



**Food Safety and Inspection Service**  
U.S. DEPARTMENT OF AGRICULTURE

# Environmental Sampling: *Listeria monocytogenes* (Lm)

“Where’s the Bug?”

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# Agenda

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Part I. Overview and Background of *Lm*

Part II. *Lm* Sampling

Part III. *Lm* Outbreaks

Part IV. IVT and *RLm* Testing Results

# Part I. Overview and Background of *Lm*

# What is *Lm*?

Products and food contact surfaces (FCS) are often cross contaminated from environmental, non-food contact surfaces (NFCS).

A RTE, post-lethality, processing contaminant.

A pathogenic bacterium that causes listeriosis.

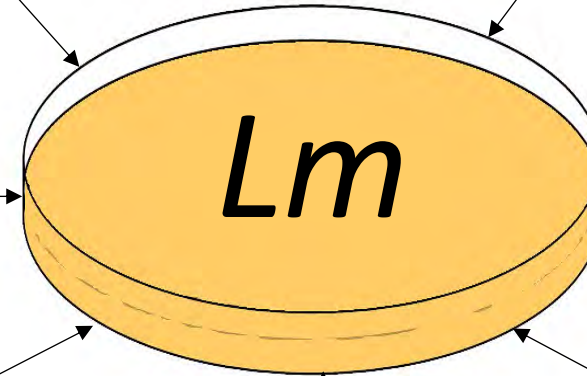
Forms biofilms which can't be seen and typically require scrubbing to remove.

A soil organism which is ubiquitous in the environment. Can be found everywhere!

Moisture facilitates growth, harborage, and cross-contamination.

Spread by water, dust, humans, etc.

Survives a wide variety of extreme conditions (heat, salt, nitrite, acidity).

