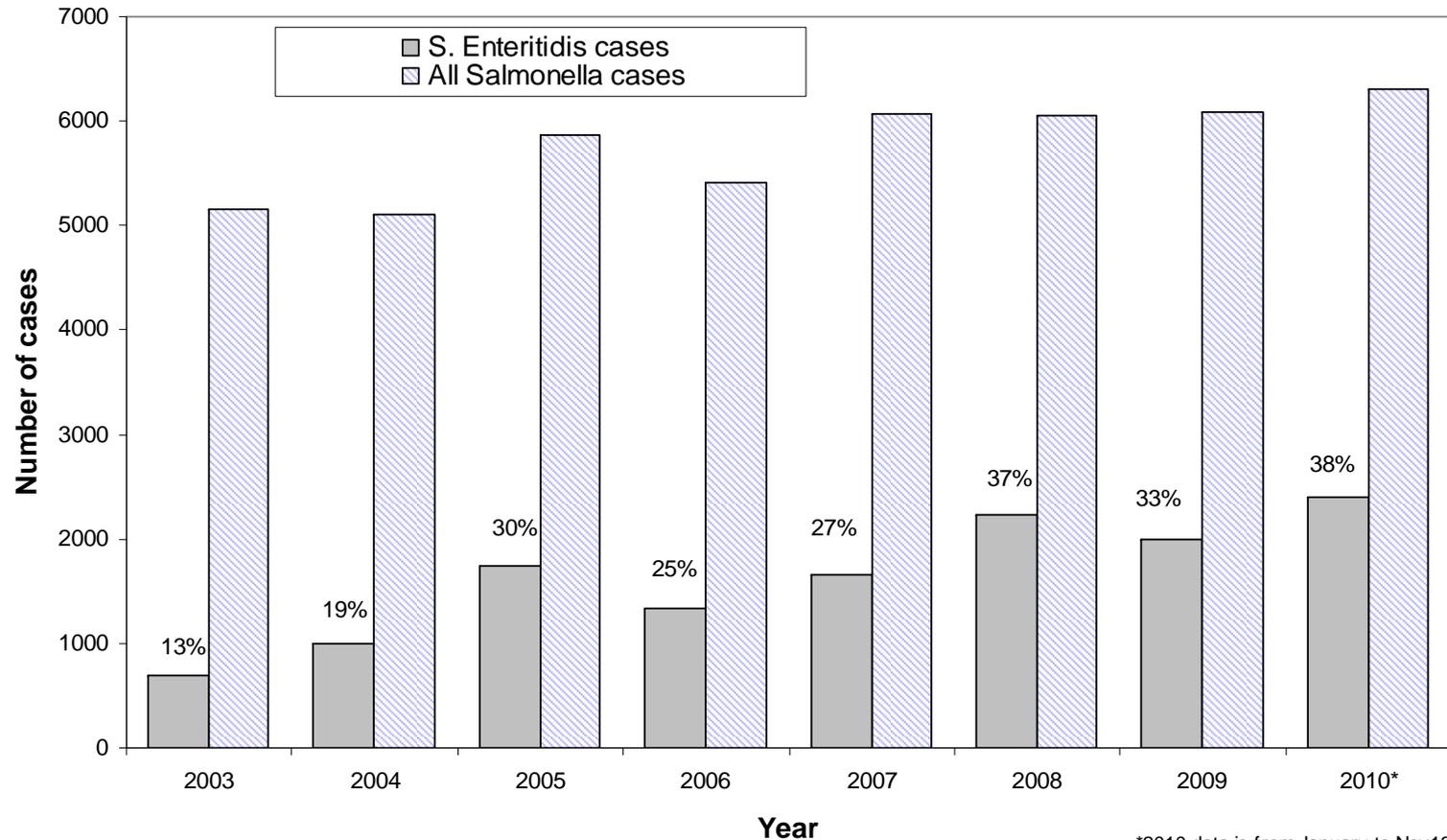
# S. Enteritidis

- According to NESP, the number of *S. Enteritidis* cases have increased since 2005, making it the most common serotype responsible for reported *Salmonella* cases . (surpassing *S. Typhimurium* and *S. Heidelberg* in 2005)
- The national annual incidence rate for *S. Enteritidis* increased from 2.16 per 100,000 person-years in 2003 to a high of 6.72 in 2008.

