

Listeria monocytogenes transmission at retail

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**Collaborative effort between Cornell
and New York State Department of
Agriculture and Markets
(Dan Rice, Joe Corby)**

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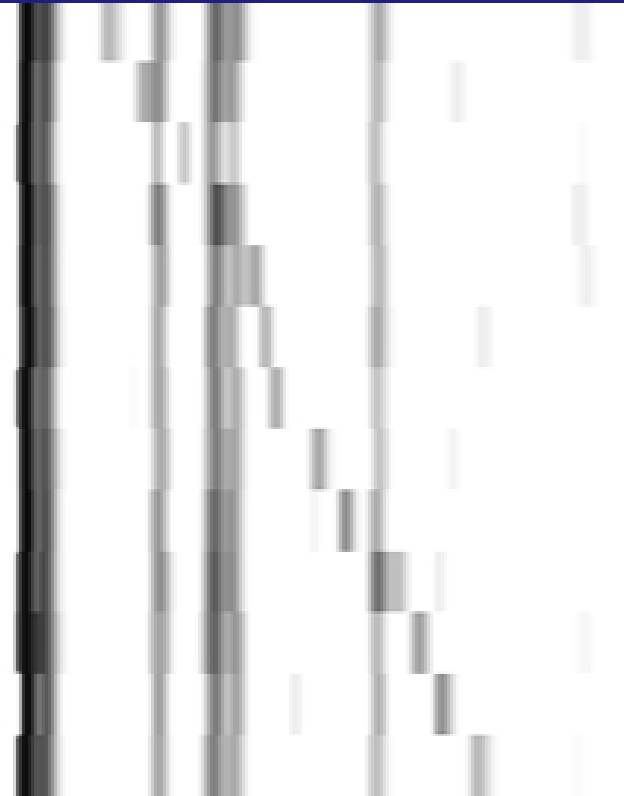
***L. monocytogenes* strain differentiation (subtyping/fingerprinting)**

- Tools which allow sensitive differentiation of bacterial subtypes
 - Detection of contamination sources
- Strain differentiation methods commonly applied to *L. monocytogenes* include serotyping, ribotyping, Pulsed Field Gel Electrophoresis (PFGE), DNA sequencing
 - While serotyping differentiates only 13 subtypes (serotypes), molecular methods generally differentiate more than >100 *L. monocytogenes* subtypes