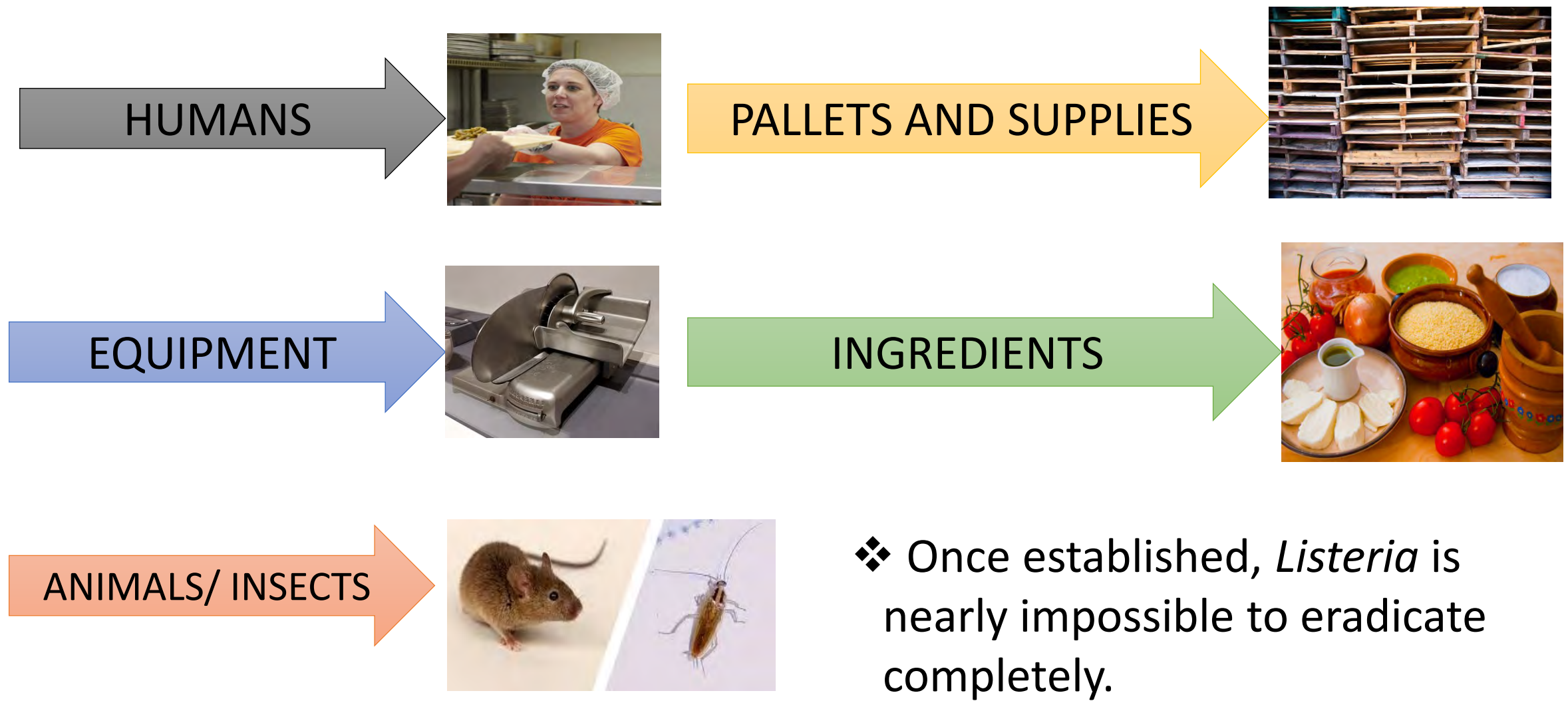


# Control of *Lm*

- Proper sanitation and traffic control.
- Use of a *Lm* control alternative, e.g., AMAPs or PLTs.
- Workers should follow GMPs, e.g., change gloves and aprons.
- Robust sampling of FCS and NFCS is ideal.



# How Does *Lm* Get Into Establishments



# How does *Salmonella* get into RTE products?

- Incidence of *Salmonella* in RTE products is much lower than *Lm*
- RTE products can be contaminated with *Salmonella*:
  - Under processing
  - Ingredients added after lethality (spices, sauces) – [Appendix A](#)
  - Cross contamination – e.g., by employees from raw ingredients.
  - Insect and animal vectors

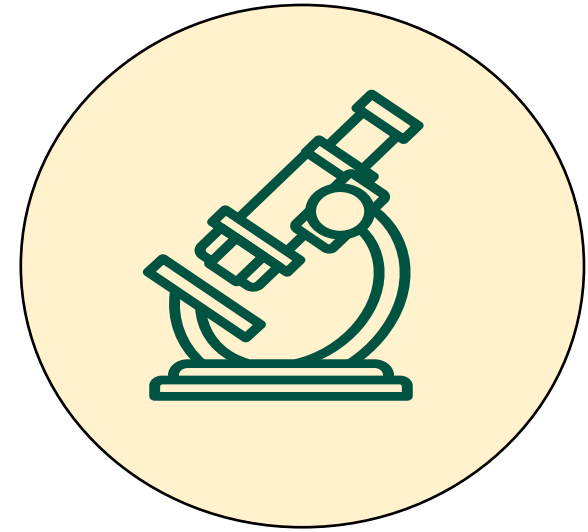


## Part II. *Lm* Sampling



## Lm Sampling

- Flow of people, supplies, ingredients, etc.
- Exposed product and FCS, post-lethality.
- Workers' hands and aprons.
- High contact areas (e.g., keypads, doorjambs, door handles).
- Moisture and condensation.
- Areas that may be overlooked during sanitation.
- Areas that are difficult to clean and sanitize effectively.



# Lm Sampling: Food Contact Surface (FCS)

- **FCS:** An area in the post-lethality processing environment that comes in **direct contact** with post-lethality exposed RTE product.

FCSs	FCSs: Cooking and Cooling	FCSs: Employees	FCSs: Packaging
<ul style="list-style-type: none"><li>• Tables</li><li>• Conveyor Belts</li><li>• Cutting Boards</li><li>• Blades of slicers, shredders, dicers, saws.</li><li>• Chutes and hoppers.</li></ul>	<ul style="list-style-type: none"><li>• Racks</li><li>• Pans</li><li>• Tubs</li><li>• Brine for chilling</li></ul>	<ul style="list-style-type: none"><li>• Utensils: knives, tongs, thermometers</li><li>• Aprons (touches product)</li><li>• Gloves/hands (touches product)</li></ul>	<ul style="list-style-type: none"><li>• Low priority</li><li>• Storage and handling of packaging material</li><li>• Film wrap</li><li>• Bags</li><li>• Soaker pads</li></ul>

## Lm Sampling: Food Contact Surface (FCS)

- Some pieces of equipment have both FCSs and NFCs
- Notate exactly where each sample was collected
- **Take good sampling notes**

### Activity



Question: Which part is an FCS area?

Answer: Employee hands, the blade, hopper, etc.

Question: Which part is a NFCS?

Answer: The slicer handle.

# Environmental, Non-Food Contact Surface (NFCS) Sampling

- **NFCS:** A surface that has no direct contact with exposed product.
- EIAOs may collect NFCS samples from any area where FSIS RTE product is processed, held, or stored.
- This includes other areas associated with post-lethality exposed, RTE processing, such as storage areas for spices, packaging, ingredients, etc.

