

# *Prevalence, Level, & Survival of Salmonella in Spices offered for Import into the United States*

American Spice Trade Association  
2012 Regulatory/Legislative Meeting  
October 10, 2012

Jane M. Van Doren, Ph.D.  
Food and Drug Administration  
Center for Food Safety & Applied Nutrition

## ***Salmonella* in Spices/Seasonings – Concern for Public Health**

- *Salmonella* hazard in 95% of U.S. food recalls associated with spices, FY1970-FY2003
- Three large-scale illness outbreaks in U.S. attributed to *Salmonella*-contaminated spices/seasonings: 2007-2010
- *Spices & Seasonings* category among the top 3 for Reportable Food Registry primary entries & *Salmonella* primary entries: Year 1 & 2

# FDA Research

1. How common is *Salmonella* contamination?
2. How extensive is the contamination?
3. How long will *Salmonella* survive in spice?



Thomas Hammack, Ph.D.

Daria Kleinmeier

Ann Westerman, Ph.D.

**Robert Blodgett, Ph.D.**

**Linda Fabbri**

**Vikas Gill, Ph.D.**

**Yinqing Ma, Ph.D.**

**Martin Muckenfuss**

**George Ziobro, Ph.D.**

Elizabeth M. Grasso, Ph.D.

Lindsay A. Halik

Susanne E. Keller, Ph.D.

FDA inspectors, field and lab scientists, Regis Pouillot, Sherri Dennis,  
*Pathogens & Filth in Spices Risk Profile Team (FDA & CDC)*

# 1. *How common is Salmonella contamination?*

## Determine PREVALENCE

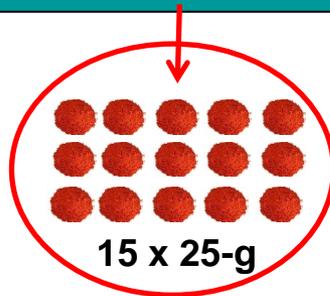
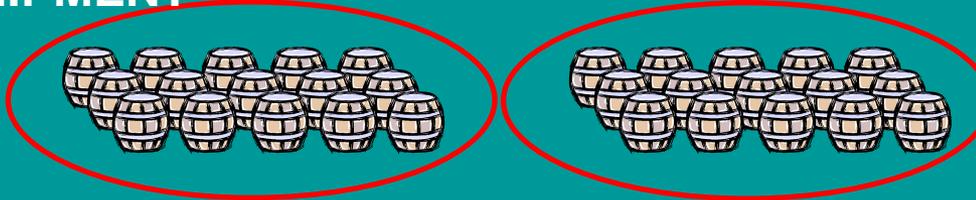
*Analyze annual imported foods  
Surveillance Sampling Test Results  
FY2007—FY2009*

**2844 Shipments of Imported Spice**

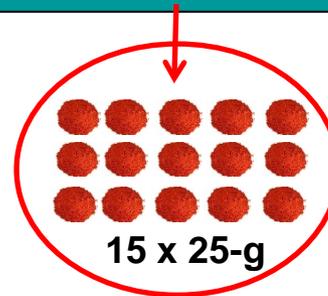
**17508 Shipments of Other Imported Foods**

# FDA Surveillance Sampling Protocol

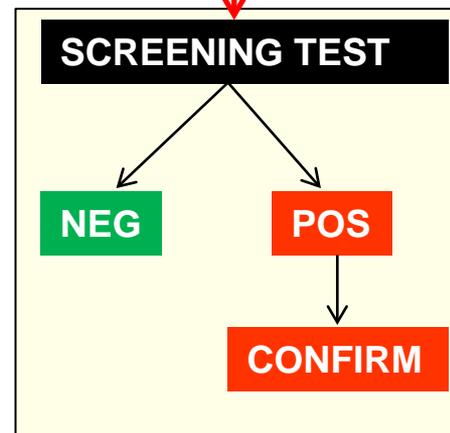
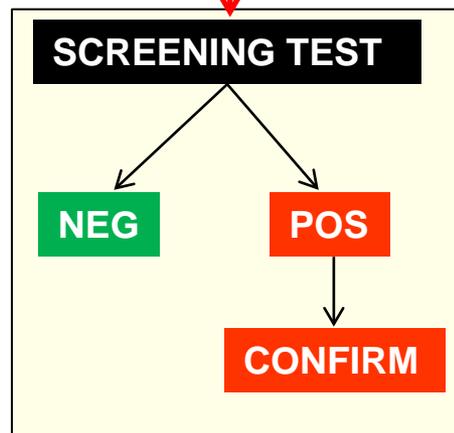
## SPICE SHIPMENT