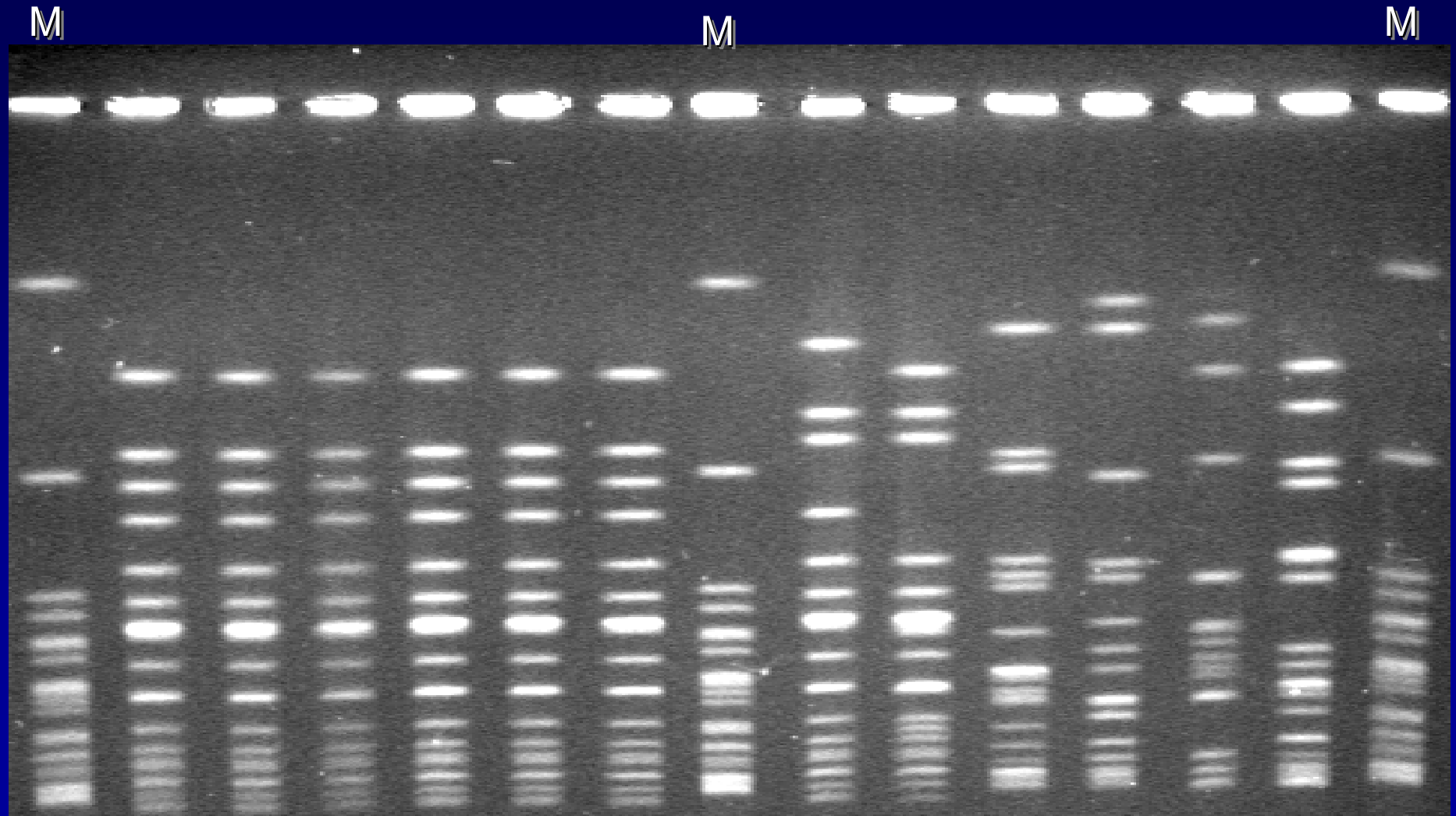
Ribotyping

Examples of different *L. monocytogenes* ribotypes

Listeria monocytogenes
Listeria monocytogenes
Listeria monocytogenes
Listeria monocytogenes
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Listeria monocytogenes
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Listeria monocytogenes