# Environmental, Non-Food Contact Surface (NFCS) Sampling

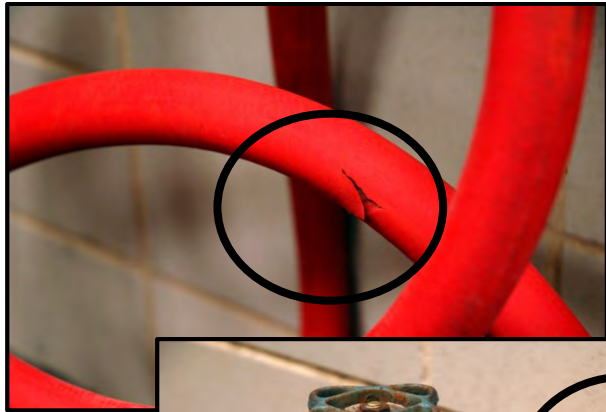
NFCSs

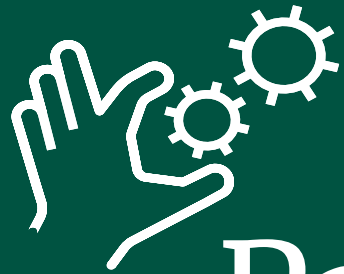
- Drains, floors, floor mats, boots, etc.
- Wheels of equipment, e.g., carts and pallet Jacks
- High contact areas, door jambs, knobs, etc.
- Anything associated with moisture or condensation: overhead surfaces, squeegees, drip pans, etc.

Collect near FCSs

- Handles, switches, and control panels
- Bottom and side edges of chairs or tables used by employees
- Equipment that overhangs product
- Sides or undersides of conveyers
- Oven smokehouse exit areas.

# NFCS Sampling Sites





# Part III. *Lm* Outbreaks

## Past Outbreak Related Positive RTE FCSs

SAMPLE	RATIONALE
Tray for deboned ribs	Extensive hand contact
Surface of portion scale	Extensive hand contact
Belt entering beef slicer (post op)	Index Sample
Top belt entering slicer (post op)	Index Sample
Slicer blades (post op)	Index Sample
Weighing bowl for sliced beef	Index Sample



## Past Outbreak Related Positive NFCSSs

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SAMPLE	RATIONALE
Wet spots at floor/wall junction	Possible harborage
Underside of rib deboning table	Sanitation overlooked
Condensation	Possible harborage
Freezer door jamb	Common contact point
Electrical Switches	Common contact point
Drains	Possible harborage
Table that trays pass over	Sanitation overlooked
Door jamb gap between door and wall	Possible harborage

# Construction in the Plant

- Bil Mar Foods Facility, Michigan: 11 states, 50 illnesses, 6 deaths, 2 spontaneous abortions.
  - Demolition of a refrigeration unit increased environmental contamination.
  - Condensation falling from overhead pipes and the ceiling onto exposed product.
  - 35 million pounds of hot dogs and deli products were recalled.
- Plantation Foods, Texas: 10 states, 29 illnesses, 4 deaths, 3 miscarriages or stillbirths.
  - Construction of the walls and floors.
  - Walls harbored *Lm* (led to cross-contamination).
  - 16.7 million pounds of products recalled.
  - Deli turkey meat probable source of infection.

