



United States Department of Agriculture

One Team, One Purpose



# Food Safety and Inspection Service

Protecting Public Health and Preventing Foodborne Illness



Food Safety and Inspection Service:

# WGS for Food Safety Management: FSIS Perspective

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# Food Safety and Inspection Service:

## **FSIS Mission**

- FSIS is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and processed egg products is safe, wholesome, and correctly labeled and packaged
- Regulates more than 6,000 slaughter and processing establishments nationwide
- Verifies safety of approximately 100 billion pounds of product annually



## Food Safety and Inspection Service:

### **Whole Genome Sequencing at FSIS: Benefits**

- **Improved resolution for foodborne illness investigations**
  - Improved strain discrimination, illness cluster detection, and case classification
- **Supports FSIS mission goals**
  - Effectively use science to understand foodborne illness and emerging microbiological trends
  - Identification of environmental harborage or recurrences of pathogens in FSIS-regulated establishments/products to further support the inspection and verification process
- **Alignment of pathogen surveillance with our domestic public health and regulatory partners**
  - Collaborative efforts with US Food and Drug Administration Center for Food Safety and Applied Nutrition (FDA-CFSAN), the US Centers for Disease Control and Prevention (CDC), the US National Institutes of Health National Center for Biotechnology Information (NCBI), and also state/local health partners/laboratories

## Food Safety and Inspection Service:

### **WGS at FSIS: WGS sequences uploaded to NCBI**

#### ***USDA-FSIS isolates Uploaded to NCBI by organism***

**Total = 2,588**

*Salmonella* spp. = 1,396

*Listeria monocytogenes* = 473

*Campylobacter* = 502

STEC = 217

#### ***Uploads to NCBI SRA by any lab***

*Salmonella* spp. = 52,179

*Listeria monocytogenes* = 9,901

*Campylobacter* = 16,346

*Escherichia coli* = 31,670

\*Numbers as of 2/17/16

## Food Safety and Inspection Service:

### **WGS at FSIS: Current Status and Short Term Plans**

- FSIS continues to build capacity for WGS of isolates obtained from FSIS sampling programs
  - Expect full capacity with 6 sequencers by FY 2017
  - Goal is to sequence around 5000 isolates per year
- FSIS considers available WGS analyses in addition to PFGE and epidemiological information to further understand the relationship between clinical and food isolates
- FSIS is part of an interagency collaboration with CDC, FDA, and NCBI (**Gen-FS**) to harmonize efforts for implementation of WGS for food safety purposes within the US

## Food Safety and Inspection Service:

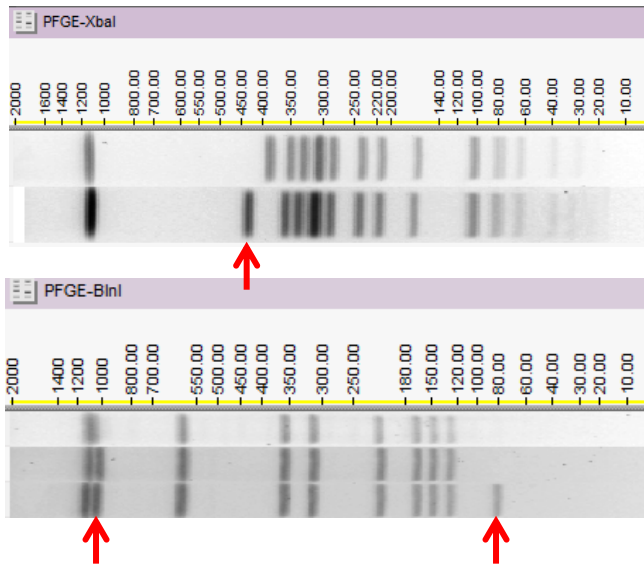
### **WGS at FSIS: Future Possibilities**

- **BAX speciation**
  - *Campylobacter*
- **Molecular Serotype**
  - *Salmonella*
- **Pulse Field Gel Electrophoresis**
  - *Salmonella*
  - *Campylobacter*
  - Adulterant STECs
  - *Listeria monocytogenes*
- **Antimicrobial Susceptibility Testing**
  - *Salmonella*
  - *Campylobacter*
  - *E. coli*
  - *Enterococcus*

**A single WGS workflow  
could potentially  
consolidate all analyses**

# Food Safety and Inspection Service:

## Example: Retrospective WGS analysis



Primary pattern A

Primary pattern B

Secondary pattern C

Secondary pattern D

Secondary pattern E

- FSIS food and environmental samples from one investigation were compared to clinical isolates with an epidemiological link to the establishment where sampling occurred
- The isolates from the investigative sampling had 2 different primary PFGE patterns and 3 different secondary PFGE patterns
- WGS was able to show high similarity (0-5 SNP differences) between differing primary PFGE patterns and primary/secondary combinations

- FSIS1pork -A/C
- FSIS2pork-A/D
- FSIS3pork -A/D
- FSIS4env -A/D
- FSIS5env-A/E
- FSIS6pork - A/C
- Clinical 1 - A
- FSIS7env - A/D
- FSIS8pork - A/D
- FSIS9env - B/C
- Clinical 2 - A
- Clinical 3 - A
- FSIS10pork-A/D
- FSIS11pork-A/C
- FSIS12pork-A/C
- FSIS13pork-A/D
- Clinical 4 - A
- FSIS14pork-A/D
- Reference

0-5 SNP

94-105  
SNP



Food Safety and Inspection Service:

**Questions?**



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