# Total *Salmonella* & *S. Enteritidis*, *S. Typhimurium* & *S. Heidelberg* rates (per 100, 000 population), NESP



# Number of *Salmonella* & *S. Enteritidis* Cases in Canada (1998-2010\*), NESP



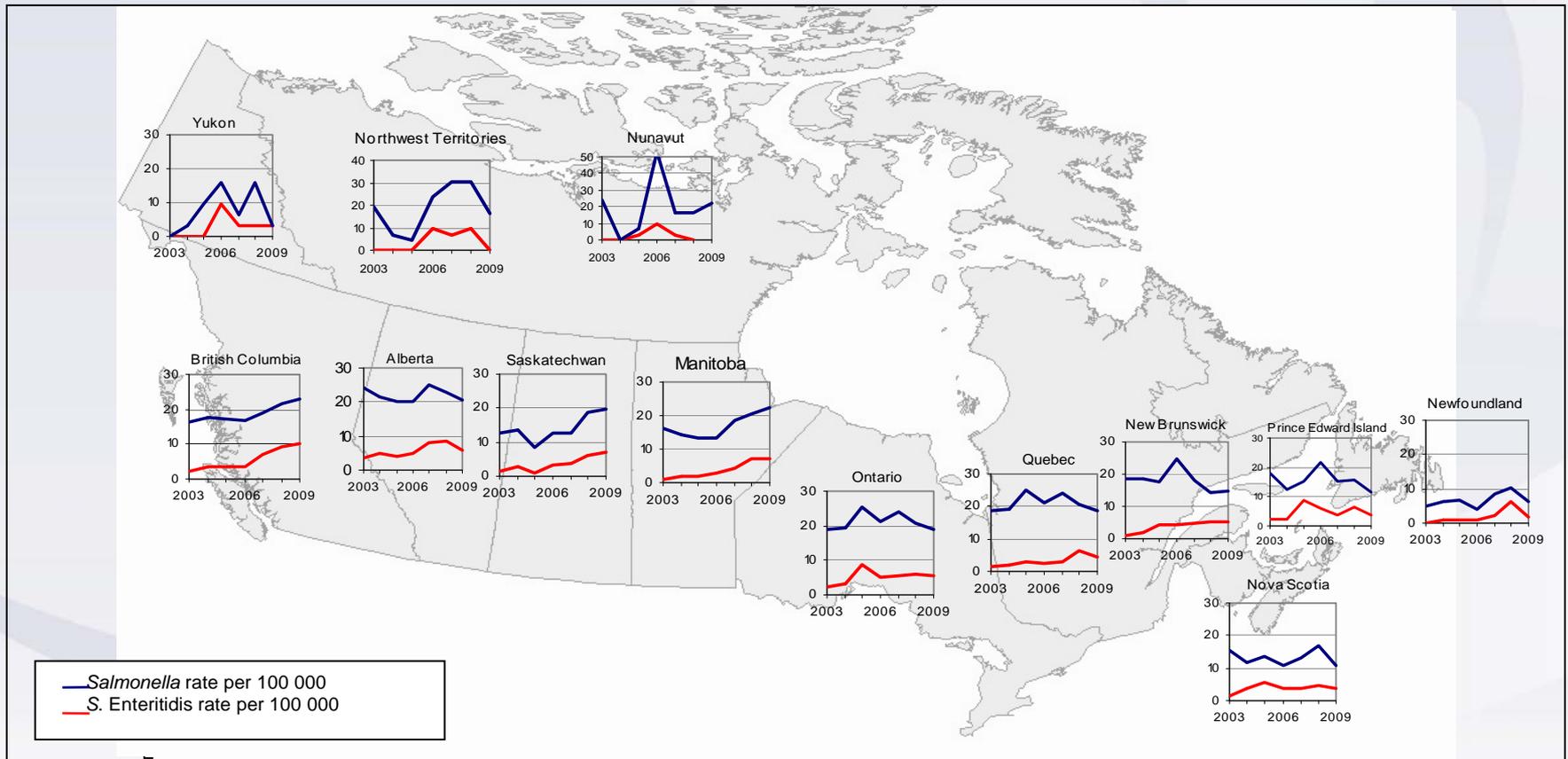
- The proportion of *S. Enteritidis* isolates of all reported *Salmonella* rose from 13% in 2003 to 38% in 2010.

# Provincial Picture of *S. Enteritidis*

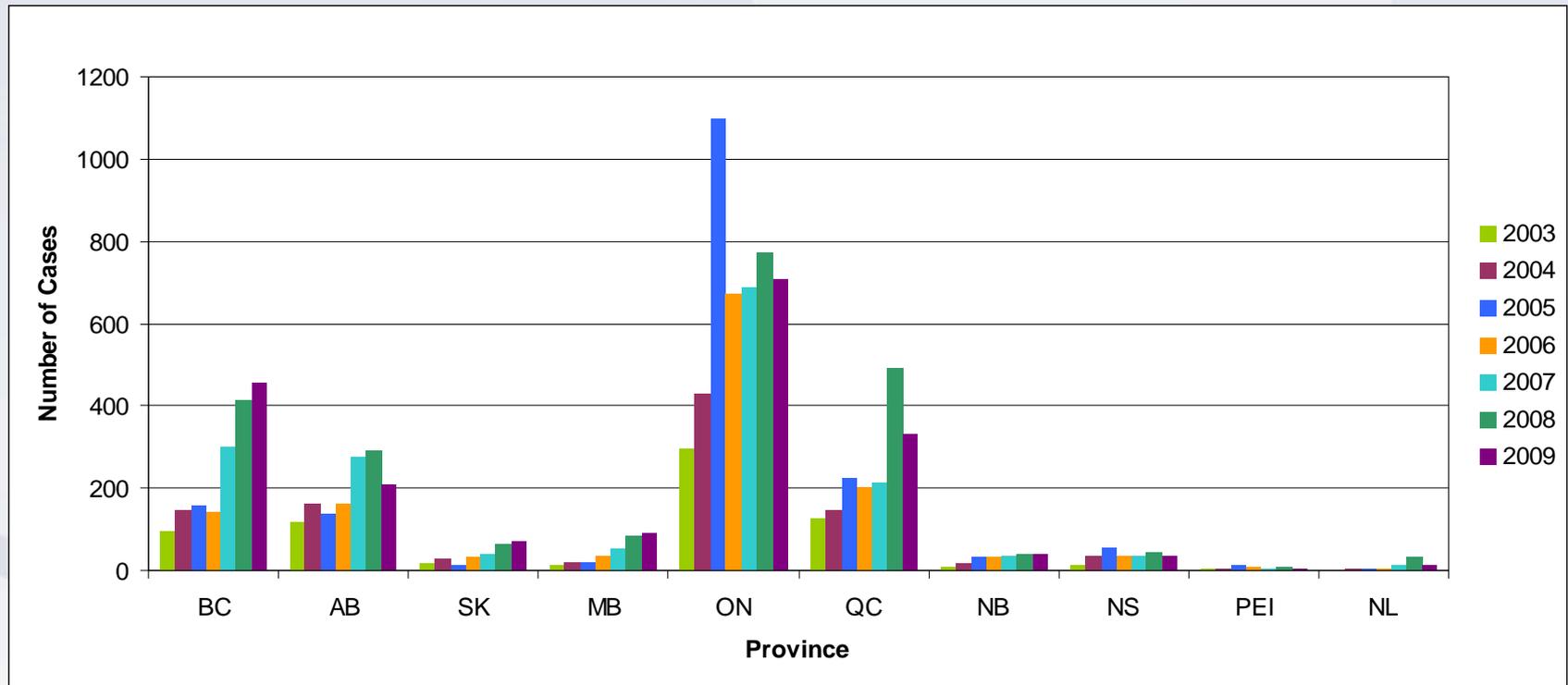
Between 2003-2009 the increase in rates of *S. Enteritidis* was observed in each of the 13 Canadian provinces and territories but with varying incidence rates and distribution of genetic subtypes.