Pulsed Field Gel Electrophoresis

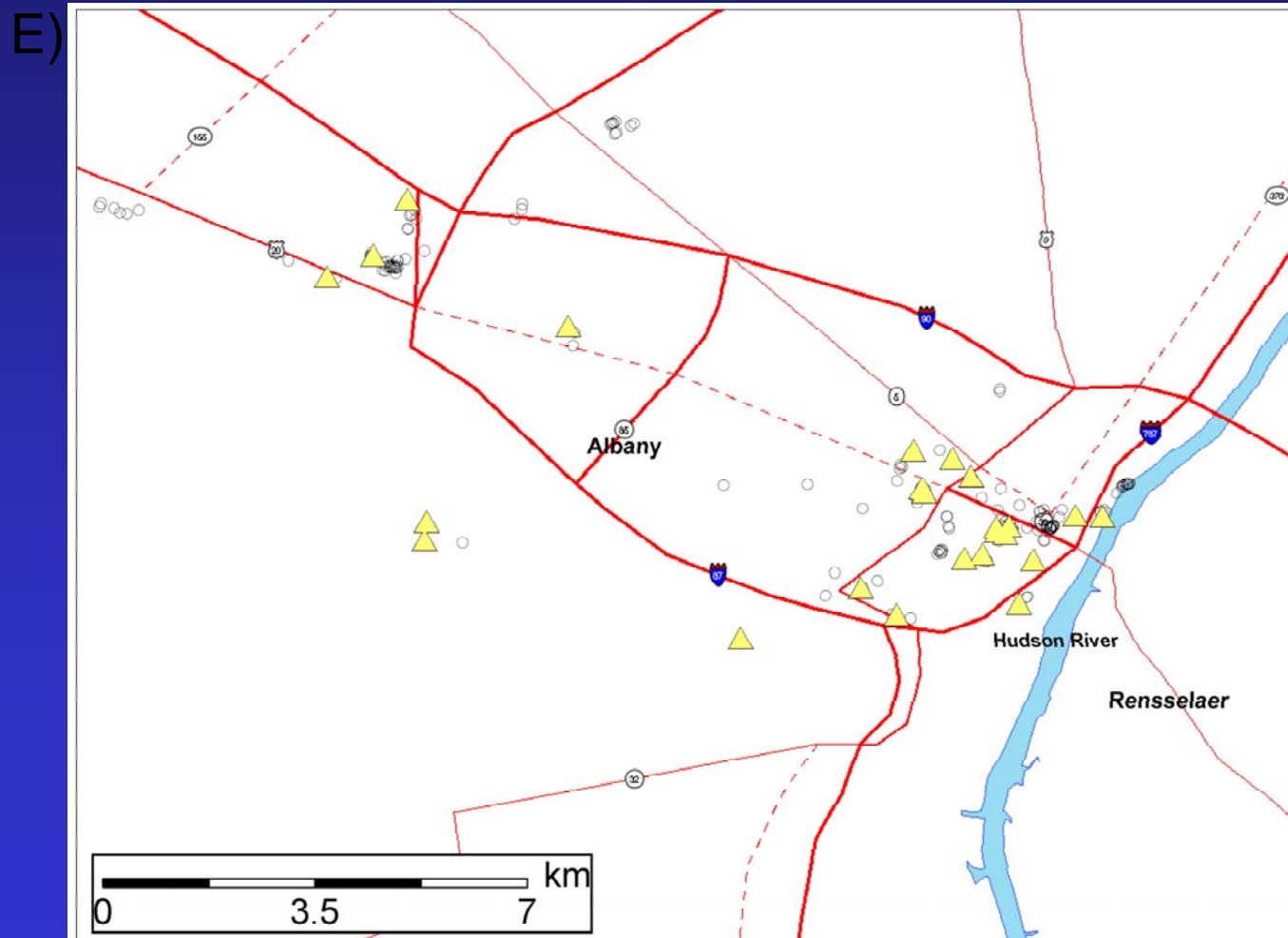


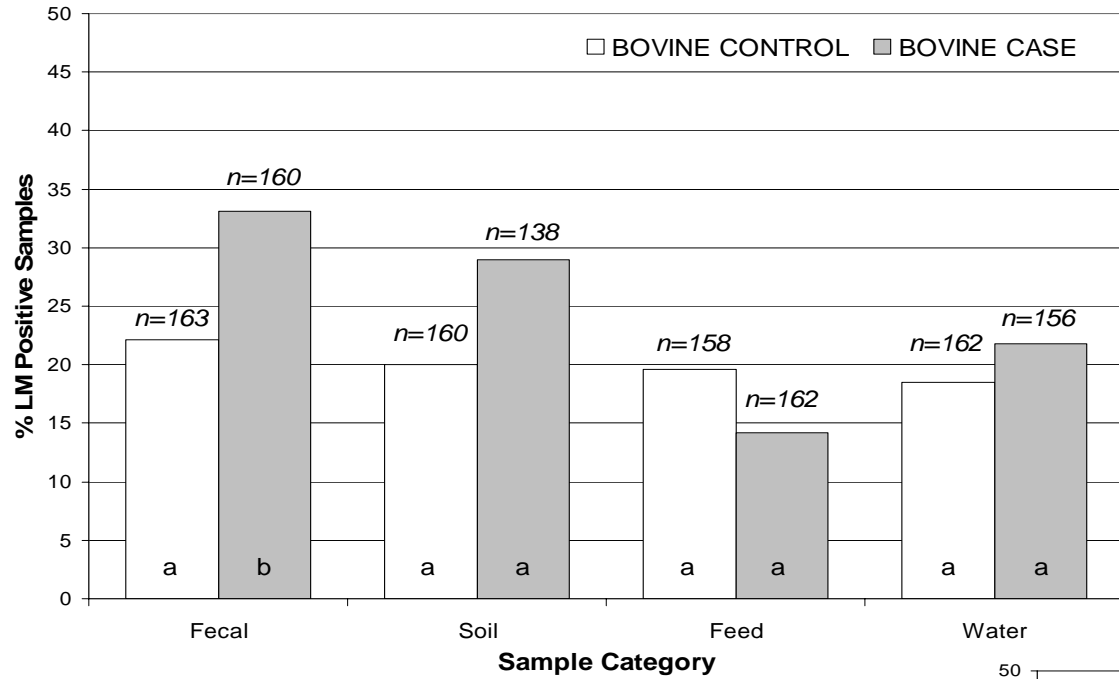
L. monocytogenes prevalence

- Pristine environments: 1.3% (n=900)
- Urban environments: 7.3% (n=900)
- Ruminant farms
 - Bovine farms with listeriosis cases: 24.35% (n=616)
 - Bovine farms without listeriosis cases: 20.06% (n=643)
 - Small ruminant farms with listeriosis: 32.92% (n=322)
 - Small ruminant farms without listeriosis: 5.89% (n=475)
- Raw foods
- Food processing environments: from <0.1% to 30% or more
- Ready-To-Eat foods: 0.17 – 4.7 % (Gombas et al., 2004)

