UNC-SG-13-09

Sea Grant North Carolina BLUEPRINTS

NORTH CAROLINA SEA GRANT NC STATE UNIVERSITY BOX 8605 RALEIGH, NC 27695-8605

Value-Added Technology

Developing a Smoked Soft Crab

By Joseph Smith, Barry Nash, Marc Turano and Willy Phillips

In 2012, North Carolina had nearly 290 Atlantic blue crab-shedding operations. Together, they produced around 326,000 pounds of soft crabs in 2012. Production is typically dependent on seasonal availability and the weather (Turano et al., 2013).

Currently, most North Carolina soft blue crabs are shipped to live markets in Washington, D.C., Baltimore and New York. However in recent years, imports of soft crabs have begun displacing domestic product, leading to lower prices for local producers. Traditionally when supply exceeded demand and prices weakened, producers cut and froze soft crabs for resale during the winter months when fresh product was unavailable. Revenues were strong during this time. The influx of imported soft crabs, however, has increased price volatility during a once-stable winter market.

Smoking Soft Crabs

To become more competitive with importers, Full Circle Crab Company devised a smoking process to enhance the flavor and texture of soft crabs. For more information on the actual process, read the project report at *www.ncseagrant.org/s/smokedcrabs*. A brief description follows.

First, fresh soft crabs were cleaned by removing the face (cutting across the body just behind the eyes), the apron and the attached vein, as well as the gills.

Next, the crabs were packaged in resealable plastic food-storage bags containing a wet brine solution. The bags were covered with ice and refrigerated for 30 minutes.

After this brining, the crabs were washed and allowed to drain. The crabs then were layered on stainless-steel sheet pans, covered with plastic wrap and allowed to air dry for one hour under refrigeration.

After testing other options, the crab processor chose applewood as the principal flavoring agent because its mild smoke did not overpower the natural taste of the crab. Air flow through the smoker-cooker was regulated by a horizontal sliding valve, known as a damper, located on top of the unit.

The cook cycle also was designed to maintain the internal temperature of the crabs at a minimum of 145 F for at least 17 minutes to destroy viable *Listeria monocytogenes*, as specified on page 422 of the fourth edition of the U.S. Food & Drug Administration's *Fish and Fishery Products Hazards and Controls Guidance*.

A North Carolina seafood seller smoked soft crabs to enhance their flavor and texture — and stabilize the selling price. Photo: Vanda Lewis

After cooking/smoking, the soft crabs were air dried at room temperature. The crabs then were placed two to a tray, vacuum packaged in oxygen-permeable, flexible film, and placed in a blast freezer to harden.

Consumer Feedback

The producer conducted two consumer evaluations before taking the smoked crabs to market: an informal sensory panel and a consumer sensory evaluation at a university-based sensory service center.

Small-Scale Consumer Evaluation

For the informal sensory panel, 12 panelists who enjoyed eating soft crabs and smoked or smoke-flavored foods were selected. Their feedback was used to adjust processing parameters and optimize the smoked soft crab's overall sensory characteristics.

Panelists were instructed to rinse their mouths with water, sample the crab, then rinse their mouths again with water

before consuming more samples. On their score sheets they were instructed to rate flavor, texture, color and appearance according to a seven-point scale, ranging from 7 for excellent to 1 for unacceptable. Scores of 5 or higher were considered acceptable.

In Trial I, the average numerical score for each of the four sensory attributes tested was in the range of 5 to 6, or "Good" to "Very Good." However, product likes and dislikes were split along gender lines. Women judged the smoke flavor to be too strong and the salt level too high, whereas males deemed the smoke flavor and salt level to be adequate or just right. Some panelists also noted the texture was too soft, wet or "mushy."

To address saltiness, the amount of dry salt in the brine was reduced, as was the amount of time the product marinated in the brine. The intensity of the smoke flavor was reduced by opening the damper more to increase air flow through the smoker-cooker. Increasing the air flow also pulled more moisture from the crabs, thereby lessening the wet or soft texture. The comments from Trial II indicated the panelists who were critical of the saltiness and smoke flavor in Trial I noted a favorable reduction in both.

Trial III confirmed the results of the second sensory evaluation could be duplicated. Panelists again rated the flavor, texture, color and appearance of the product as "Good" to "Very Good," and the level of smoke and salt flavors appealed equally to both men and women.

Larger-Scale Consumer Evaluation

The producer then conducted an evaluation at the Sensory Services Center at North Carolina State University's Department of Food, Bioprocessing and Nutrition Sciences. Smoked soft crabs were served to 125 panelists recruited from the campus who enjoyed eating crabmeat and were willing to taste the product. Panelists first read a concept statement and evaluated the product visually relative to the concept description. Then they were instructed to rinse their mouths with water, taste the crab, and rate its freshness, saltiness, smoke flavor and texture.

Panelists really liked the product concept. It scored 7.1 on a nine-point preference scale. It was judged as being highly unique as is, and also compared to deli meat. The desire to purchase before tasting also was high.

Panelists liked the color of the product, with a majority saying the color was optimal or "just about right." The appearance of the product, relative to the concept statement, was judged as "having met expectations."

Overall, panelists found the product appealing. They liked its freshness, texture, salt level and smoke flavor. Saltiness, smoke flavor and texture were judged as "about right" by a majority of the panelists. While there was a slight decrease in liking scores relative to the concept statement that was evaluated before tasting, all of the product's sensory attributes after tasting were highly rated, equal to or greater than six on a nine-point scale.

The purchase intent after tasting, cited as "may or may not buy," fell slightly from the "would buy" assessment before tasting. This decrease in appeal relative to the product's concept statement was minor. Overall, the sensory scores showed the panelists liked the eating quality of a smoked soft blue crab.

Lessons Learned

The process of smoking soft crabs involves both scientific knowledge and manufacturing experience because of the natural variability of the raw product. Small crabs will absorb more brine than larger crabs. The final salt content — and salty flavor — of a smoked soft crab also will be influenced by 1) the geographic location of harvest, and 2) the salinity of the water in shedders as crabs molt. At higher salt concentrations, longer cook cycles may be required to remove moisture from the crabs because salt will cause the meat to retain water.

Weather, too, affects production. The cook cycle may need to be extended during periods of high humidity because more time may be needed to brown and dry the product. Again, cook cycles also will require adjustments to account for the relative size of crabs. Smaller, thinner crabs will process faster than larger, bulkier crabs.

References

Turano, Marc, Steve Gabel and Debra Sloan. *North Carolina Aquaculture Update – 2012*. Presented at the North Carolina Aquaculture Conference, New Bern, N.C., Feb. 8, 2013.

Authors

Joseph Smith is a former employee of Full Circle Crab Company. Barry Nash is North Carolina Sea Grant seafood technology and marketing specialist. Marc Turano is the former North Carolina Sea Grant mariculture and blue crab specialist. Willy Phillips is proprietor of Full Circle Crab Company.

This project, 12-ST-01, was funded by the N.C. Fishery Resource Grant Program.

Printed October 2013

A publication of Sea Grant pursuant to National Oceanic and Atmospheric Administration Award No. NA10OAR4170080. Funding for the research provided by the N.C. Fishery Resource Grant Program, administered by North Carolina Sea Grant.