Numbers of cases have also increased significantly in some provinces and have required public health response.

# Rate of *S. Enteritidis*, by Canadian province, by year, 2003 - 2009, NESP



# Number of *S. Enteritidis*, by Canadian province, by year, 2003 – 2009, NESP



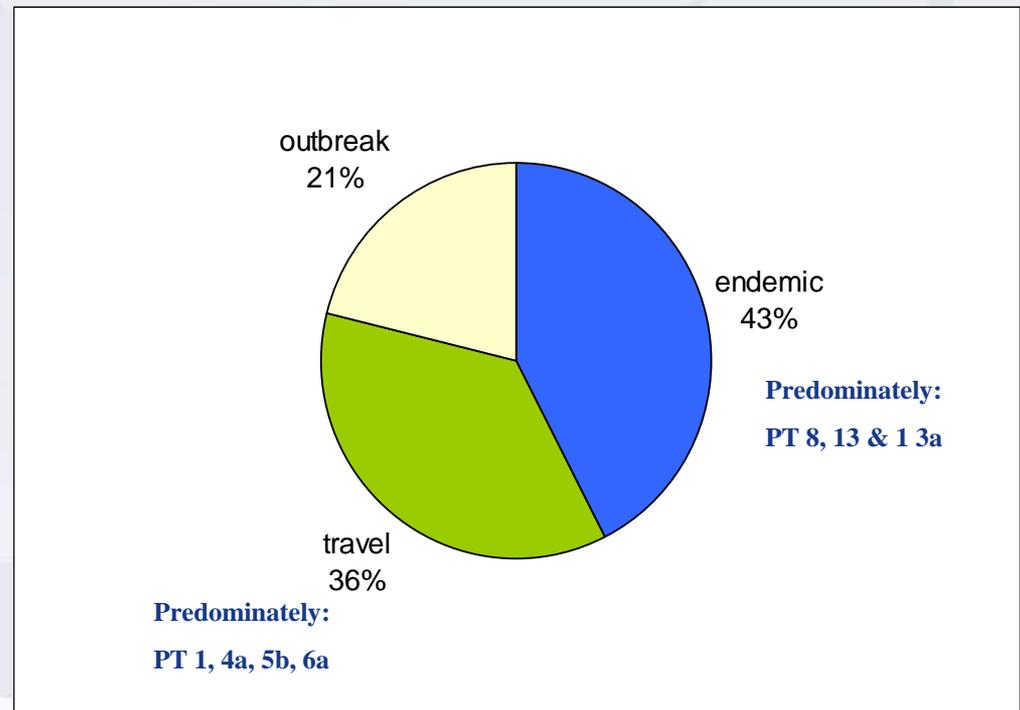
# C-EnterNet

- Cases classified according to sporadic, outbreak and travel and associated phage types.