L. monocytogenes in urban environments

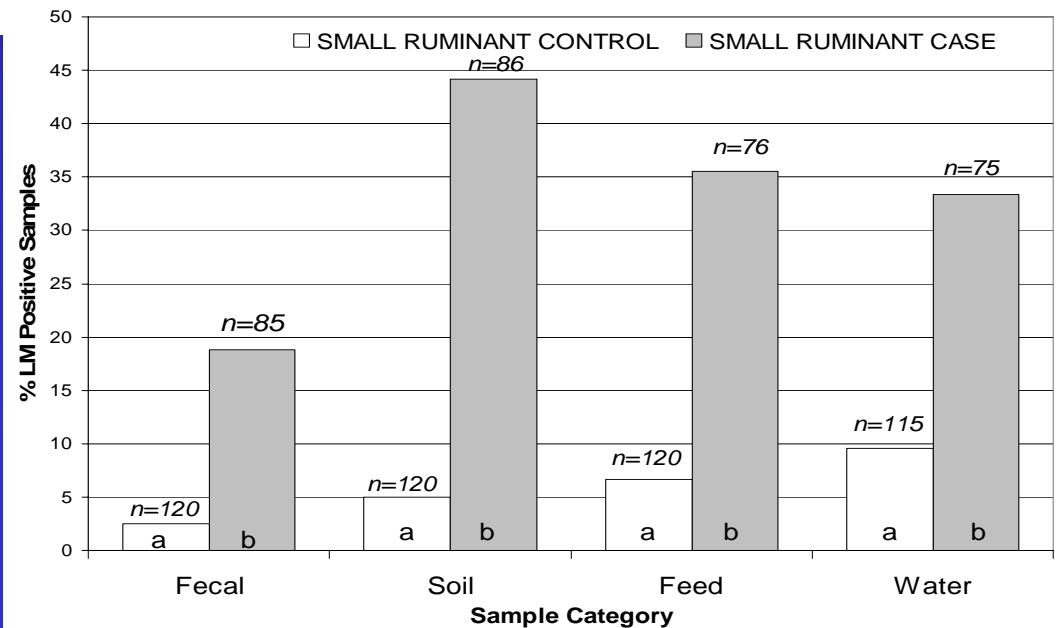
- Albany, NY
 - 214 samples tested
 - 27 positive for LM
 - 10 isolates were ribotype DUP-1038B (over three samplings and >1 year)





Cattle

Small ruminants



Plant A1	3/1/01	3/21/01	4/18/01	5/15/01	6/13/01	7/9/01	8/7/01	10/2/01	11/1/01	12/4/01	2/14/02	3/11/02	4/9/02	5/7/02	6/5/02	7/1/02	8/1/02	8/28/02	9/24/02	#####	12/2/02	#####
Raw Product																						
	L.spp	L.spp	1052A	1042B	-	1039A	1039C	1039C	-	-	1038B	L.spp	L.spp	L.spp	-	L.spp	L.spp	L.spp	1042C	1027A	1052A	1042B
	1 of 6	3 of 6	2 of 6	1 of 6	6 of 6	1 of 6	1 of 6	1 of 6	6 of 6	6 of 6	1 of 6	3 of 6	2 of 6	2 of 6	6 of 6	2 of 6	1 of 6	2 of 6	1 of 6	1 of 6	1 of 6	1 of 6
Raw Environment																						
E2: Drain	-	1043A	-	1052A	1045B	1045B	1039C	1039C	1043A	1043A	L.spp	1052A	1039C	1048A	1039C	1043A	1043A	-	1043A	1062A	1027A	1052A
E8: Apron	1062A	1062A	-	-	-	-	1052A	-	1043A	-	-	-	-	-	-	-	-	-	L.spp	1044A	-	-
Fillet knife						1043A																
Finished Enviroment																						
E1: Drain	1039C	1043A	1042B	1039C	L.spp	L.spp	L.spp	L.spp	1043A	L.spp	1043A	-	1043A			-	1043A	-	L.spp	-	1039C	1039C
E3: Drain	1043A	-	1043A	-	1043A	1039C	-	L.spp	-	1043A	1042C	1042C	1042C	L.spp	1043A	1042C		1043A	1052A	1038B	1052A	1052A
E4: Cooler Floor	1062A	L.spp	-	-	1043A	-	L.spp	L.spp	1052A	1043A	L.spp	-	-	L.spp	1052A	L.spp	-	-	-	1058B	-	L.spp
Floor								L.spp														
Floor mat											L.spp	1052A										
E6: Cart wheels	L.spp	1043A	-	1052A	1027A	1043A	L.spp	1043A	1043A	1052A	1052A	-	-	-	-	-	-	-	-	-	-	-
E5: Under Slicer	-	-	-	-	-	-	L.spp	L.spp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E9: Sliding Door	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Food Contact Surfaces																						
E7: Gloves	-	-	-	-	-	-	-	-	L.spp	1043A	-	-	-	-	-	-	-	-	-	-	-	-
E10: Slicer	-	-	-	-	-	-	-	-	-	-	1027A	-	-	-	-	-	-	-	-	-	-	L.spp
E11: Skinner	-	-	-	-	L.spp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1039C	-	-
E12: DeBoner	-	-	-	1042B	-	-	-	-	-	-	-	-	-	-	-	L.spp	-	1043A	1044A	1044A	1044A	1044A
E13: Sal. Table	-											L.spp	-	-	-	L.spp	L.spp	L.spp	-	-	1044A	-
Tubs-dirty									1062A													
Tubs-clean									1043A	1044A												
New Mixer																-	-	-	L.spp	L.spp	L.spp	-
New Table																-	-	-	-	-	-	-
Finished Product																						
	1 of 6	1 of 6	6 of 6	6 of 6	6 of 6	1 of 6	1 of 6	1 of 6	6 of 6	1 of 6	1 of 6	6 of 6	1 of 6	1 of 6	1 of 6	1 of 6	6 of 6	1 of 6	6 of 6	1 of 6	6 of 6	1 of 6
	L.spp	L.spp	-	-	-	1062A	L.spp	L.spp	-	1043A	1042C	-	L.spp	1042C	L.spp	1052A	-	L.spp	-	L.spp	-	L.spp

