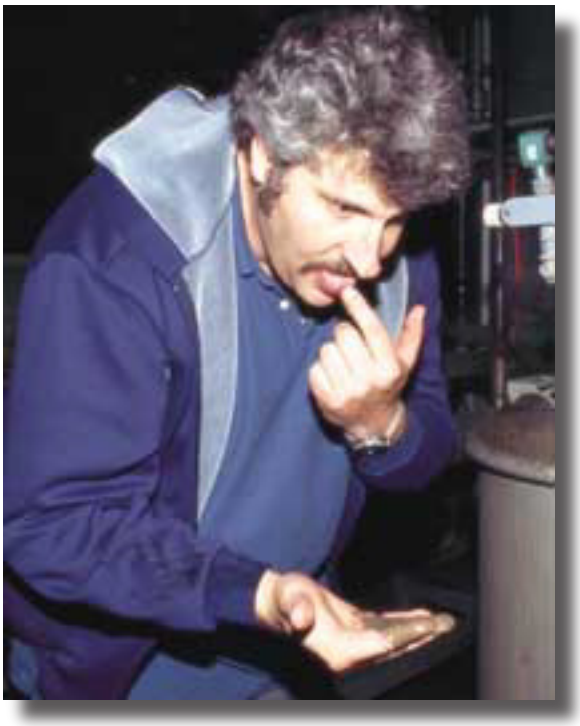
A Taste for Waste

OSU researchers are helping Oregon's fishing industry make new products out of leftovers

by Dennis Hinkamp



Will Knuth, operations manager at Protein Recovery, Inc., in Warrenton, Oregon, samples concentrated fish protein made from processing leftovers. The product goes into animal food. Photo: Bob Rost

The pork industry's slogan for its efficient use of byproducts is "everything but the squeal." This production approach depends on a well-developed web of markets for byproducts. The beef and poultry industries follow this approach as well, and even the dairy industry is starting to "fractionate"--find markets for the basic constituents of milk rather than just selling fluid milk.

Why has the fishing industry lagged behind?

Michael Morrissey, director of the Oregon State University Seafood Laboratory in Astoria, a branch of OSU's Newport-based Coastal Oregon Marine Experiment Station, muses that perhaps the root of this is that fishing has always been thought of as hunting rather than farming or ranching. It is also much less predictable than land-based food production. Consequently, not as many markets have been developed for fish byproducts.

Though the demand lags behind, the supply of byproducts is there--tons of it. Now there is a push towards "full utilization" for the economic health of the fishing industry. And, Morrissey adds, there are political and environmental pressures for more utilization of fish byproducts. Some of these are linked to a reform bill of the Magnuson Act that governs our coastal waters. This bill is under consideration in Congress.

Plus, there's always the image problem.

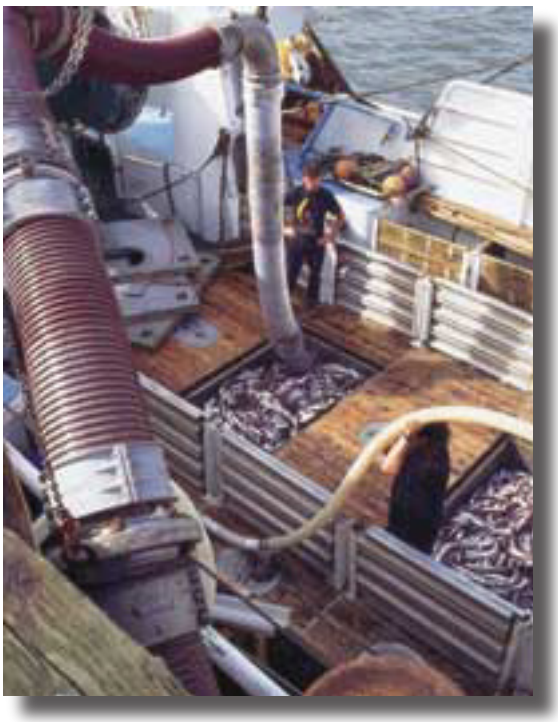
"Truckloads of fish waste rolling down the highway and being dive-bombed by seagulls looking for a free lunch is not a progressive image," says Morrissey. "The industry is making some good strides in finding more ways to use byproducts."

Full utilization of harvested fish is becoming especially important in Oregon's seafood industry as surimi becomes a growing part of the Oregon coastal economy. Surimi is a bland, paste-like substance, the raw material for a variety of seafood products including some of the imitation crab you may have seen at salad bars in restaurants. It is a popular ingredient in many foods consumed overseas in countries such as Japan.

In Oregon, surimi is made from a silver-gray fish called Pacific whiting. But surimi production uses only 17 to 20 percent of the fish. "That means for every 100 pounds of Pacific whiting that crosses the dock, you only get 17 to 20 pounds of surimi," says Morrissey. "The rest has to go somewhere."

There are several types of waste in a surimi operation.

"The whiting goes through a deheading, evisceration, deskinning operation," Morrissey explains. "This is solid waste and usually



A trawler crew unloads Pacific whiting at the Point Adams Packing Company at Warrenton. The fish will be used to make surimi, a paste-like substance used in many seafood products. Photo: Bob Rost

Protein Recovery, Inc., is next to the Point Adams Packing Company. Here, a worker shovels whiting bones, skin, fins, intestines and other leftovers into a grinding mill. Photo: Bob Rost

represents 70 percent of the original fish. The remaining 30 percent (essentially the flesh meat) undergoes several washing/dewatering operations and many of the small proteins, leftover blood components, etc., are removed into the waste water and represent about 10 to 13 percent of the original fish. It is important to distinguish between the two because the industry is finding uses for solid wastes but having problems with the waste water."