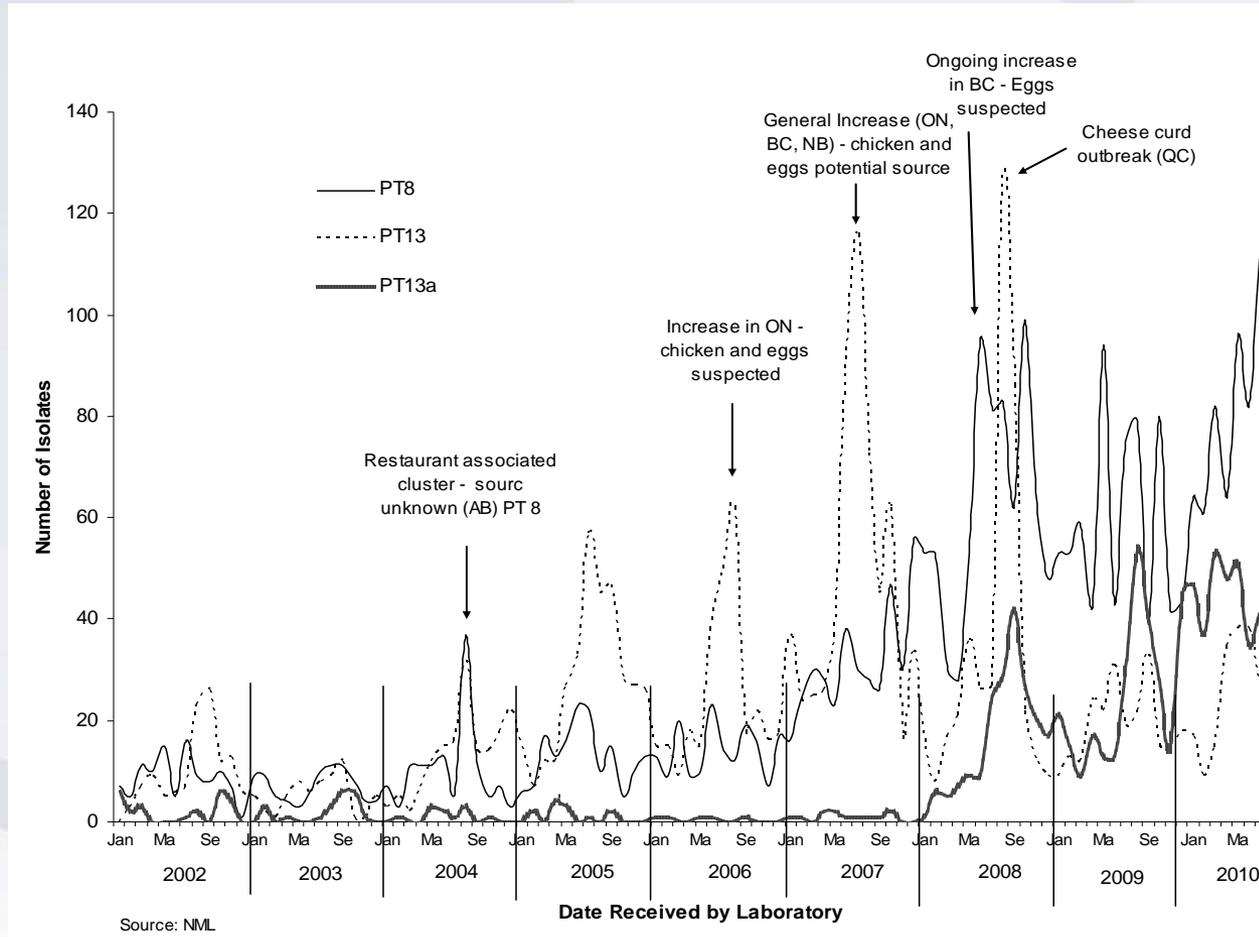
- PT 13, 8 and 13a are generally associated with cases of domestically acquired infections.

- PT 4, 1 and 6a, are more likely associated with cases linked to international travel.

Percentage of endemic, travel- & outbreak-related *S. Enteritidis* cases:  
C-EnterNet Pilot Site (Region of Waterloo, ON), 2005-2009



# S. Enteritidis PT8, PT13a & PT13 isolates by month, Canada 2003-2010, NML



Note: 2005 outbreak in Ontario related to mung bean sprouts was removed.

# Regional Phage Type Trends

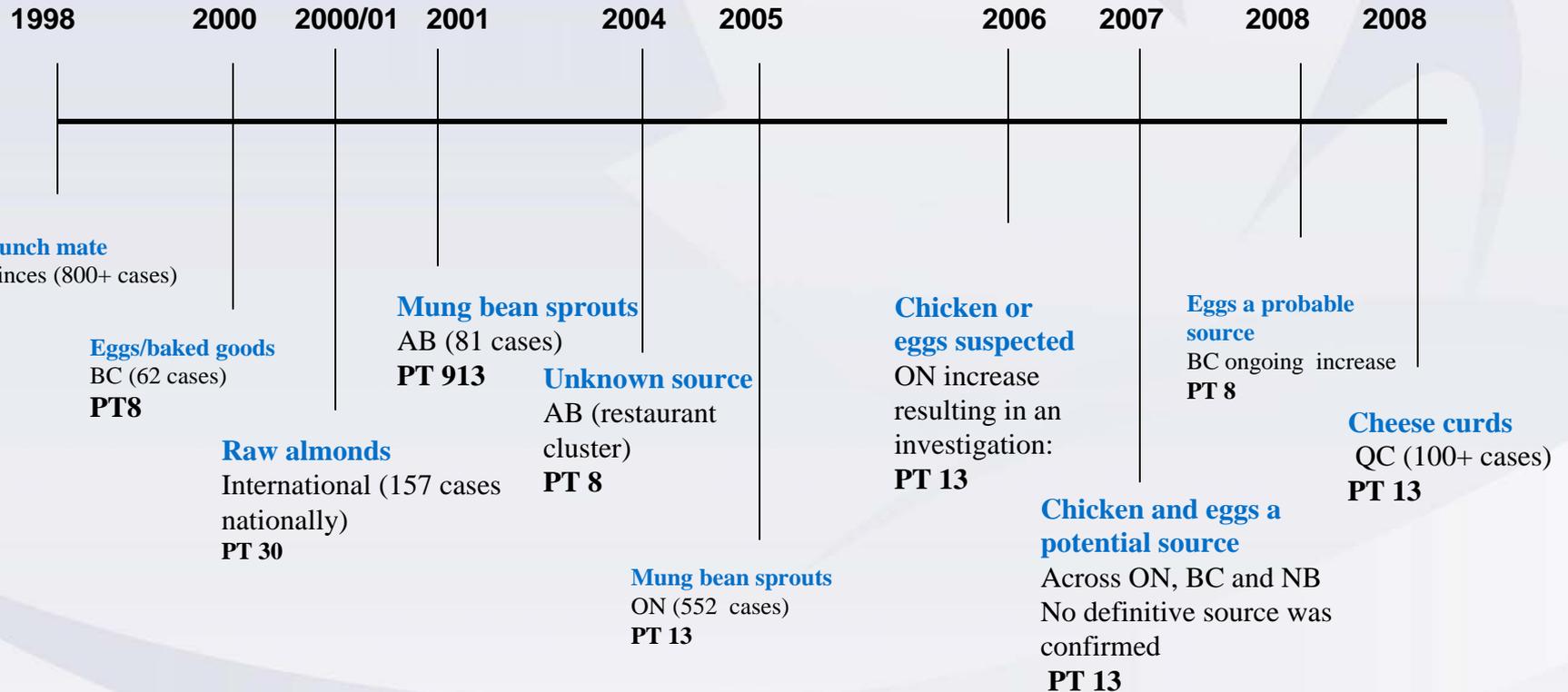
- Prior to 2004 PT 13, 8, and 13a represented less than 25% of all PTs
- PT 13 overall increase in 2004, 2005, 2006 and 2007 followed by a decrease in 2008 and 2009
  - BC dramatic increase in 2007
  - Quebec a large outbreak in 2008
  - ON increase in 2005, 2006 and 2007
- PT 8 continual increase from 2004 to 2010
  - In 2005/2006 regional differences were observed, with PT8 as the predominate strain in the eastern and western provinces
  - Notable increases were observed in nearly all provinces since 2007
  - BC dramatic increase in 2008
- PT 13a emerged in 2008 and continues to increase
  - Notable increases observed in nearly all provinces 2008/2009