***L. monocytogenes* in retail environments**

- Subtyped 98 food and 40 environmental *L. monocytogenes* isolates collected from retail establishments in New York State between 1997 and 2002
 - Isolates collected from 50 different retail establishments were characterized.
- 16 retail establishments showed evidence for persistence of one or more specific *L. monocytogenes* strains as indicated by isolation of the same *EcoRI* ribotype from food and/or environmental samples collected in a given establishment on different days
- 17 ribotypes were found among human clinical isolates as well as among food and environmental isolates

Distribution of *Listeria monocytogenes* Molecular Subtypes among Human and Food Isolates from New York State Shows Persistence of Human Disease–Associated *Listeria monocytogenes* Strains in Retail Environments

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ABSTRACT

L. monocytogenes in retail environments - example

Est. Code	Source	Sample Description	Date Collected (No. isolates)	Ribotype	Persistent Ribotype (Lineage)
V	Food	Oven roasted turkey	08/17/00	DUP-1062A	DUP-1062A (II)
	Food	Smoked turkey breast	08/25/00	DUP-1062A	
	Environment	Swab; display cooler	08/29/00	DUP-1062A	
	Environment	Swab	08/29/00	DUP-1062A	
	Environment	Swab	08/29/00	DUP-1062A	
	Environment	Swab; deli case	09/21/00	DUP-1062A	
	W	Environment	Swab	10/27/00	
Environment		Swab	10/27/00	DUP-1053A	
X	Food	Ham	11/07/00	DUP-1042C	DUP-1042C(I)
	Environment	Swab	11/20/00	DUP-1042C	
	Environment	Swab	11/20/00	DUP-1042C	
	Environment	Swab	12/04/00	DUP-1042C	
	Environment	Swab	12/04/00	DUP-1042C	

On-going prospective study on *L. monocytogenes* in retail

- The goal of this project is to collect and test for LM environmental sponge samples from 120 retail establishments over 12 months (10 establishments/month)
 - in each month sponge samples are collected from 5 establishments where NYS Ag & Mkts collected sliced deli meats and from 5 establishments where NYS Ag & Mkts collected store made salads
- Sampling visits are part of NYS Ag & Mkts regular routine surveillance, only change is that environmental sponges will be tested in addition to scheduled food sample

Environmental samples collected

- Slicer *or* bowl, spoon, cutting boards, tables (e.g., utensils used to prepare salads)
- Sponge from deli case
- Sponge from sink interior in deli/salad area
- Drain in deli area
- Drain in raw meat area
- Drain in raw seafood area
- Floor in a dry isle
- Sponge from dairy case
- One sponge sample from wheels of 4 grocery carts (if no carts are available sponge sample from floor near store entrance will be taken)
- Two optional sponge samples, including, if possible, one sponge sample from a drain in the produce preparation area and one from a drain in a restaurant/café located in the retail operation