Composite 1

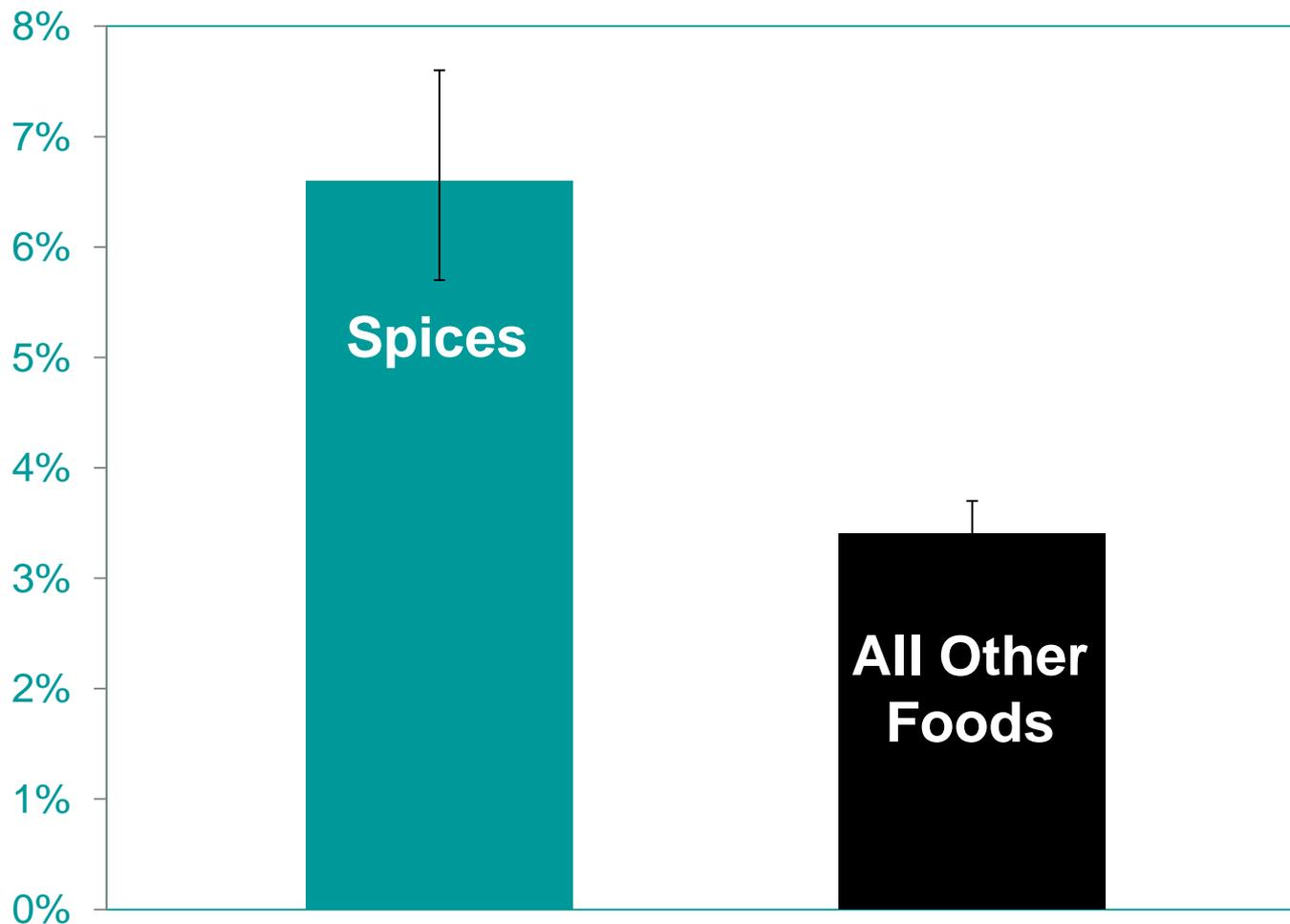


Composite 2

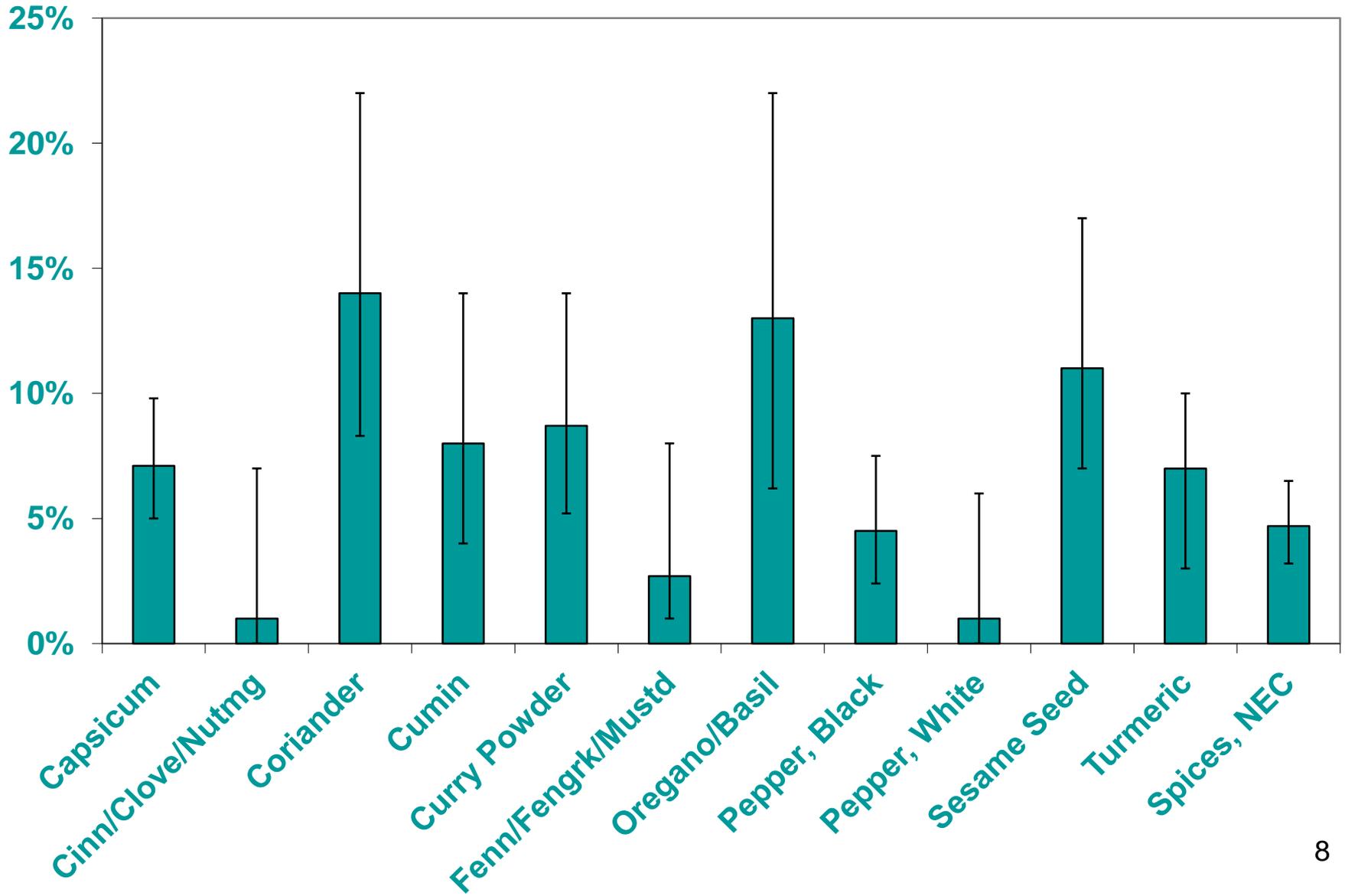


***If either composite tests