**Currently seeing a combination of these 3 PTs represented in most provinces (representing 62% nationally in 2009).**

# Outbreak Investigation

- **NESP** identifies an increase in cases
- Phage type and PFGE lack discriminatory power
- Challenging to distinguishing between outbreak and sporadic cases
  - **Epidemiology assessment** is required to determine if an outbreak requiring investigation is occurring

# Outbreaks of *S. Enteritidis* in Canada and potential exposures



# Sources of *S. Enteritidis*

- *S. Enteritidis* often gains attention from its association with foodborne outbreaks, however majority cases of *S. Enteritidis* are sporadic.
- While outbreaks in Canada have identified multiple sources they have included chicken and eggs.
- Literature from the US and Europe have identified risk factors for *S. Enteritidis* to include chicken meat & eggs <sup>(1,2,3,4,5)</sup>.  
Example: One large case-control study in the US found that *S. Enteritidis* was associated with consumption of chicken and undercooked eggs prepared outside the home and international travel<sup>(1)</sup>.
- Outbreaks in the US have also identified multiple sources, recently a multi-state *S. Enteritidis* PT8 outbreak investigation (summer 2010) identified shell eggs as source of infection <sup>(6)</sup>.

## Sources:

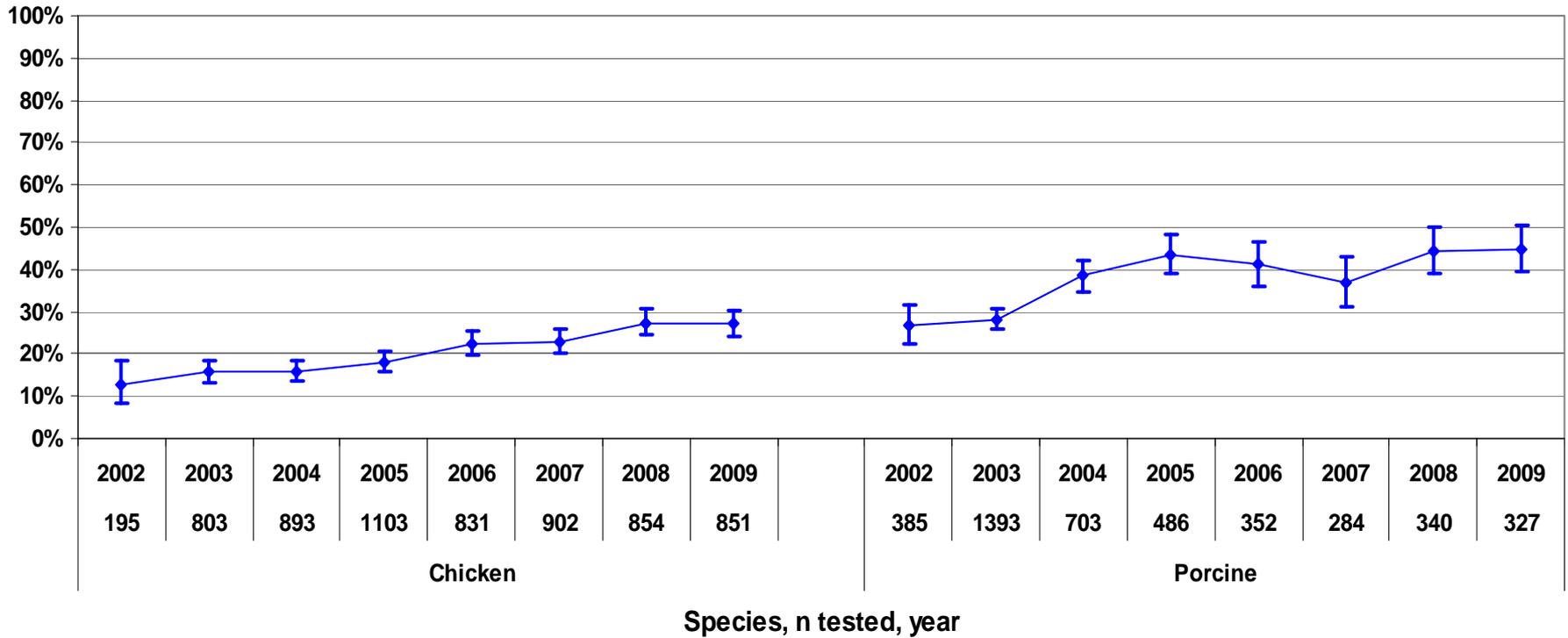
1. Voetsch AC, Poole C, Hedberg CW, Hoekstra RM, Ryder RW, Weber DJ, et al, 2009
2. Kimura AC, Reddy V, Marcus R, Cieslak PR, Mohle-Boetani JC, Kassenborg HD, et al. 2004
3. Marcus R, Varma JK, Medus C, Boothe EJ, Anderson BJ, Crume T, et al. 2007
4. Collard, J, Bertrand S et al 2007
5. Molbak K and Neimann, J, 2002
- 6 CDC website: Investigation Update, Sept 20, 2010 <http://www.cdc.gov/salmonella/enteritidis/#investigation>.