Subtyping results (completed for 16 stores with >1 LM positive sample)

- 5 stores: all different subtypes
 - One store with positive RTE salad had different subtypes in product and environment (deli sink)
- One store: drains in produce, seafood, and bakery area all same subtype
- One store: drains in raw meat and produce area, dry isle floor, and sink in deli area all same subtype
- One store: drain in raw meat and produce area same subtype
- One store: drain in raw meat area and sink in deli area same subtype

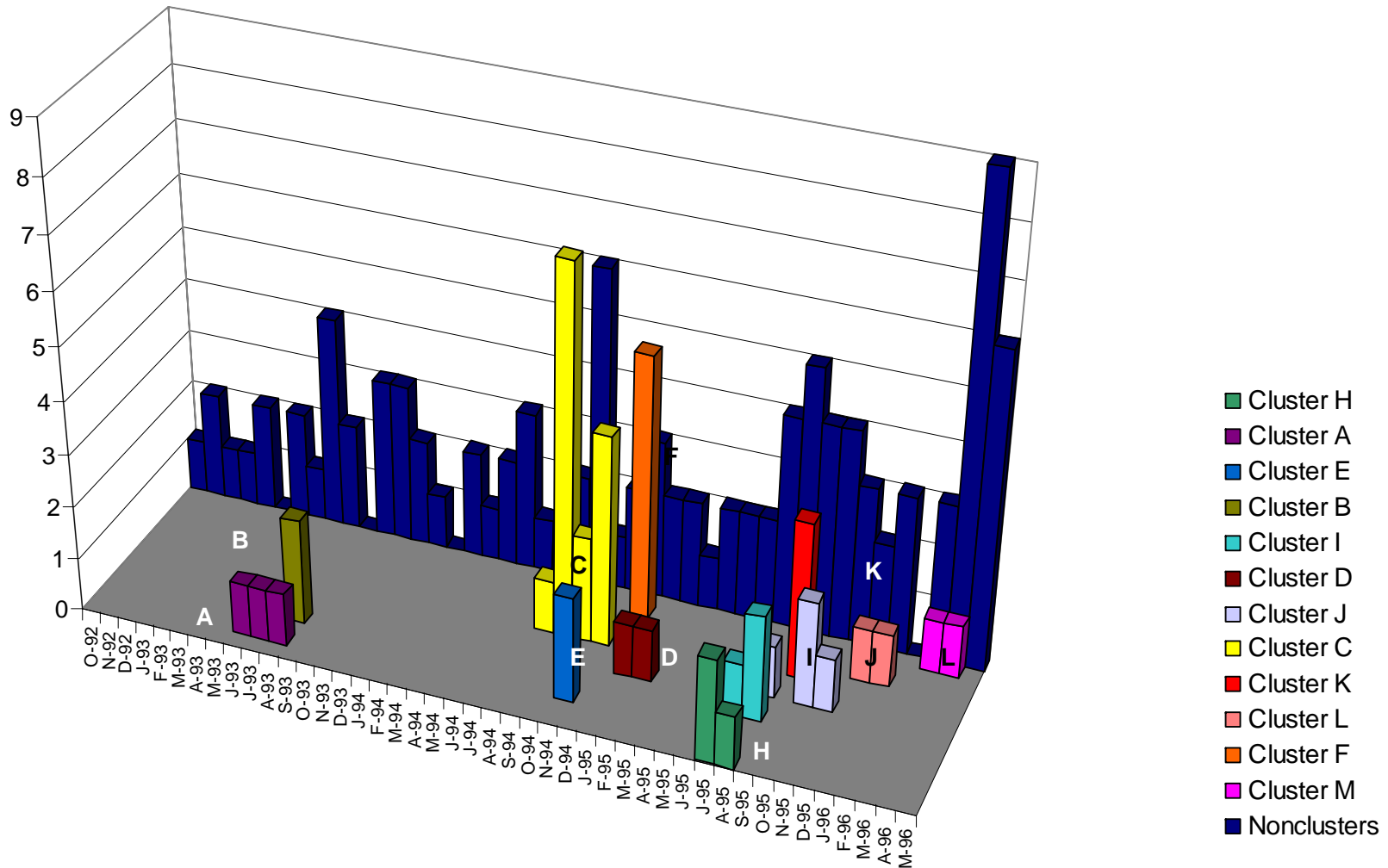
More subtyping results.....