Much of the solid waste is used for fish meal and pet foods, explains Morrissey. "There are complicated formulas that regulate how much fish waste in the wash water one can safely return to large outflows such as the Columbia River," he says. "While some plants have permits to dump this waste, others are forced to truck it away, which increases their costs."

Dumping requires permits and adds nothing to a seafood processing company's income. But it doesn't have to be that way. "There is an untapped potential for fish waste, but right now it is still thought of more as a disposal problem than as a salable commodity," says Morrissey.

"One of the things we're researching at the OSU Seafood Laboratory," he continues, "is extracting 'bio-active' compounds from the waste. For instance, there are some valuable natural antioxidants that we could extract. These antioxidants are used by the food industry to keep fats in food from changing color and going rancid. We are also looking at ways to filter these out of the water used to process the fish. In addition to antioxidants, the waste water used in surimi processing contains about 1 percent protein that could be recovered."

At the other end of the production line, Morrissey's colleague Jae Park is trying to squeeze a couple more percentage points out of the Pacific whiting. Park is head of the OSU lab's successful "Surimi School," which draws an international group of producers, marketers and food scientists who want to learn about innovative methods of making and marketing surimi. Along with his work with the Surimi School, Park is involved in several surimi research projects.

"The processing [of Pacific whiting into surimi] yields about 70 percent guts, skin and bones, which leaves about 30 percent potential meat and byproducts," says Park. Some 50 percent of that 30 percent goes into surimi. "We'd like to increase the overall yield a few more percentage points," says Park. "My colleagues and I are working on methods of recovering the rest or at least keeping it from going into the waste stream."

And the 70 percent guts, skin and bones?

In Newport, Ken Hilderbrand, a seafood processing specialist with OSU's Extension Sea Grant program, is working on a project to help lumber mills compost fish waste and bark dust for sale as high value fertilizer. "These are the kind of cooperative projects that show potential. This way you, the processor, don't have to truck the waste and you form a mutually beneficial relationship," Morrissey says.

Morrissey points to another cooperative venture, this one just south of Astoria, as an example of where the full utilization of seafood materials might go.

After conferring with OSU Seafood Laboratory researchers, Mark Ludlow designed the Protein Recovery facility. He says it's the largest fish waste recovery facility on the West Coast. Photo: Bob Rost

Lihan Huang, an OSU graduate student in food science, works with a membrane filtration system that will recover valuable protein from surimi processing waste water. Photo: Bob Rost

While the OSU Seafood Laboratory is working on a micro level, Mark Ludlow is on the macro end of the fish waste continuum. The Nebraska native, who studied mechanical engineering at Portland State University, has found a way to turn a profit on what most processors are desperately trying to get rid of: 22 to 26 percent protein available in the heads, guts and various other parts left after surimi production.

His business is called Protein Recovery, Inc. Operational since 1994, it is the largest facility of its kind on the West Coast, capable of processing 250 tons of fish waste a day. After conferring with Morrissey and others at the OSU Seafood Lab, Ludlow worked with Point Adams Packing Company, a surimi plant in Warrenton, Oregon, to develop Protein Recovery, Inc., which he says is both economically and environmentally satisfying.

His "enzymatic hydrolyzing facility" looks like part giant meat grinder, part brewery and part oil refinery. His engineering design, which uses scrap parts, is what makes the transformation from waste to protein possible.

"Everything about this operation is recycled. We found the boiler sitting in a field in Canada. There's a tomato pulper over there and a pear juice evaporator at that end," Ludlow says.

He has a symbiotic relationship with the Point Adams surimi plant. In fact, they share the same roof, and their production lines are a scant 20 feet apart.

"The relationship between Point Adams and me has been mutually beneficial," says Ludlow. "Their operation is dependent upon being able to dispose of hundreds of thousands of pounds of filleting waste each day. They were previously discharging much of it into the Columbia River."

To make high-quality surimi, plants like Point Adams must process whiting quickly after the fish are caught. "Filleting waste is pumped directly from the Point Adams surimi line into our side of the operation," says Ludlow, "and it has rarely been out of the ocean for more than five or six hours."

Hundred-gallon bucket loads of waste, fresh off the surimi line, go through several grinding processes before the waste is heated and reduced to a dark brown, viscous liquid that comes out the other end. It looks like sludge, but plant manager Will Knuth says he prefers to refer to this end product as "hydrolyzed protein." It is fit for human consumption, says Knuth, who has been known to offer visitors a taste (they usually decline).

Some day the hydrolyzed protein may find wider audiences in far-flung parts of the world, but for now most of it is trucked down to Stockton, California, where it ends up in pet foods, fertilizer for vineyards and milk replacements used to wean cattle and swine.

Ludlow downplays his innovation, saying, "I was just a mechanical engineer looking for a way to make a living in the area." But he likes to quote inventor/philosopher Buckminster Fuller, saying, "Pollution is just somebody else's un-utilized byproduct."

"There is something wrong with a market system that doesn't value protein and allows 80 percent waste as part of the economic model," says Ludlow. "It is doomed for failure. Anybody can catch a fish and fillet it. Large parts of the world are starving for lack of protein. We try to squeeze every little bit out.

"Sometimes all this sounds like a lot of hippie-dippy stuff, because recycling is environmentally 'green,'" he adds. "But that was only part of the motivation. I proved it could create jobs, help Point Adams do more business, supply a salable product to Stockton, California, and turn a profit for its owners."

Obviously pleased with Ludlow's accomplishment, Morrissey says Oregon's seafood industry is built on such entrepreneurship. Perhaps the OSU Experiment Station researcher feels it's a small step toward a day when the seafood industry will be able to brag about utilizing "everything but the swim" in its raw materials.

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