Pressed for Success

High-pressure oyster processing is offering new opportunities to an ancient coastal industry

by Theresa Novak

Oyster farmer Dave Nisbet hopes collaborating with OSU researchers will assure a future in the oyster business for his daughter Kathleen. Goals of the research: new products, markets and customers. Photo: Lynn Ketchum

Oregon State University researchers have discovered the Holy Grail of oyster production, created a safe-to-eat raw oyster and developed new oyster party treats, all in the name of revitalizing an ancient coastal industry bedeviled by modern times.

"It's the most significant development in the oyster industry in the last 100 years," said OSU food scientist Michael Morrissey, who is the director of Oregon State University Seafood Laboratory in Astoria.

Canning oysters more than a century ago was the last big change in an industry where oyster harvesters still pull the black-and-gray oysters by hand from the sand at low tide, filling plastic baskets. These are picked up later by small oyster boats for sorting and processing.

While the process is the same for producing oysters as it has been for centuries, the climate for selling them has changed drastically in the past few decades, said oysterman Dave Nisbet.

The owner of an oyster farm and a processing plant on Willapa Bay, Nisbet said he needed help from OSU's Oregon Marine Coastal Experiment Station because he wanted new markets and new customers to ensure a future for a family business that his 17-year-old daughter would someday like to enter. It's an uncertain future.

Global competition from Korea and other Asian nations has crowded the international market with oysters produced more cheaply due to lower labor costs and fewer health and environmental regulations.

Other threats to the oyster industry come from predatory starfish, red Japanese crabs, green crabs, and ghost shrimp. Invasive, non-native Spartina grass overgrows oyster beds around the nation, crowding out oyster habitat.

Consumers who used to eat oysters by the gross year round now eat them primarily in oyster stuffing at Thanksgiving and Christmas. "The average oyster-eating consumer is in his 40s or 50s," Morrissey said.

Morrissey and Nisbet thought new oyster products could change that trend and create younger oyster enthusiasts.

After all, the Seafood Laboratory exists to help invigorate coastal economies by creating new products and new markets for existing products, and to solve existing problems.

When Nisbet came to Morrissey at the Seafood Laboratory in 1996 for help in developing a new oyster product, it was the start of an association that has not only yielded new oyster products, it has broken new ground in oyster safety—and has resulted in the discovery of a product that Morrissey called "The Holy Grail" of the oyster market: An automatically shucked-in-the-shell oyster.

This oyster odyssey of discovery and innovation began with Nisbet standing in an East Coast bar in 1996, watching some young people have a good time.

"He noticed these kids were eating oyster shooters," Morrissey said. The oyster shooters were served raw with cocktail sauce, in shot glasses. They followed the oyster shot with a shot of cold vodka, or a swig of beer.

Nisbet thought that if more people tasted oysters the way those kids in the bar had, they might continue to buy them for parties at home, which might lead to additional sales of shucked oyster meat in jars for use in other kinds of oyster dishes. "I wanted to see them buying our 10-ounce-size jars and frying 'em up for hoagie sandwiches or using them to make oyster stew," Nisbet said.

Nisbet wanted to produce the shooters at his Nisbet Oyster Co. on

While the tide is out, harvesters Francisco Meliton, foreground, and Samuel and Hector Meliton dig oysters from the mud at the Nisbet oyster farm in Willapa Bay in southwestern Washington. Foreign oysters produced with cheap labor are crowding the international oyster market. Photo: Lynn Ketchum

Willapa Bay, in South Bend, Washington, 45 miles north of Astoria, but he soon discovered there was more to making these shooters than packaging them in a shot glass with cocktail sauce.

The oysters packaged with the cocktail sauce soon turned orange. Also, the cocktail sauce overwhelmed the flavor of the oyster until it was barely distinguishable.

David Morrison, at the Nisbet oyster processing plant near Willipa Bay, maneuvers a stainless steel canister full of raw oysters and water into a high-pressure chamber. The oysters will be exposed to 45,000 pounds per square inch (psi) of pressure, killing bacteria and automatically shucking the oysters in the shell. Photo: Lynn Ketchum

After some experimenting, Morrissey and other food scientists at the OSU Seafood Laboratory discovered the secret was to flash-freeze the shooters in the cocktail sauce. They also developed a shooter in salsa.

The product now sells under Nisbet's Goose Point Oyster label to bars and restaurants and some grocery outlets. Pre-packaged individually or in packs of four, the oyster shooters are ready to thaw and serve as needed.

"An oyster producer in Oregon is selling them, too," Morrissey said.

While the new product benefits Nisbet, expanding oyster products benefits the entire oyster industry, said Robin Downey of the Pacific Shellfish Growers Association.

The growers would like to see as many new customers as possible trying oysters and other shellfish and making them a regular part of their menu planning.

