# Emerging Issues In Food Irradiation

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# Seafood Safety

- Seafood accounts for more foodborne illness outbreaks than any other food group.

  CSPI. 2008. Available at: http://www.foodproductiondaily.com/Quality-Safety/Fish-and-shellfish-cause-most-foodborne-illness-outbreaks-CSPI

- In the EU, food safety alerts due to contamination of seafood by pathogenic bacteria were more frequent than with meat, poultry, or produce.

  Wan Norhana et al. (2010) Food Control 21: 343-361

# U.S. Consumption

- Americans, on average, consumed approximately 16 lbs of seafood in 2008.
- The majority of seafood in the United States is sold on the frozen form.

VanVorhees, D. 2008. Fisheries of the United States. National Marine Fisheries Service, Office of Science and Technology. Pritchard, E. (Ed.). 118p. Available at: http://seafood.nmfs.noaa.gov.

- Seafood quarantined for *Salmonella* contamination by the U.S. FDA:
  - shrimp 58%
  - tilapia 4%,
  - catfish 2%
  - lobster 5%,
  - squid 3%

  Ref: VanVorhees, D.  2008.

- Salmonella and Listeria contamination common for shrimp, often antibiotic resistant.

- A petition was filed by the National Fisheries Institute (2001) with the U.S. FDA to allow irradiation of crustaceans, which is currently under review.

- Prevention of post-harvest loss of seafood a global priority according to IFT Seafood and Aquaculture Division (IFT-2010).

# Advantages of Seafood Irradiation

- Irradiation is convenient following freezing process.
- Seafood is very low fat, therefore the 2-alkylcylcobutanones not an issue.
- Many fish and crustacean products are value added products.
- Allowed in many countries.
- However, there is a lack of radiation D-10 value information for foodborne pathogens on frozen seafood products (Arvanitoyannis et al, 2009).

# Procedure

- Multi-isolate cocktails of *Salmonella*, *S. aureus*, and *Listeria monocytogenes*.
- Surface-inoculated onto 10g of seafood.
- Flash frozen and maintained at -20C
- Irradiated (-20C)
- Cs-137 Irradiator with temperature control.
- Samples processed to determine D-10.
- Reciprocal of slope as described by Diehl.

# Pathogen D-10 Values on Seafood

| **Seafood** | ***L. monocytogenes*** | ***S. sureus*** | ***Salmonella spp.*** |
|---|---|---|---|
| Scallops | 0.52 (0.05) | 0.56 (0.04) | 0.61 (0.06) |
| Lobster(Cold Water) | 0.66(0.03) | 0.71 (0.04) | 0.70 (0.04) |
| Lobster(Warm Water) | 0.55 (0.02) | 0.62 (0.03) | 0.63 (0.01) |
| Maryland Blue Crab | 0.58 (0.01) | 0.62 (0.01) | 0.61 (0.02) |
| Squid | 0.56 (0.03) | 0.63 (0.03) | 0.62 (0.03) |
| Octopus | 0.48 (0.02) | 0.53 (0.01) | 0.47 (0.04) |
| Swordfish | 0.51 (0.01) | 0.55 (0.01) | 0.61 (0.01) |
| **Mean D-10** | **0.55(0.03)** | **0.60 (0.03)** | **0.61 (0.03)** |
| **Ground Pork** | **1.26 (0.01)** | **0.94 (0.01)** | **1.18 (0.01)** |

# Future Work

- Inactivation and growth models to be incorporated into the USDA-ARS Pathogen Modeling Program.
- Irradiation in combination with antimicrobials (phosphates, organic acids, etc.)
- Post-irradiation storage studies (6-12 months, -20C)
- Heat sensitivity of bacteria following irradiation, freezing, and thawing.