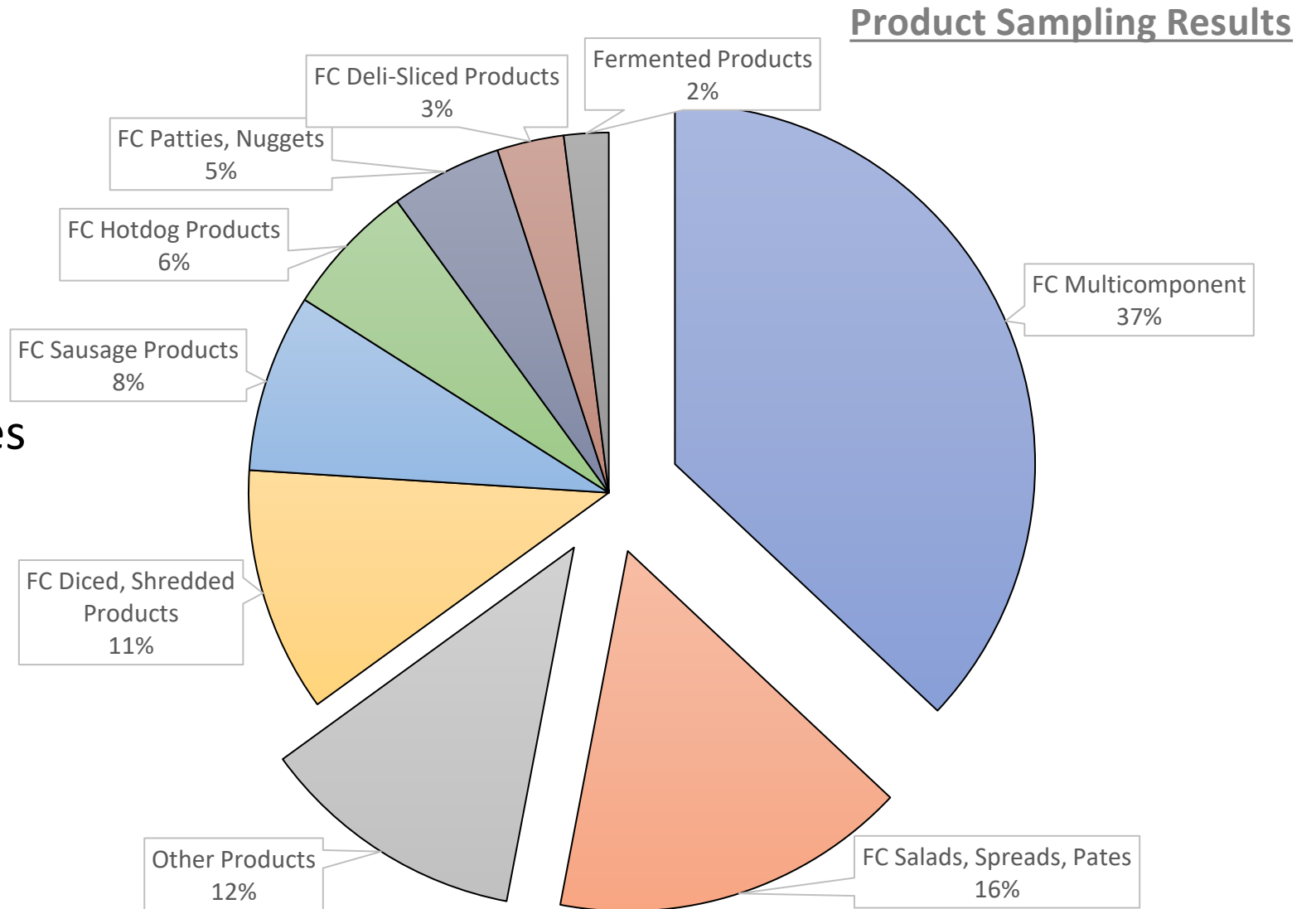
[Controlling \*Listeria monocytogenes\* in Post-lethality Exposed Ready-to-Eat Meat and Poultry Products](#) (Construction pp. 76 – 77)

# Part IV. IVT and RLM Testing Results



# IVT Product Results (2005-2014)

- Products with the most positive results:
  - FC Multicomponent Products
  - Salads, Spreads, Pâtés