The development of the oyster shooters led to technology based on OSU food scientist Daniel Farkas' research. This technology has make Nisbet's oyster processing plant one of only two nationally that produce and sell raw, in-the-shell oysters that are free of contamination from the Vibrio pathogen.

That is a big deal for consumers, Morrissey said. It represents the culmination of 20 years of Farkas' research into hydrostatic high-pressure food processing.

Farkas, the former head of OSU's Department of Food Science and Technology, retired in 2000 as the internationally recognized leader in the field of applied hydrostatic pressurization to preserve food. The technique of making food "fresher with pressure," as Farkas likes to describe it, was discovered in 1890 but languished on the drawing board as impractical for nearly a century.

Morrissey had the idea of applying Farkas' research to oyster processing after one of the worst outbreaks of Vibrio parahaemolyticus, a shellfish-related illness, occurred in the summer of 1997 along the Pacific Coast.

Nisbet worker Brandon Spry puts oysters in a giant canister for high-pressure processing. Photo: Lynn Ketchum

Treating oysters with high pressure makes Antonio Gonzales' job easier. The firm, cream-colored oyster slips out of its shell after trrreatment. This self-shucked oyster will wind up as an oyster shooter. Photo: Lynn Ketchum

Between July and August 1997, health officials from British Columbia to California recorded 209 confirmed cases of illness linked to Vibrio parahaemolyticus. One man in British Columbia died. Health officials linked all the cases to consumption of raw shellfish, mostly oysters.

Morrissey and microbiologist Paul Reno, who is based at OSU's Hatfield Marine Science Center in the Newport branch of the Oregon Coastal Marine Experiment Station, responded to the outbreak by quickly obtaining approval from the National Sea Grant Office for a $140,000 grant. They wanted to study ways that Farkas' hydrostatic pressurization technique might be used to kill Vibrio parahaemolyticus in fresh oysters.

"I knew Farkas already had done a lot of work with the Army in preparing ready-to-eat meals for field use," Morrissey said. The processed food was virtually bacteria-free, stayed fresh longer, and it still looked and tasted good.

Although still expensive and applicable only to relatively small quantities of food, the pressurization

At OSU's Hatfield Marine Science Center in Newport, microbiologist Paul Reno and research assistant Prudy Caswell-Reno innoculate Pacific oysters with bacteria, Vibrio parahaemolyicus, that can cause health problems when humans eat raw oysters. This is the first step in testing the bacteria's reaction to high-pressure treatment intended to kill such contaminants. Photo: Lynn Ketchum

technique had found commercial favor with some Japanese manufacturers of apple preserves. It was field-tested under a long-term contract with the U.S. Army to provide field troops with long-lasting rations of spaghetti, yogurt and pasta salad.

Pressure-treated avocado dip sells in some local grocery stores. It retains its color and freshness far longer than freshly prepared dip.

Morrissey invited Dave Nisbet to participate in the research because he and Nisbet already had worked together to develop the frozen oyster shooters.

"I remember when Nisbet and I drove a pickup truck of oysters to the Food Sciences department at OSU, where Farkas had three high-pressure vessels," Morrissey said.

They loaded up the vessels with small-shelled oysters, filled them with water and applied the high pressure. Before they could even test whether the naturally occurring pathogens within the oysters had been killed, they were in for another surprise.

"Our jaws dropped," Morrissey said. "All of the oysters had been perfectly shucked. It was like the Holy Grail of the oyster industry—a self-shucking oyster processing method."

Since that day in 1998, Morrissey, Nisbet, Reno and the OSU Food Science department have worked together.

Nisbet acquired the money for the pressurization equipment from the Shorebank Enterprise Pacific bank of Ilwaco, Washington, a non-profit economic development bank that funds ventures designed to improve the social and environmental conditions in rural coastal communities.

With a $200,000 loan, and additional funds from W.G. Kellogg Foundation of Battle Creek, Michigan, Nisbet outfitted his Nisbet Oyster Co. processing center with the half-million-dollar hydrostatic pressurization equipment. The only other such commercial oyster-processing operation is in Louisiana.

Nisbet's plan: kill off the bacteria within in-the-shell oysters so they are safer to eat raw, then sell them to markets all over the world. Before that could happen, Paul Reno went to work to ensure that the pressurization technique indeed killed the Vibrio parahaemolyticus.

Oyster producers had tried other methods of producing a Vibrio-free product, but health officials such as Dr. Ken Kauffman of the Oregon Department of Human Services—formerly known as the Oregon Health Division—said these didn't work well.

