

Crab HACCP: An Update

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Processing Overview

- Three Market Forms

- Fresh
- Pasteurized
- Frozen

Cook → Air Cool → Refrigerate → Hand Pick
→ Pack → Box with ice
→ Seam → Pasteurize → Refrig. Storage

The U.S. blue crab processing industry is based in the mid-Atlantic and Gulf. Extension and Sea Grant programs in these states have worked closely with federal and state regulatory agencies to assure uniform guidance when advising industry. However, some inconsistencies have occurred leading to confusion. The simplified flow diagram in this slide depicts a typical mid-Atlantic process for fresh and pasteurized crabmeat.

High Risk Product

- Ready to Eat
- Cooked First, Then Handled
- Listeria Risk Assessment
- *Clostridium botulinum* – Pasteurized

And Yet –
Excellent Safety Record

Crabmeat products are ready-to-eat and are considered to be high risk. Ample opportunity exists for post-cook contamination due to the level of handling they receive. Potential pathogens, such as *Listeria monocytogenes* and *Staphylococcus aureus* in fresh crabmeat and *Clostridium botulinum* in pasteurized products, warrant prudent controls. It is important to recognize, however, that these products have had an excellent safety record over their long history.

Tri-state Seafood HACCP Committee

- Need to Standardize HACCP Expectations
- Reviewed Potential Hazards and Industry Practice
- Developed Model HACCP Plans
- Met with FDA and Revised
- Basis of Most Crab HACCP Programs in Mid-Atlantic

The Tri-state Seafood HACCP Committee was established in 1997 to assist industry and regulators with the uniform implementation of HACCP. The committee is composed of representatives from state health regulatory agencies and university faculty from Virginia, Maryland and North Carolina. A set of model HACCP plans were developed for the mid-Atlantic industry and were discussed with the U.S. Food and Drug Administration, Office of Seafood. These models became the basis for most crab processing HACCP plans in the mid-Atlantic. They do not address processing procedures and controls used by the Gulf of Mexico blue crab industry or processors of other crab species.

Tri-State Recommendations

- CCPs
 - Fresh
 - Cooking – default C.L.s
 - Time crabs/meat at room temperature
 - Storage
 - Pasteurized
 - Seams / Seals
 - Thermal process schedule
 - Refrigerated storage

In the Tri-State model for fresh crabmeat, critical control points are identified for cooking, the maximum time that cooked crabs and crabmeat are held at room temperature during processing (3.5 hours) and storage temperature (presence of ice or maximum cooler conditions of 40°F for 6 hours). Conservative, default critical limits are provided for cooking (time and temperature) in retorts and atmospheric steamers when a schedule has not been established by a process authority. The pasteurization model identifies CCPs for package integrity, time-temperature thermal process (to meet national standards) and refrigerated storage (maximum of 50°F for 4 hours).

FDA Recommendations

- Hazard Guide similar to Tri-state
 - Atlantic and Gulf models for –
 - Crabs backed at time of picking
 - Post-cook cooling – no CCP
 - Crabs backed warm before cooling
 - Cooling time/rate -- CCP

The FDA Fish & Fishery Products Hazards & Controls Guide identifies HACCP plans for typical blue crab processing facilities in the mid-Atlantic and Gulf. The mid-Atlantic model is similar to the Tri-state model in that no CCP is identified for post-cook cooling. Experience and in-plant studies indicate that little recontamination occurs when crabs are held in their original cooking baskets until the meat is picked. According to FDA, the Gulf process of removing the backs and viscera before the crabs are fully cooled requires HACCP controls at this step.