positive = Contaminated Lot***

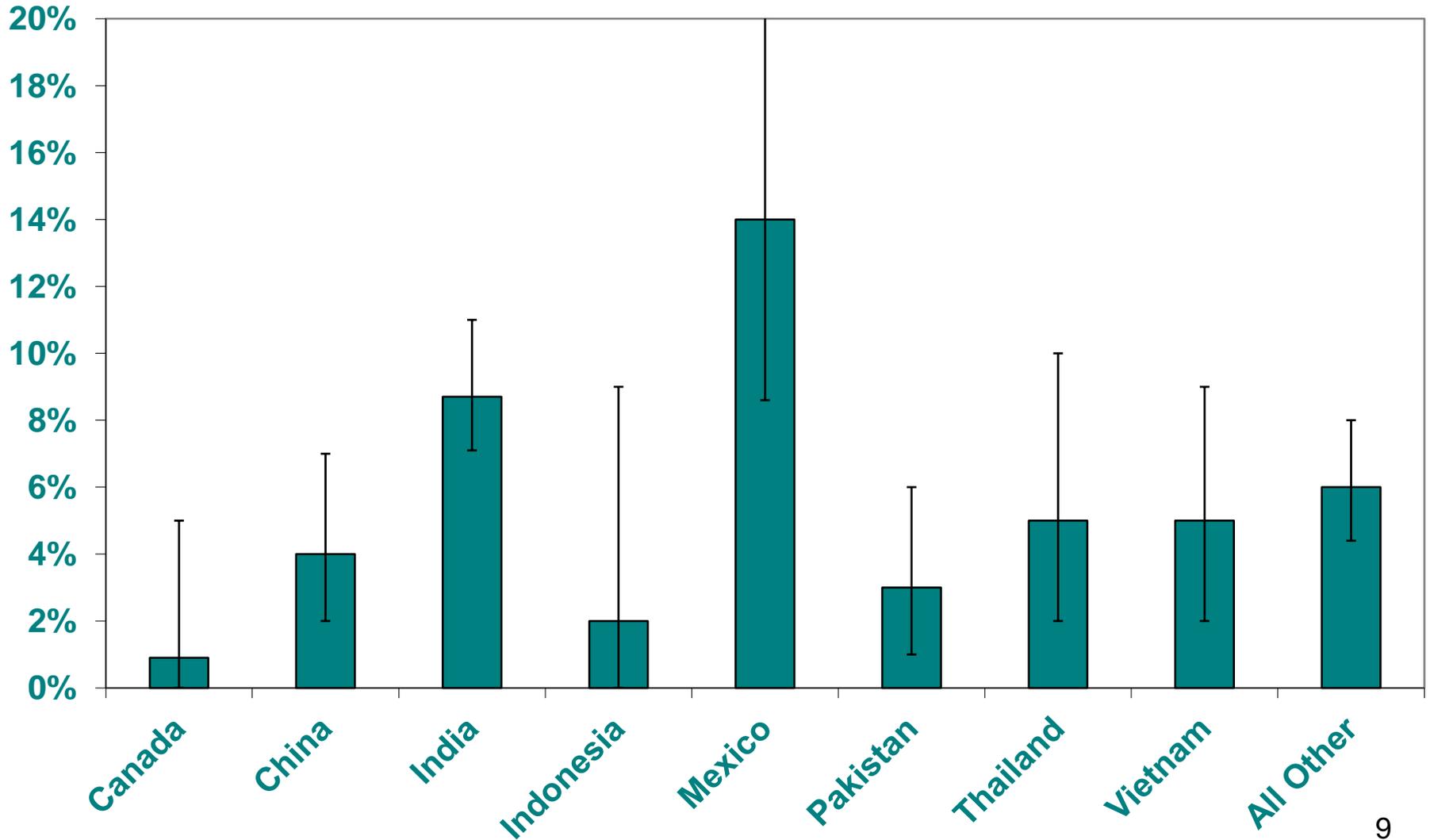
## Prevalence of *Salmonella* in Imported Spices/Other Foods FY2007-2009