# Integrated Surveillance Programs

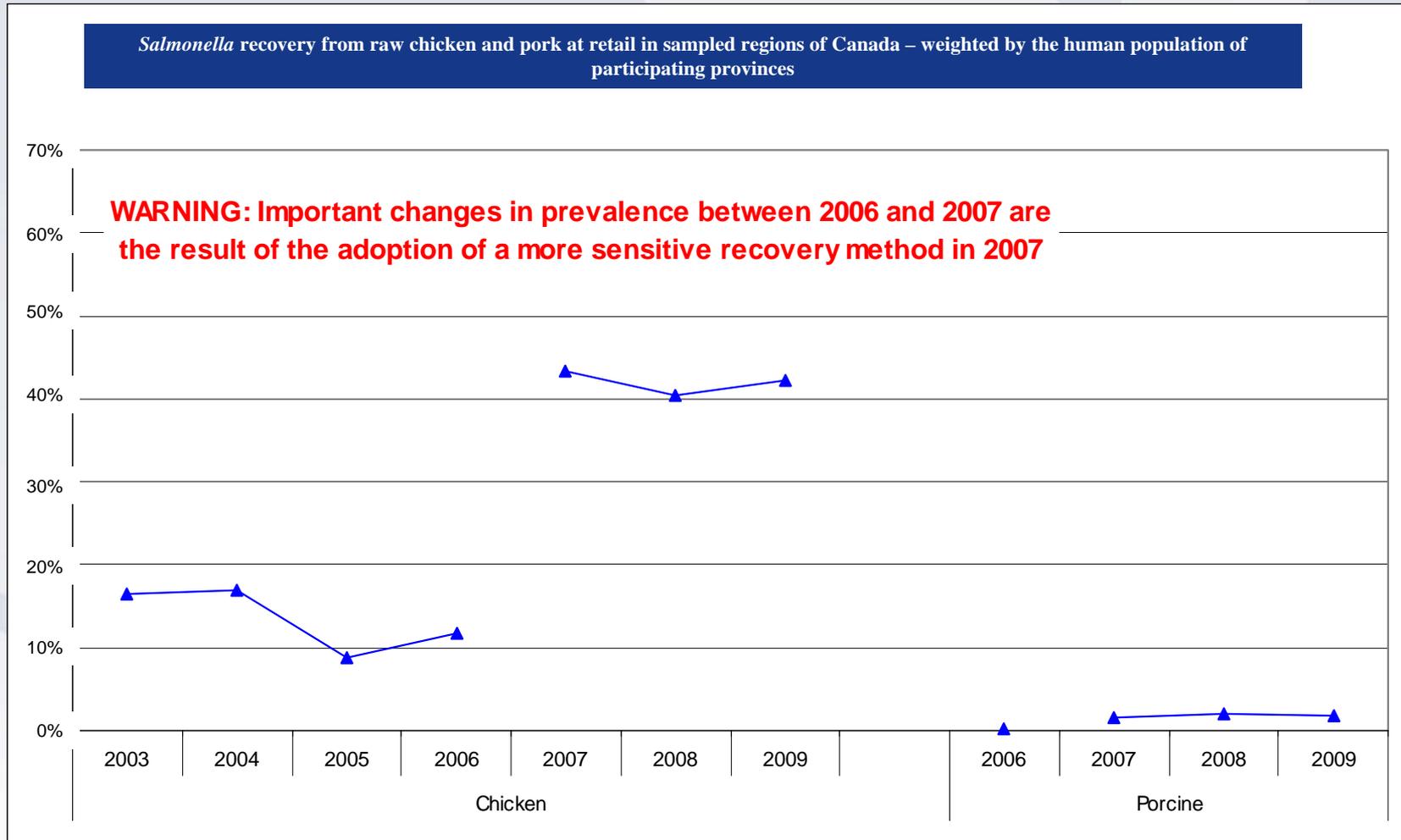
- PHAC's Integrated Surveillance Programs, C-EnterNet and CIPARS monitor agri-food
  - Both survey poultry, swine, beef and humans
  - C-EnterNet: detailed information at the sentinel site level
  - CIPARS: information representative at the national or provincial level
- No surveillance in eggs at the consumer level,
  - CIPARS pilot surveillance of spent layer hens at slaughter since March 2009 (111 isolates to date)
  - CIPARS short survey of breaking egg station in 2007, early 2008 (175 isolates)