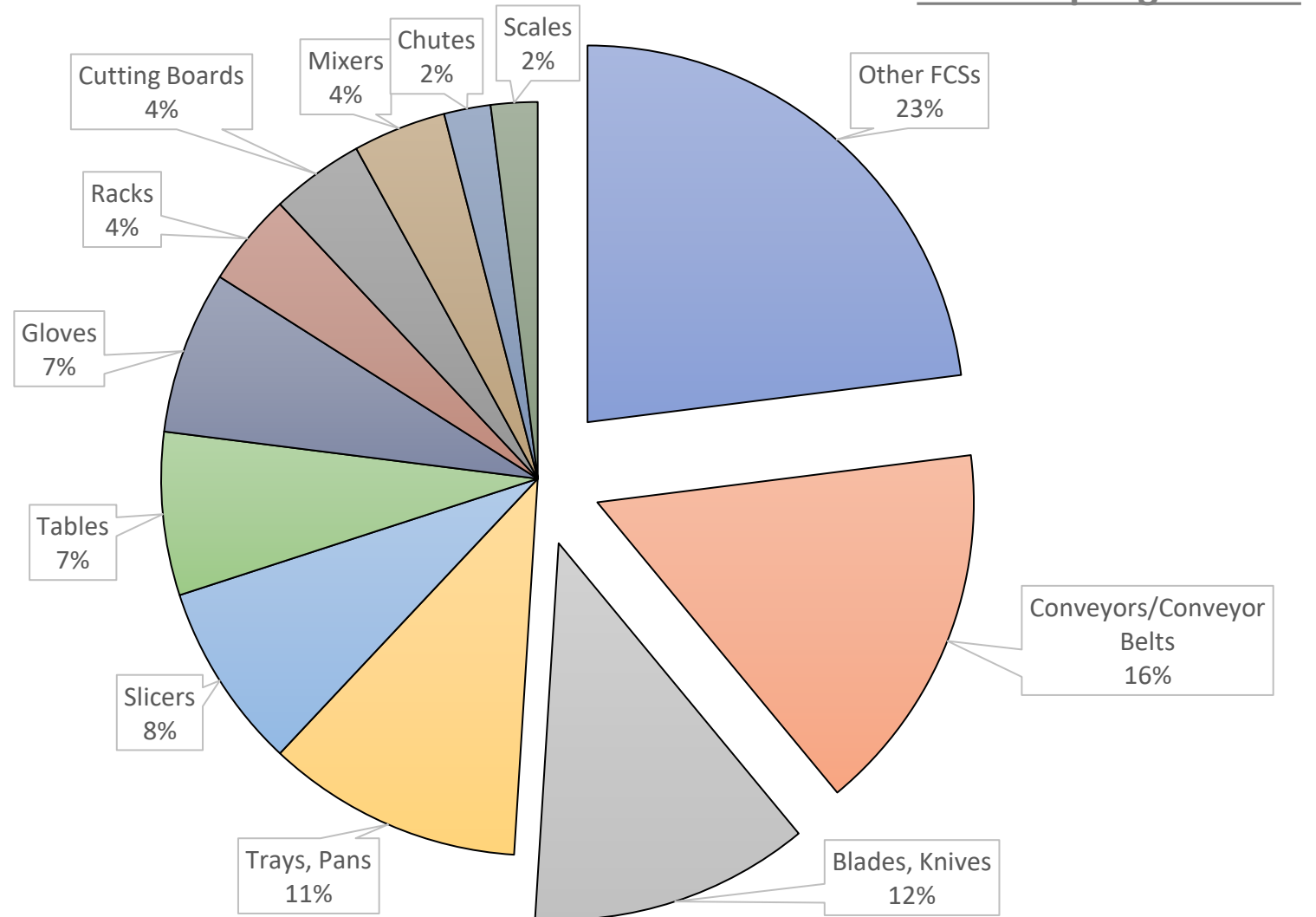
FC = fully cooked

Other = individually have not come up positive often or are not sampled often

# IVT FCS Results (2005-2014)

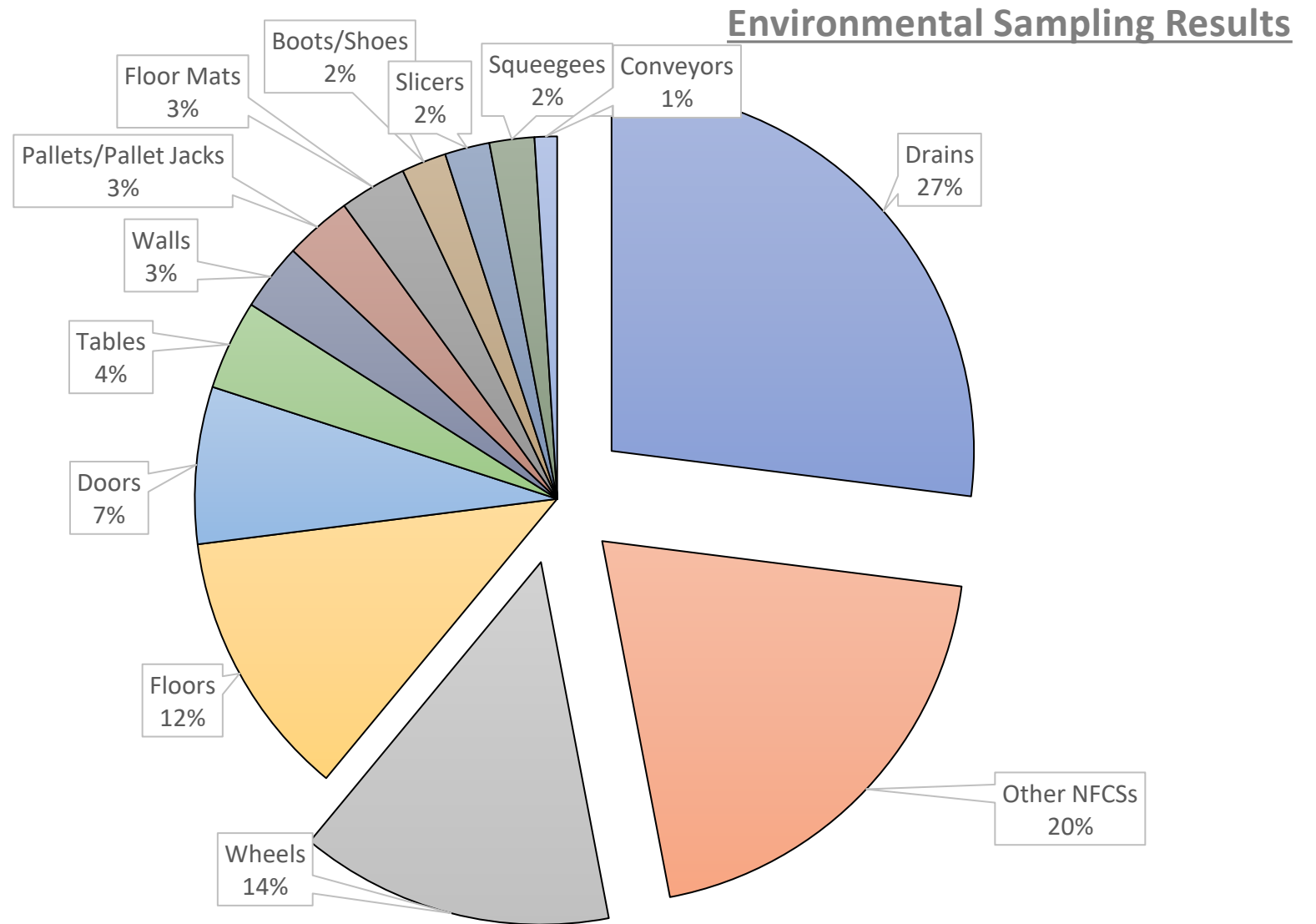
- FCSs with the most positive results:

- Conveyors/Conveyor Belts
- Blades, Knives



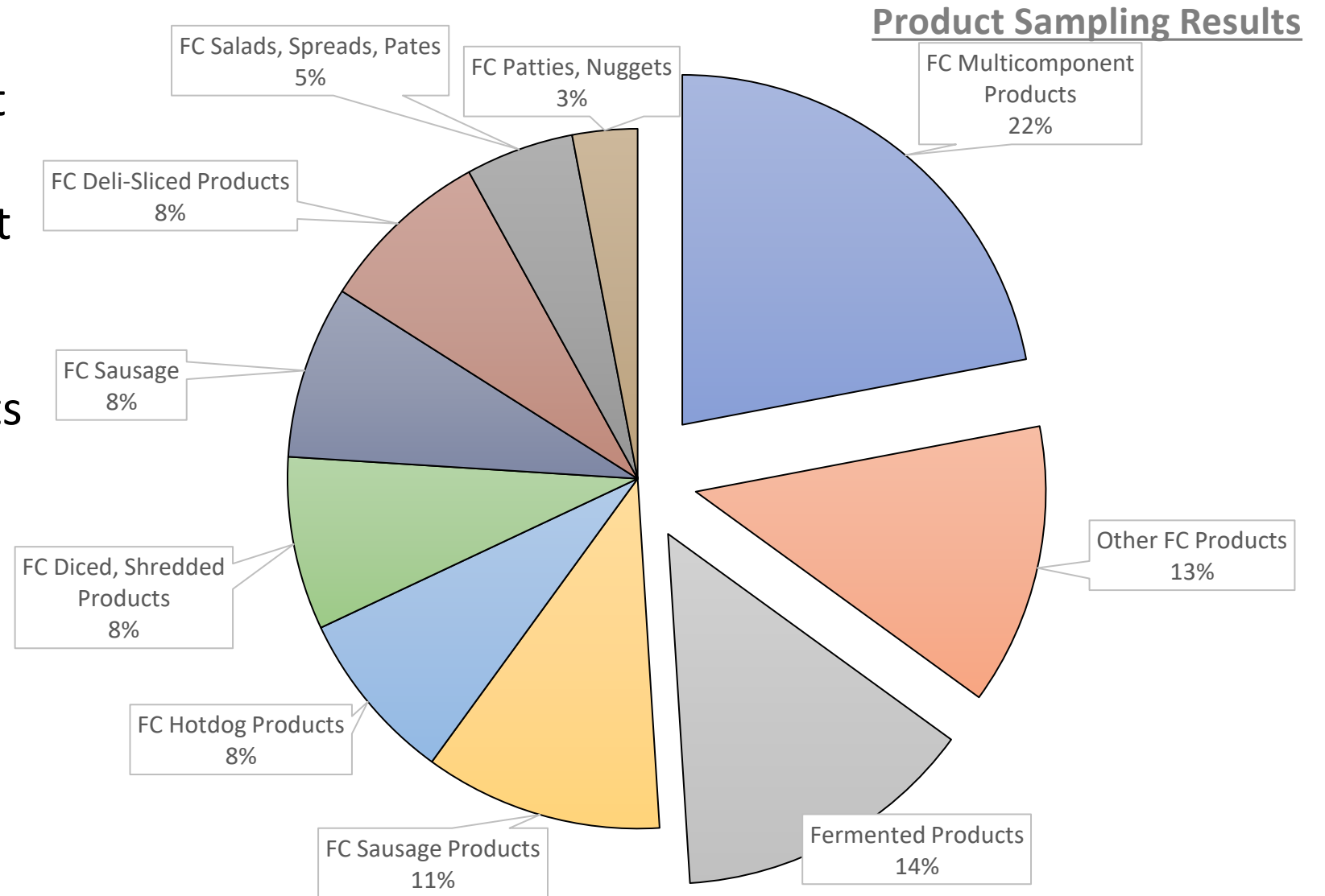
# IVT NFCS Results (2005-2014)