# Prevalence of *Salmonella* by Spice Type



# Prevalence of *Salmonella* by Export Country



## 2. How extensive is the contamination?

**Determine LEVEL & DISTRIBUTION**

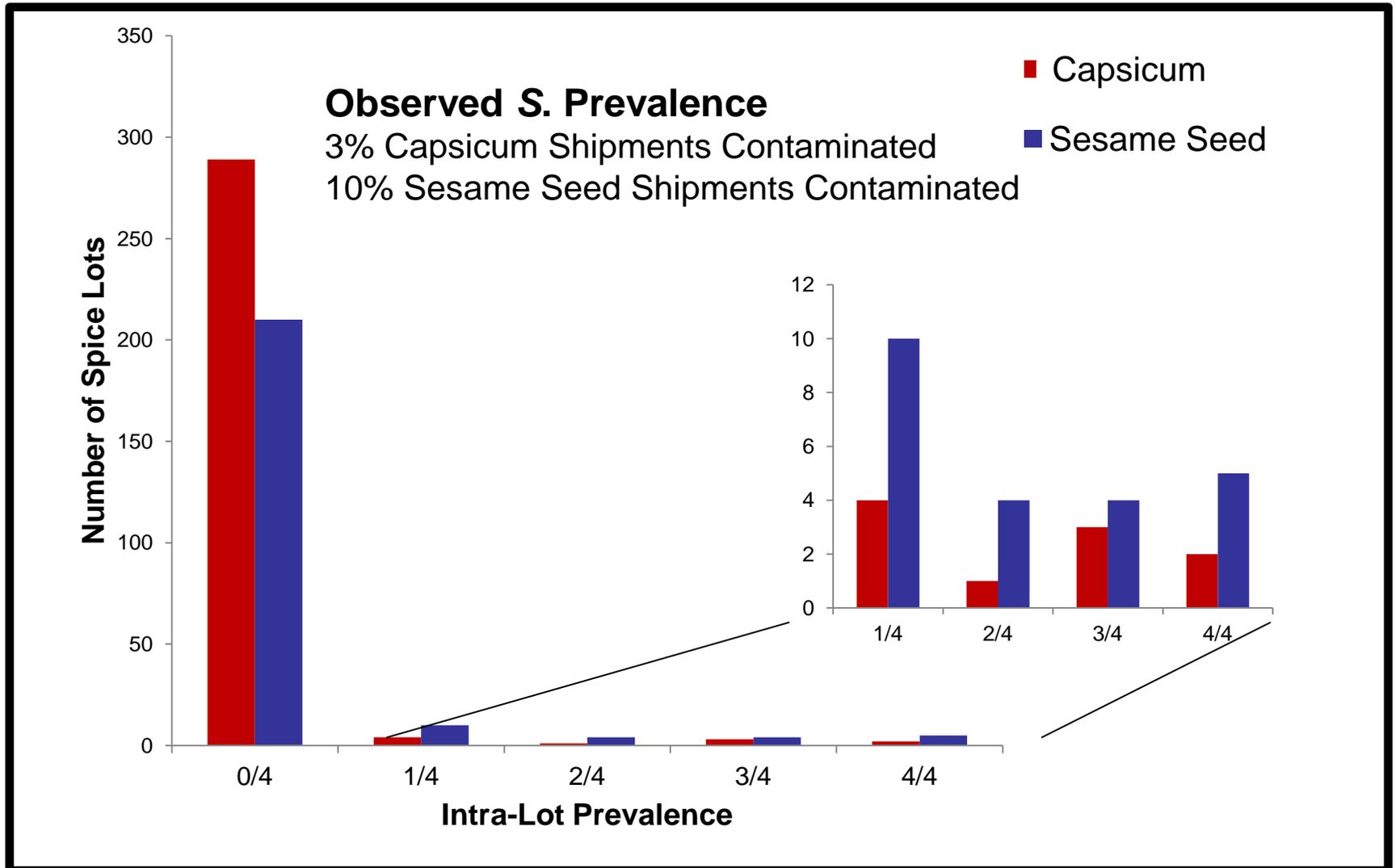