- One store: floor in deli area and dairy case same subtype
- One store: shopping cart wheels and sink in meat area same subtype
- One store: shopping cart wheels and dry isle floor same subtype
- One store: shopping cart wheels produce prep area same subtype
- One store: floor drain in deli area and sink in deli area same subtype
- One store: deli salad utensils and sink in deli area same subtype
- One store: shopping cart wheels and sink in meat area same subtype
- **11 stores with same subtype in multiple sites**

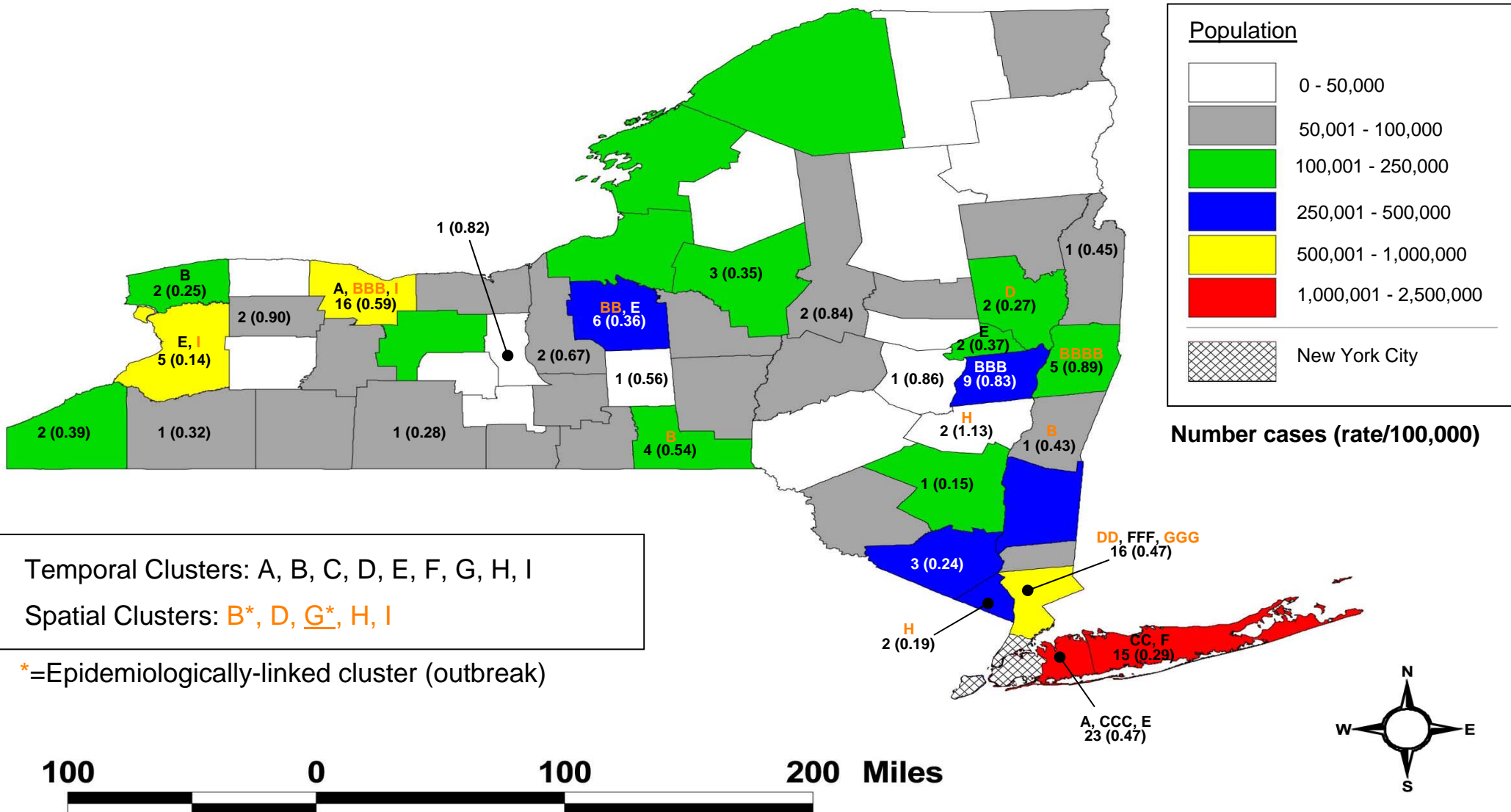
Human listeriosis?