# CIPARS Data: *Salmonella* recovery from chicken and pork at slaughter (2002-2009)

Salmonella prevalence from CIPARS abattoir caecal samples



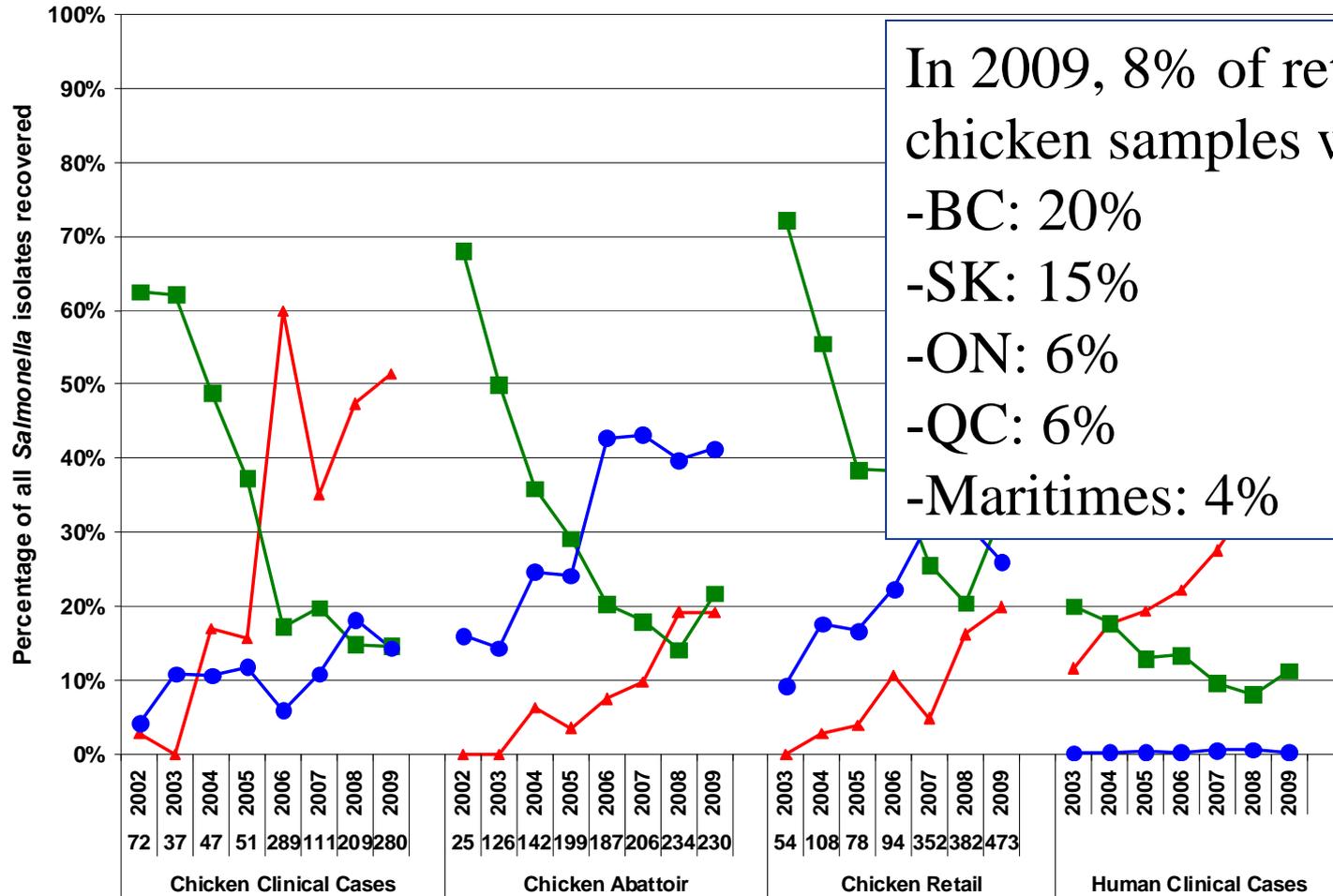
# CIPARS Data: *Salmonella* recovery from retail chicken and pork (2003-2009)