**SAMPLE , SCREEN, & ENUMERATE**



**299 Imported Capsicum Shipments**

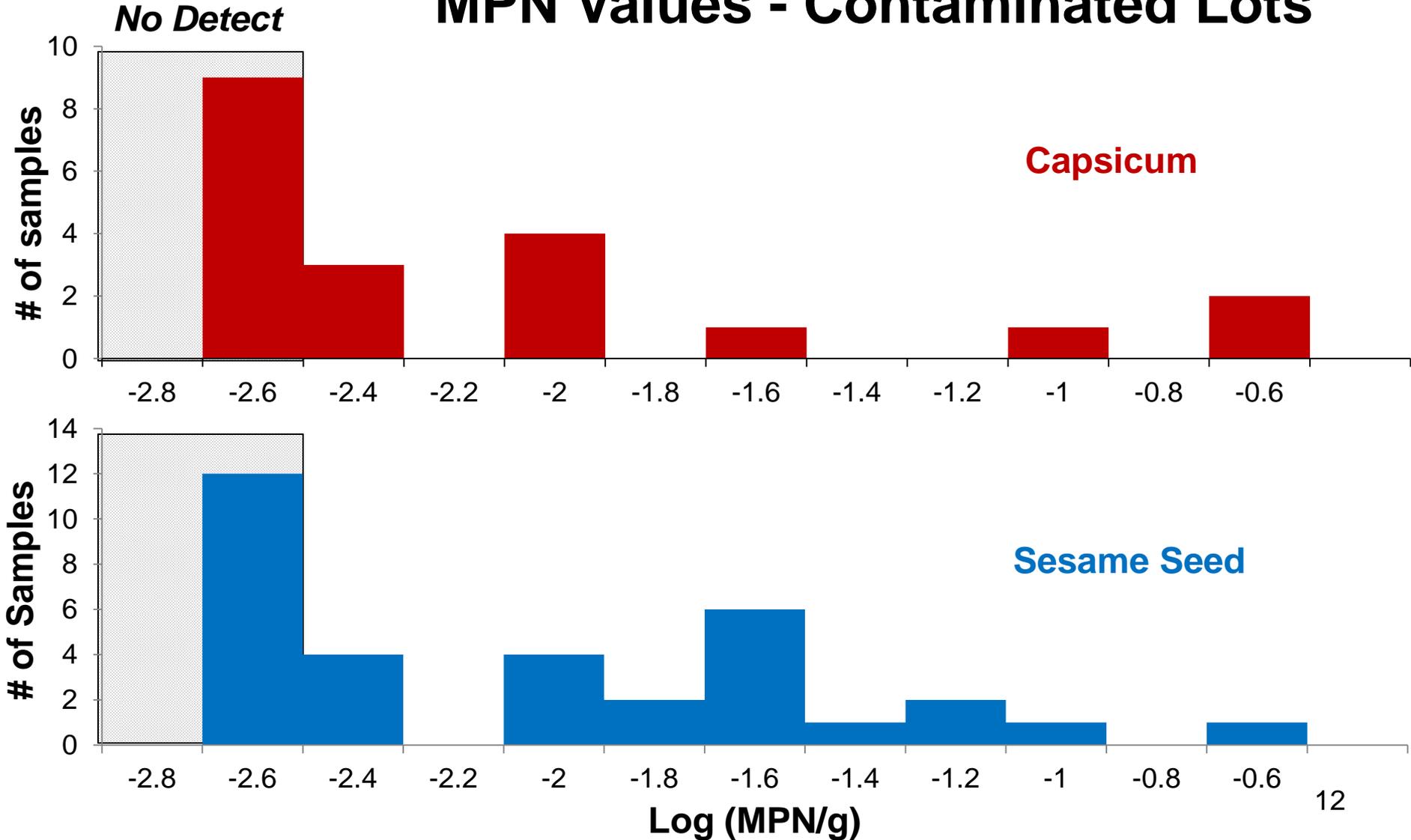
**233 Imported Sesame Seed Shipments**

# Screening Test Results



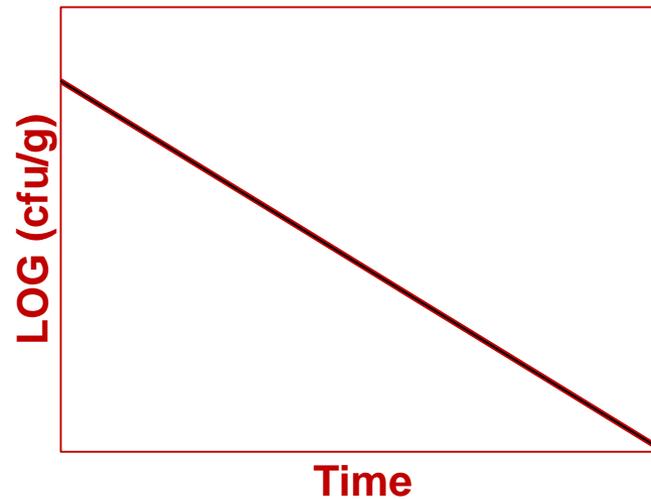