- NFCs with the most positive results:
  - Drains
  - Wheels
  - Floors



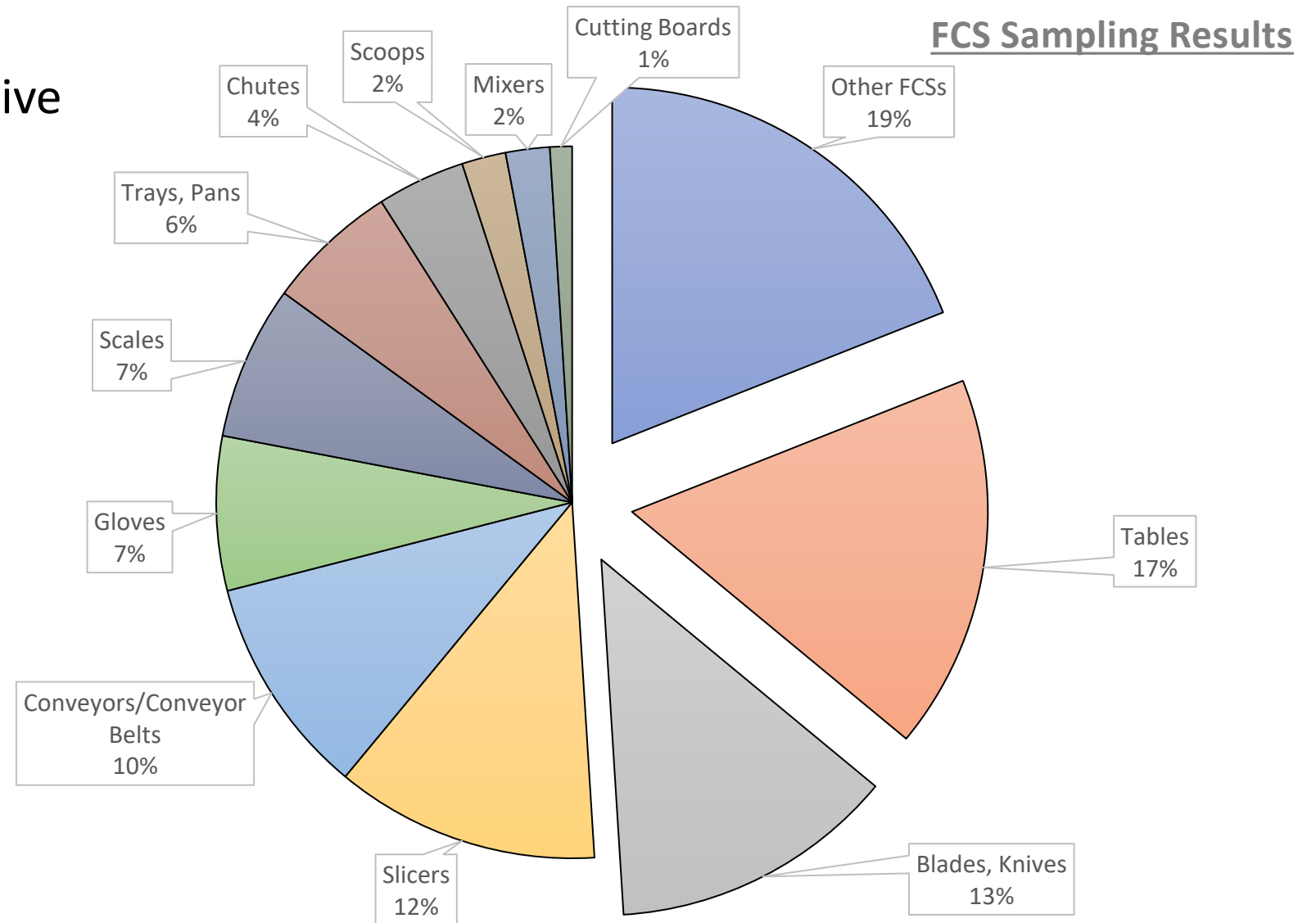
# RLm Product Results (2006-2014)

- Products with the most positive results:
  - FC Multicomponent Products
  - Other FC Products
  - Fermented Products