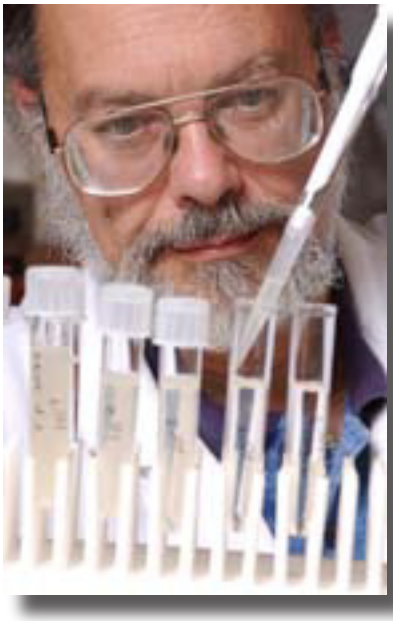
Methods such as "flash-shocking" raw oysters in a 155-degree hot-water immersion, or fast-freezing them to incredibly cold temperatures, did not kill enough of the Vibrio parahaemolyticus to render the raw oysters as safe as cooked ones, Kauffman said.

Oyster experts are quick to point out that Vibrio parahaemolyticus—known as Vibrio or Vp for short—is primarily a danger for the very young, the very old, or people ill from other causes. Nevertheless, the danger is real.

"We recommend that people never eat raw shellfish or meat of any kind," Kauffman said. "If there was a high-pressure method of treating oysters that really did kill off virtually all traces of Vibrio, I'd be very interested to know it."

Reno said his experience with hydrostatic pressurization indicates that it works.

With a combination of the scientific method and some trial and error, Reno and a team of technicians tested whether the hydrostatic pressurization method killed off Vibrio parahaemolyticus by first deliberately flooding unshelled oysters with 10 times the normal level of Vibrio parahaemolyticus normally found in the environment.



OSU's Paul Reno examines oyster tissue after high-pressure treatment. His research shows that high pressure kills undesirable bacteria. Photo: Lynn Ketchum

A technician loaded the contaminated oysters into a shiny, stainless-steel pressurization cylinder that resembles a submarine torpedo. He

Mike Morrissey, director of OSU's seafood lab at Astoria, samples an oyster shooter. The facility, part of OSU's Coastal Oregon Marine Experiment Station, helped processor Dave Nisbet develop the innovative product. Photo: Lynn Ketchum

added water to completely fill the cylinder. The water acts as a "cushioning" agent to keep the oysters from turning to mush when they are squeezed together during pressurization.

Reno then exposed the oysters to 45,000 pounds per square (psi) inch of pressure in tests that lasted from one to four minutes.

The pressurized oysters were then removed, ground up into a paste, and placed in a laboratory culturing medium to see whether Vibrio parahaemolyticus still could grow after exposure to such high pressure.

Reno said that some Vibrio survived after being exposed to the pressure for one minute. All Vibrio bacteria were killed in the oysters exposed for four minutes. However, those oysters turned into something like in-the-shell oatmeal. Oysters exposed to 45,000 psi for two minutes were just right. Even at 10 times the allowable amount, the Vibrio were killed. The oysters retained their creamy texture, firm flesh and fresh taste.

"We found anything after two minutes, and oyster quality began to be affected," Reno said.

Why should this matter to consumers? They now have their first opportunity to buy bacteria-free, in-the-shell oysters for raw presentation.

The pressure-treated oysters are sold in half-gallon containers to the restaurant market. Others are packaged under the Goose Point Oyster label for sale in Los Angeles and Hong Kong.

To preserve their freshness, the oysters are kept at a constant 34 degrees Fahrenheit.

As with many foods, tastes in oysters vary with the nation, Nisbet said.

"In China, they like larger oysters. The Japanese consumers prefer the smaller ones."

Trucks carrying the Goose Point Oysters logo are driven to Portland and Seattle constantly to meet a target 24-hour turnaround from Bay to destination.

Today's oysters are larger than those Native Americans on the Pacific Coast ate historically. They were about the size of a quarter. Photo: Lynn Ketchum

Nisbet now produces pre-shucked oysters for sale on the half-shell. Technicians place a blue shrink-wrap band around each oyster before pressure treatment.

"After the pressure treatment shucks the oyster in the shell, all the consumer has to do is cut the band to have a dozen oysters on the half-shell for a Saturday night dinner party. These have become very popular in California," Morrissey said.

Goose Point Oysters, marketed by the Nisbet processing plant in Willipa Bay, Washington, are shucked in the shell with a high-pressure treatment pioneered by OSU food scientist Dan Farkas. Photo: Lynn Ketchum

So far, the oyster pressurization technology may be new and expensive and available in only one site in Washington, but Morrissey likened it to the development of early computers. They were big, expensive and hard to find, but so useful that continued innovation now makes them small enough to carry in a pocket, affordable—and everywhere.

"Some day, you might be able to go into a bar and watch a machine pressurize your oyster right there before your eyes," Morrissey said.

For oyster producers, that represents something they value: future possibilities for their ancient industry.

From *Oregon's Agricultural Progress,*
Oregon State University,
Winter 2003