# MPN Values - Contaminated Lots

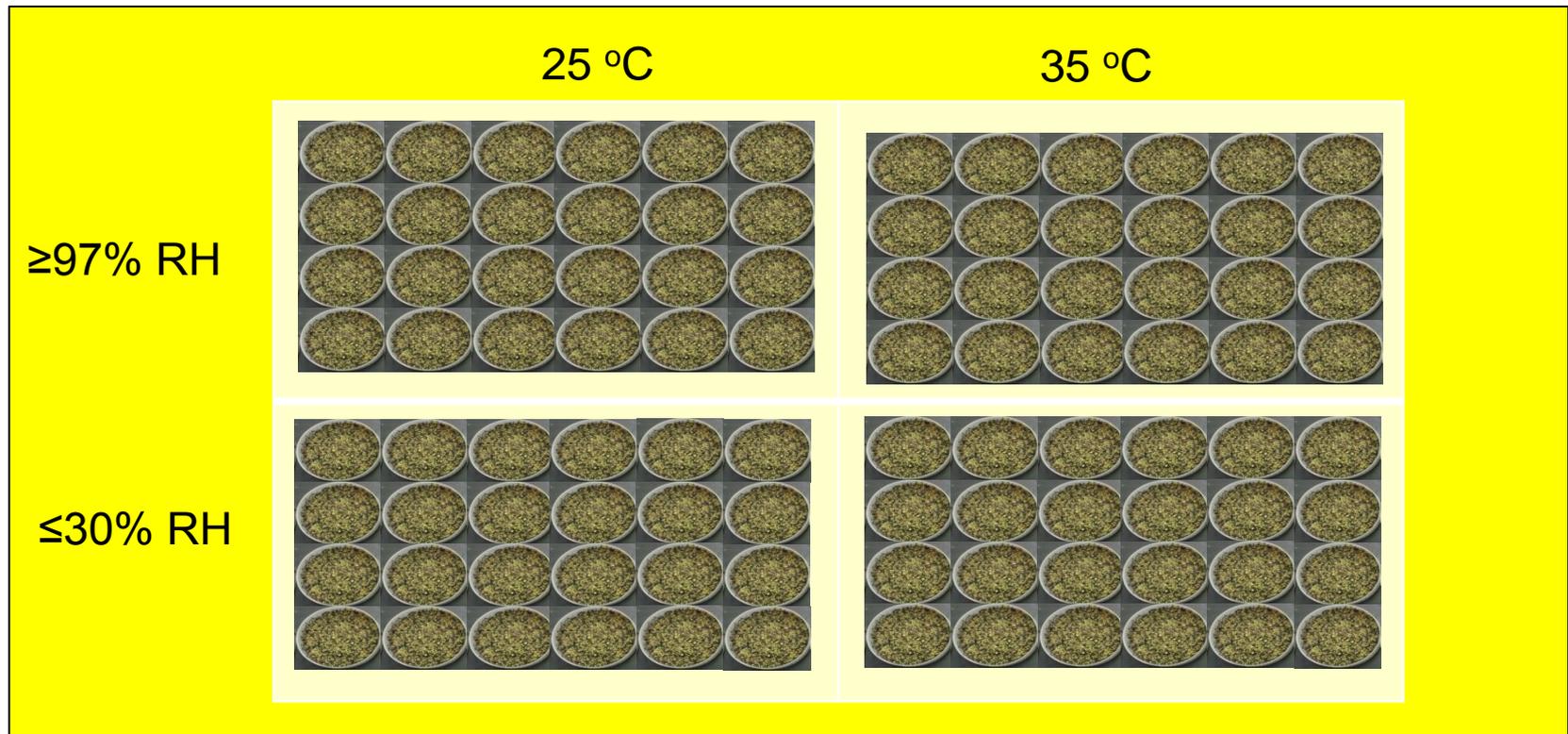


3. How long will *Salmonella* survive in spice?

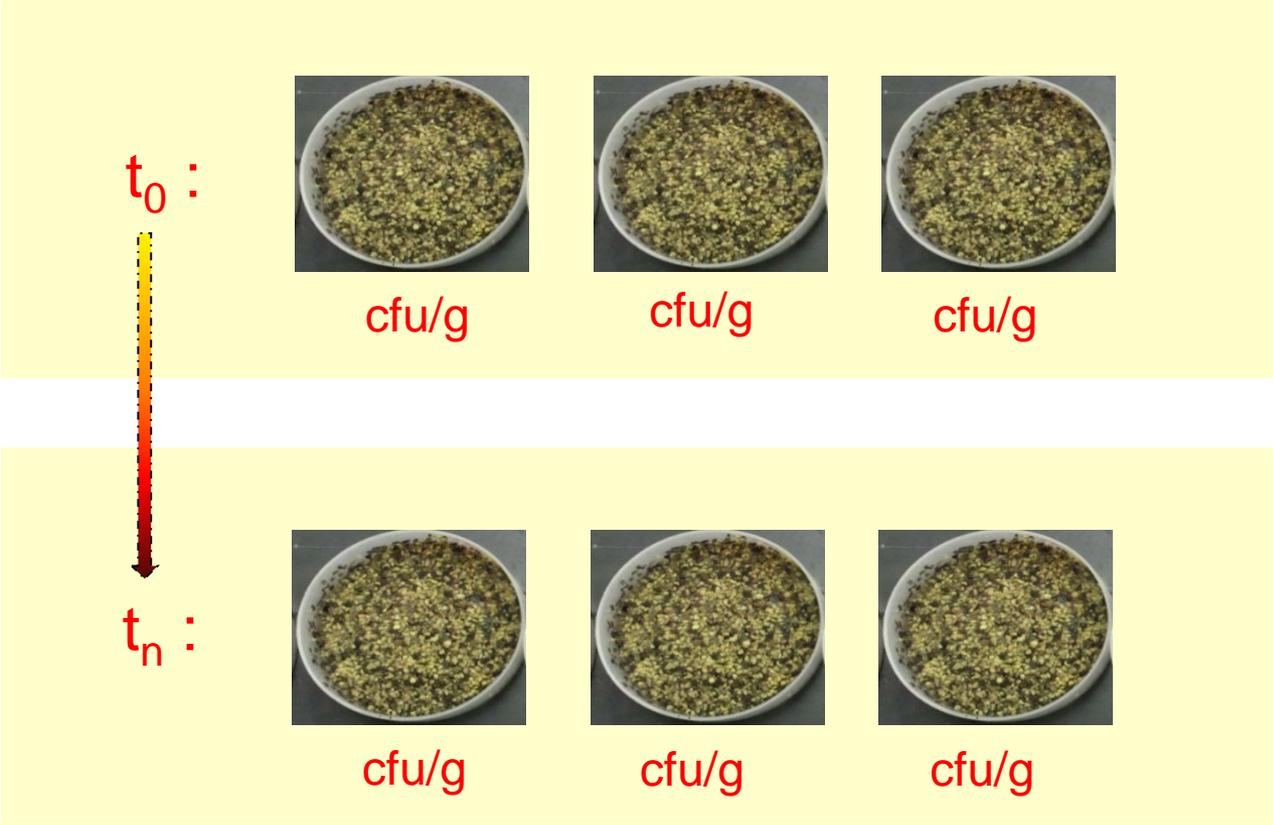
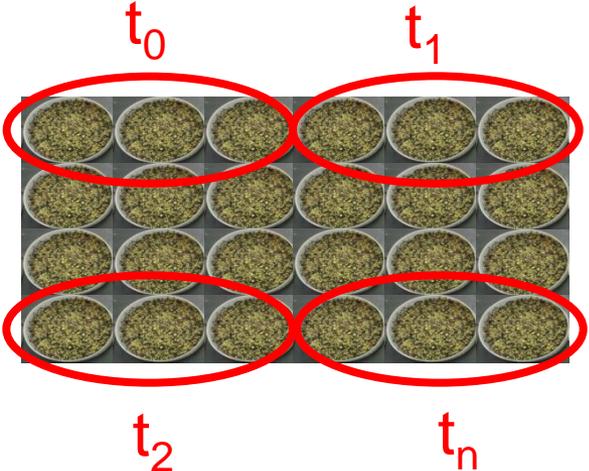
**Determine DECAY KINETICS**