FDA Recommendations

- Exceptions -- FDA now expects
 - Another CCP for pasteurized
 - Chlorination of cooling water
 - Lower storage C.L. for pasteurized
 - Continuous monitoring for refrigerated storage

Current FDA guidance does not fully agree with the Tri-state recommendations. This requires a new look at the Tri-state models. FDA now expects that chlorination of pasteurizer cooling water be monitored under HACCP, not under the company's sanitation program, as the Tri-state previously recommended. Some individuals also interpret the Hazard Guide as requiring a critical limit of 40°F, not 50°F, in the pasteurized product storage cooler. This requires clarification from the agency. Pasteurization eliminates non-proteolytic *C. botulinum* and proteolytic types do not grow below 50°F. Also, storage temperatures must be monitored continuously rather than manually, as previously recommended.

Maryland Study Md. Dept. Health, U. Maryland, Industry

- Objective
 - Determine the effect of processing method on bacterial contamination and growth

Field studies conducted by researchers at Virginia Tech, University of Maryland, North Carolina State University, and Louisiana State University generally indicate that bacteria grow slowly in crabmeat, suggesting that some HACCP plans may be excessively conservative with respect to pathogen growth. Also, Gulf coast processors are not represented by the Tri-state models and have questioned the need for a more extensive HACCP plan than is required of mid-Atlantic processors. A study was initiated by the Maryland Department of Health and Mental Hygiene, the University of Maryland and the Maryland blue crab industry to determine the effect of various processing methods on bacterial contamination and growth.

Maryland Study

- All crabs received same retort cook.
- Process 1
 - Air cool 4 hrs.
 - Refrigerated overnight
 - Backed, picked and packed in 4 hrs.
 - Iced storage

Crabs were placed in five screen-mesh cages and pressure cooked at a Maryland processing plant to achieve the minimum heat exposure required by the Maryland Health Department ($F_{235}15=1.0$ minute). Each of the five sets of crabs were cooled and picked following different schedules. Process 1 is listed here. This is a typical mid-Atlantic process except that extended time periods were used for air-cooling and picking/packing. These times were selected to test the appropriateness of proposed changes to state health regulations.

Maryland Study

- Process 2
 - Air cooled 2 hrs.
 - Backed, picked and packed in 4 hrs.
 - Iced storage

Crabs in the second process were not refrigerated prior to picking. Rarely, crabs are not fully chilled prior to processing.

Maryland Study

- Process 3
 - Air cooled 2 hrs.
 - Backed and washed (held 2 hrs.)
 - Refrigerated overnight
 - Picked and packed in 4 hrs.
 - Iced storage

Crabs in process 3 were air-cooled, debacked and washed with tap water, held at room temperature for two hours, refrigerated, then picked over a period of four hours before icing (six hours total at room temperature after backing).

Maryland Study

- Process 4
 - Air cooled 2 hrs.
 - Backed and washed (held 2 hrs.)
 - Picked and packed in 2 hrs.
 - Iced storage

Process 4 was similar to process 3 except that crabs were picked warm and packed in two hours (four hours total at room temperature after backing).

Maryland Study

- Process 5
 - Chilled in ice slush 10 min.
 - Backed and washed (held 2 hrs.)
 - Refrigerated overnight
 - Picked and packed in 4 hrs.
 - Iced storage

Process 5 involved submerging the hot crabs directly in ice slush, backing/washing, holding at room temperature for two hours, refrigeration, then picking over a period of four hours before icing (six hours total at room temperature after backing).

Maryland Study Preliminary Results

- Aerobic Plate Counts unaffected by process or 4 days of storage
- A few coliforms in process #5
 - crabs cooled in ice slush
- No *Staphylococcus aureus*

Findings consistent with Va. Tech studies

A single employee hand-picked the meat for each of the treatments using common commercial sanitation procedures. Crabs and crabmeat were analyzed for aerobic plate count (35°C), total coliforms, fecal coliforms and coagulase positive *Staphylococcus aureus* at intervals during processing and after four days of iced storage. All five treatments produced similarly low levels of contamination (approximately 3,000 cfu/g APC). These numbers did not increase after four days. This study represents a single trial and no statistical analysis has been performed. Although not conclusive, this preliminary trial adds to existing evidence that lag phases are long for mixed microflora on blue crab meat. The study will be triplicated.