# S. Enteritidis in Exposure Sources

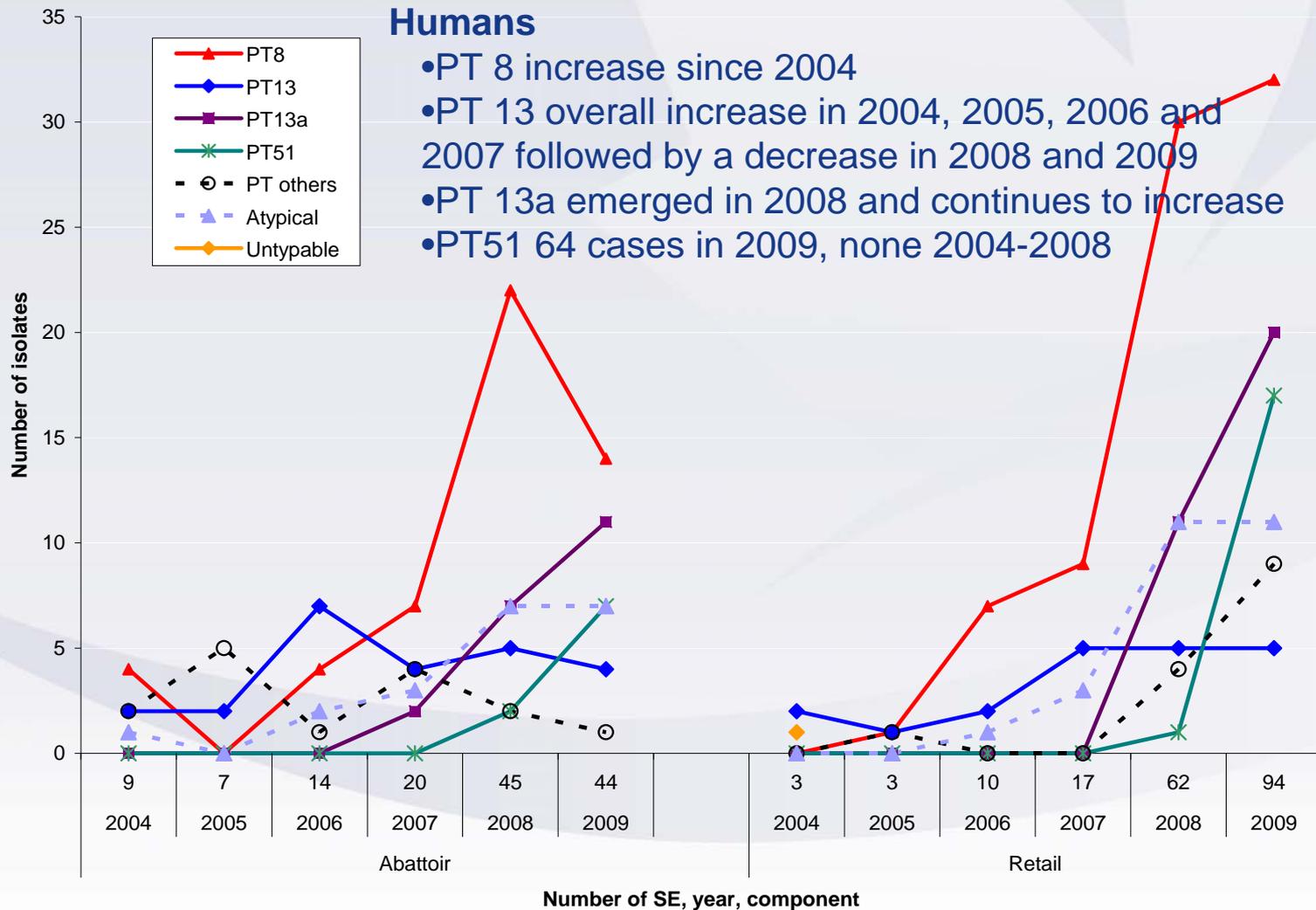
- *Pigs/Pork:*
  - <1% of all *Salmonella* isolates recovered from pigs on-farm or at abattoir
  - 3% of *Salmonella* from retail pork (0.6% of retail pork with SE)
- *Beef cattle/Beef:* Few *S. Enteritidis* isolates from beef commodity (1 isolate in retail ground beef, 1 isolated beef farm manure)
- *Layers:*
  - Spent hen: 7% (8/111) of all *Salmonella* are SE
  - Breaking egg station: 4% (7/175) of all *Salmonella* are SE
  - No data from eggs

# Changes in serovar prevalence across time in chicken and human *Salmonella* isolates, 2002-2009, CIPARS



In 2009, 8% of retail chicken samples with SE  
 -BC: 20%  
 -SK: 15%  
 -ON: 6%  
 -QC: 6%  
 -Maritimes: 4%

# S. Enteritidis phage types recovered from chicken at slaughter and retail, (2004-2009)



Source: CIPARS data

# **S. Enteritidis isolates from poultry (2005-2009): C-EnterNet Pilot Site (Region of Waterloo, ON)**

## **Retail and Farm**

- the % of *S. Enteritidis* on chicken breast and chicken farms varied, both with the highest percentage in 2009 (16% in both sources).
- PT8 and PT13 were the most frequent phage types identified.

# CIPARS and C-EnterNet *S. Enteritidis*: Summary

*S. Enteritidis* was detected in sources other than chicken, however contamination was low and data insufficient to conduct a full source attribution exercise.

Integrated surveillance data showed that recovery of *S. Enteritidis* from chicken has increased since 2004, along the increase in humans.

The predominant phage types detected in farm, abattoir and retail chicken samples (PT 8, 13, and 13a) were also the most common phage types in humans.

The information available identify chicken as an important exposure source.

# Surveillance Limitations/ Challenges

- Foodborne illness is under-reported
- Separating outbreak and sporadic cases during an ongoing increase seen over years is difficult
- Discriminatory power of genetic typing (ie. phage type and PFGE) is limited
- Surveillance data is not collected for all possible food sources (ex. pilot data on spent hens)

# Summary

- While *Salmonella* levels remain relatively stable nationally, some provinces have experienced increases. This pathogen continues to be an important foodborne illness issue in Canada.
- *S. Enteritidis* infections has had a three-fold increase in Canada over the last 6 years.
- Similar *S. Enteritidis* phage types have been detected in humans and poultry commodities at retail, abattoir and farm level.
- While surveillance data on eggs is limited, outbreaks and a recent case-control study in BC have determined eggs as a source.

# Conclusion

- PHAC is concerned about the rising levels of *S. Enteritidis* infections.
- Collaborative efforts for prevention, investigation and control are required among stakeholders along the food chain.
- Action is needed to mitigate future illness and continued integrated surveillance to monitor effectiveness of these control measures.



Questions?