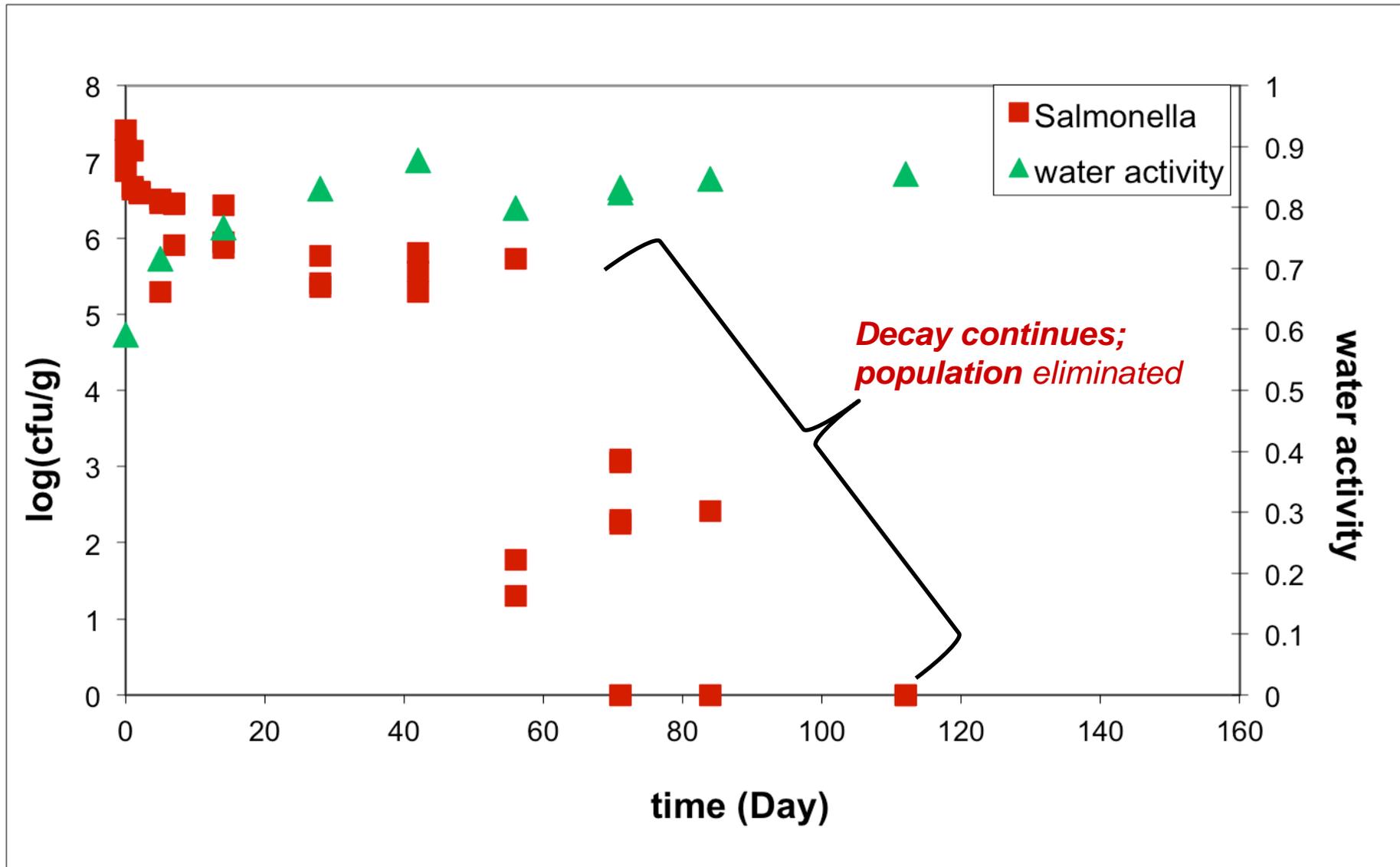
# Salmonella Survival Experiments



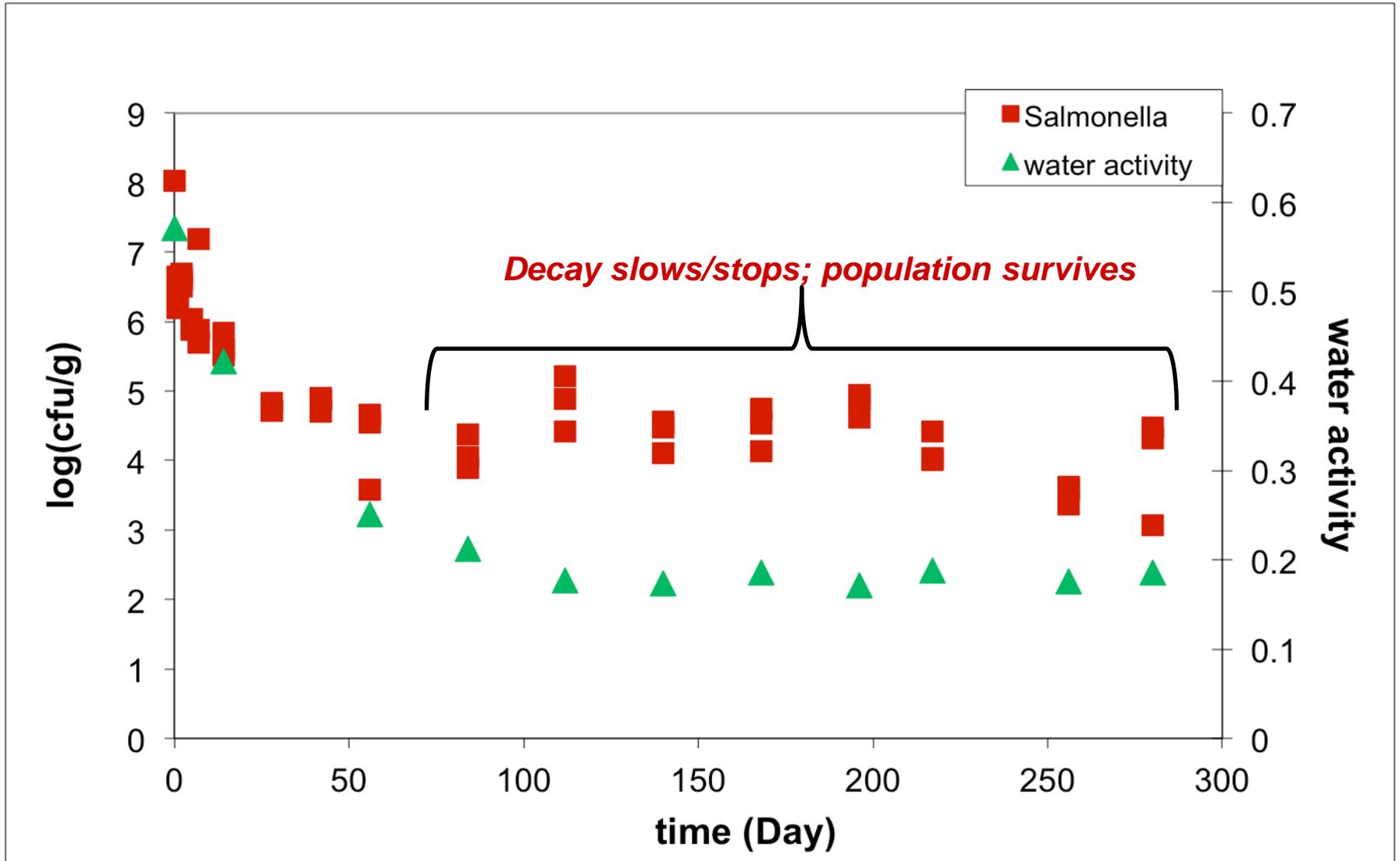
# Time Evolution



# Survival of *Salmonella* in black pepper 25 °C, $\geq 97\%RH$



# Survival of *Salmonella* in black pepper 25 °C, $\leq 30\%RH$



# Conclusions

- A wide diversity of imported spices exported from a wide range of countries are found to be contaminated with *Salmonella* when sampled at the point of entry into the U.S.
- Some differences in prevalence among groups of spices/export countries exist.
- The levels of *Salmonella* in examined imported capsicum and sesame seed lots were determined to average less than 1 MPN/g.
- *Salmonella* distribution in contaminated capsicum spice shipments (mostly ground/cracked) appear to be, on average, Poisson at U.S. entry.

# Conclusions

- *Salmonella* can survive for long periods of time when stored at room temperature at low water activity
- Water activity affects the length of survival; survival is shortened at high water activity
- Increasing temperature decreases survival time at high water activity

# QUESTIONS



Image: <http://siamspices.com/images/categories/dry%20spices.jpg>