- On-going subtyping of human listeriosis cases conducted in collaboration with NYS Department of Health and New York City Department of Health

Patterns of human listeriosis



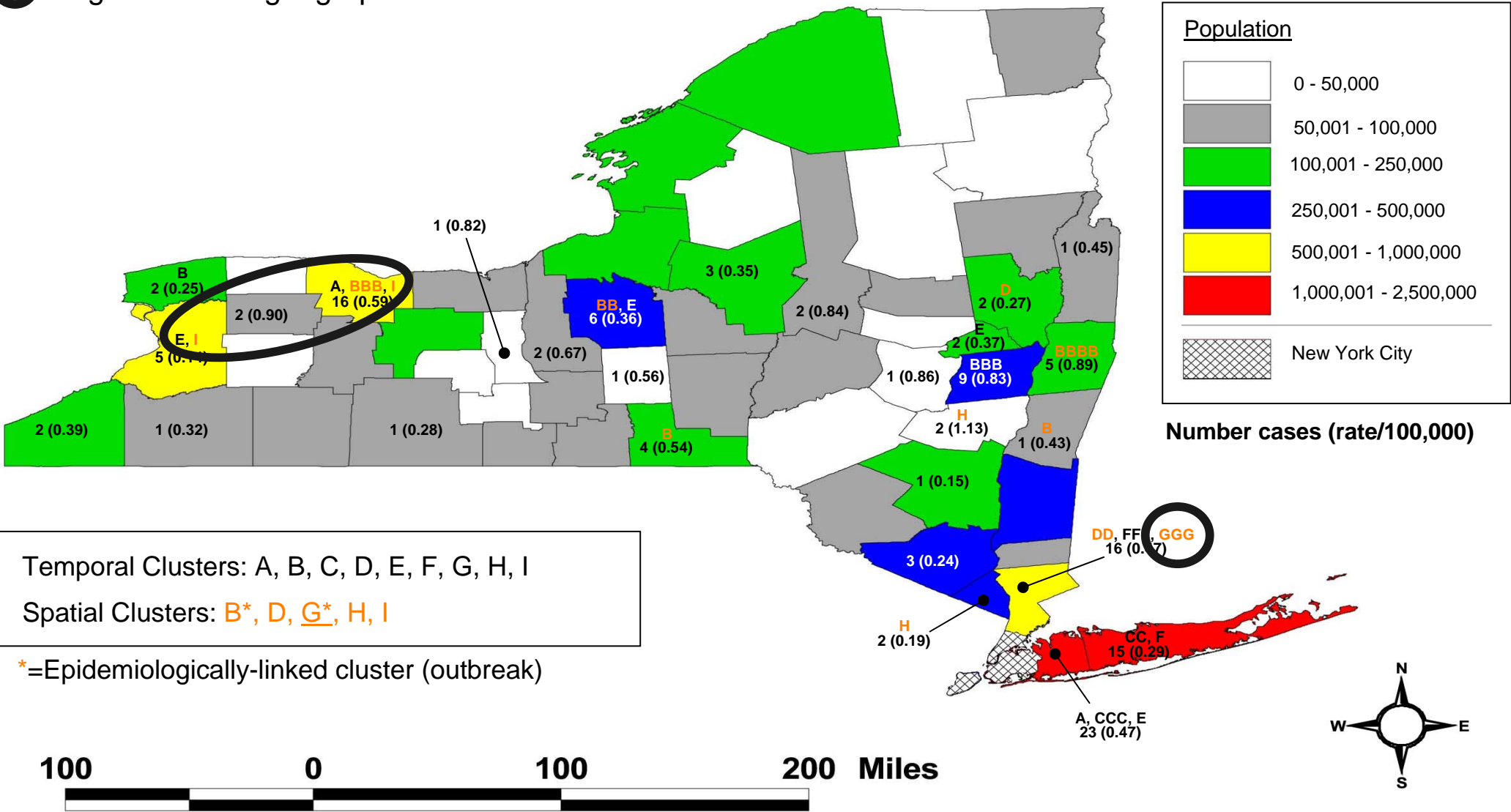
Geographic Distribution of Human Listeriosis Cases



Geographic Distribution of Human Listeriosis Cases

Example: Cluster G

○ Single localized geographic cluster



Summary and conclusions

- *L. monocytogenes*, including subtypes that have been linked to human disease, can persist in natural and urban environments, on farms, in food processing plant and in retail environments
 - Persistence is likely to also occur in other environments (e.g., restaurants, consumer homes)
- More human listeriosis cases than previously assumed may represent small outbreaks
 - Persistence in food chain is likely to be critical for occurrence of listeriosis outbreaks
- Lm contamination in retail operations appears to be dominated by positives in drain samples and multiple sample sites often have appear to have the same subtype
 - Improved sanitation procedures and procedures to reduce cross contamination can likely reduce risk of RTE product contamination

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