# RLm FCS Results (2006-2014)

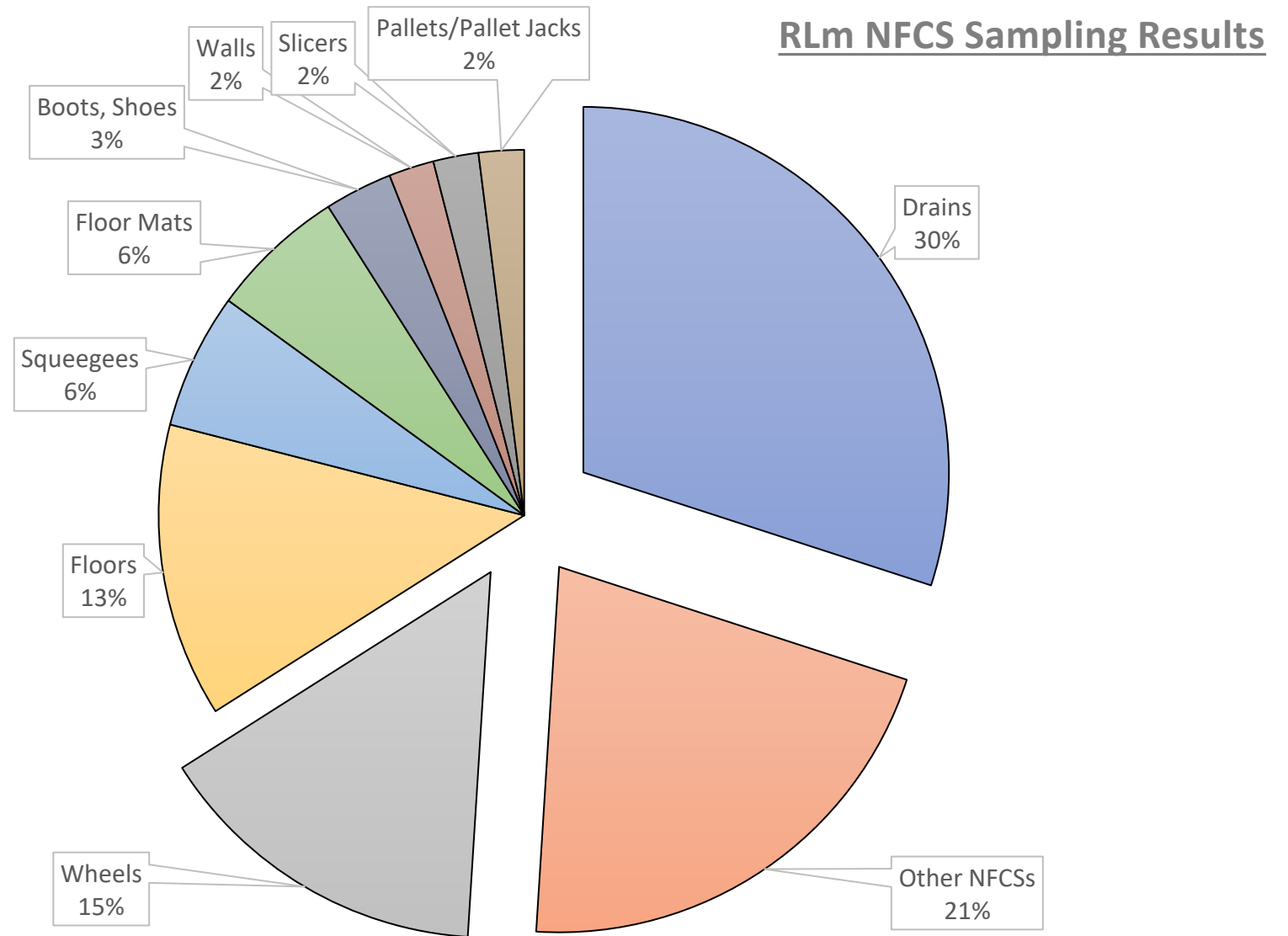
- FCSs with the most positive results:
  - Tables
  - Blades, Knives





# RLm NFCS Results (2006–July 2009)

- NFCS locations with the most positive results:
  - Drains
  - Wheels
  - floors



# Take-Aways



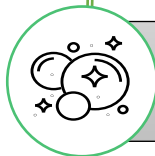
*Lm* survives a wide range conditions. Moisture facilitates growth and cross contamination.



*Lm* is known to form biofilms which can't be seen, require scrubbing to remove.



Establishments should control *Lm* through sanitation, traffic control, GMPs, etc.



Anything brought into the post-lethality RTE environment should be thoroughly cleaned and sanitized.



Construction in the RTE area is high risk for *Listeria* contamination.



Take good sampling notes that describing what and where the sample was collected.

Questions??



QUESTIONS