Case study one

Developing the potential of fish processing byproducts takes guts

Dr. Peter Bechtel
USDA/Agricultural Research Service

Pete Nicklason
University of Idaho

Dr. Michael Rust
NOAA Northwest Fisheries Science Center

and Dr. Scott Smiley
University of Alaska
Fishery Industry Technology Center

If you ask a pork producer about how much of his product is actually used by society, he is likely to reply, "We use everything but the squeal". In fact, much of agriculture has long made good use of the various parts of animals that humans don't eat. Much of these so called 'byproducts' or 'coproducts' are usually processed into feed for pets and livestock. While the recovery and repurposing of all parts of terrestrial animals is quite efficient, recovery of fish parts is just starting to improve.

If you buy a nice one pound fillet at your local fishmonger, it is likely that about one pound of other potentially useful stuff has also been generated in cutting that fillet. Various terms such as 'fish trimmings', 'fish wastes', 'fisheries byproducts', 'fisheries coproducts', 'fish scraps', and even 'fish offal' (pronounced "awful") are used to describe various components of the heads, guts, fins, bones, and skin that are left over after cutting two fillets from a whole intact fish.

Nowhere is the potential to effectively capture this valuable material greater than in the State of Alaska. The Alaskan seafood industry harvests more than half of the total U.S. commercial fish catch each year and processing this harvest into food for people leaves over 1.1 million tons of fish processing waste. Experts have estimated that a quarter of this waste may be discarded and it's potential value lost.

The challenge in Alaska and elsewhere, is that much of this fish processing waste is created seasonally in remote areas with poor infrastructure. Given the biology of the fish, they are often available in huge amounts but for only a very short season. Because fish spoil so quickly and because a huge volume of fish processing waste is produced in such a short period of time, it requires big expensive equipment and a good deal of energy to process it all before it spoils. After the season, there is nothing to do with that expensive equipment until the next harvest occurs. For some fisheries this might mean a six week-long season followed by the rest of the year off.

Aside from the huge processing operations along the shore of the Bering Sea, small processors specializing in remote and seasonal fisheries, such as salmon, rarely generate sufficient volumes of fish processing waste to justify investment in large scale equipment. The intermittent nature of the fishery, and the remote seasonal nature of the locations the fish are processed, mean that traditional approaches such as those used by the year round pork and chicken industries are not cost-effective when it comes to fish, so waste material ends up back in the sea.

Driven by the sheer potential for economic and environmental gains, state and federal researchers are developing techniques that will help industry and local communities tap into the value of fish processing waste from Alaska and elsewhere. For some of the larger fisheries that harvest over a longer period of time, a great deal of progress has been made with modifications to traditional solutions. For example most of the processing byproducts from pollock (one of the world's largest human food fisheries) and other

Case study one

Walleye pollock (*Theragra chacogramma*)
Photo courtesy AFSC

white fish are used to make fish meal and oil. This has already made Alaska the second largest producer of fish meal in the United States. But the pollock fishery is huge with roughly 1 million metric tons harvested annually making a more traditional processing approach feasible with relatively small modifications. Additionally, government regulations required processors building new seafood processing plants along the Bering Sea to include machinery designed to effectively handle seafood processing byproducts.

An important and more difficult challenge facing researchers remains to develop reliable methods to stabilize small volume fishery processing waste until it can be dried and worked on after the initial hectic processing season closes. This is important because many Alaskan salmon processors are small, seasonal and remote so they do not have fish meal machinery necessary to handle their byproducts before they spoil.

Working collaboratively, researchers have shown that the byproducts of seafood processing can be converted into commercially valuable products including protein meals, oils, and more. In addition, researchers are finding that diets incorporating protein from fish processing waste and used for feeding fish, pigs, poultry, dogs, cats, and even reindeer, are equal in nutritional value to those made with traditional fish meal and oil. Significant progress has also been made by supporting research on the development of new cost-effective processing methods as well as the development of new feed ingredients.

Several collaborative studies demonstrated that seafood byproducts could be stabilized against microbial degradation for the short term (weeks to months) by lowering the pH through the addition of acids–a process similar to how yogurt is stabilized. This stabilization allowed for room temperature storage. Most important, the resulting dried meal remained suitable as a protein feed ingredient for salmon and

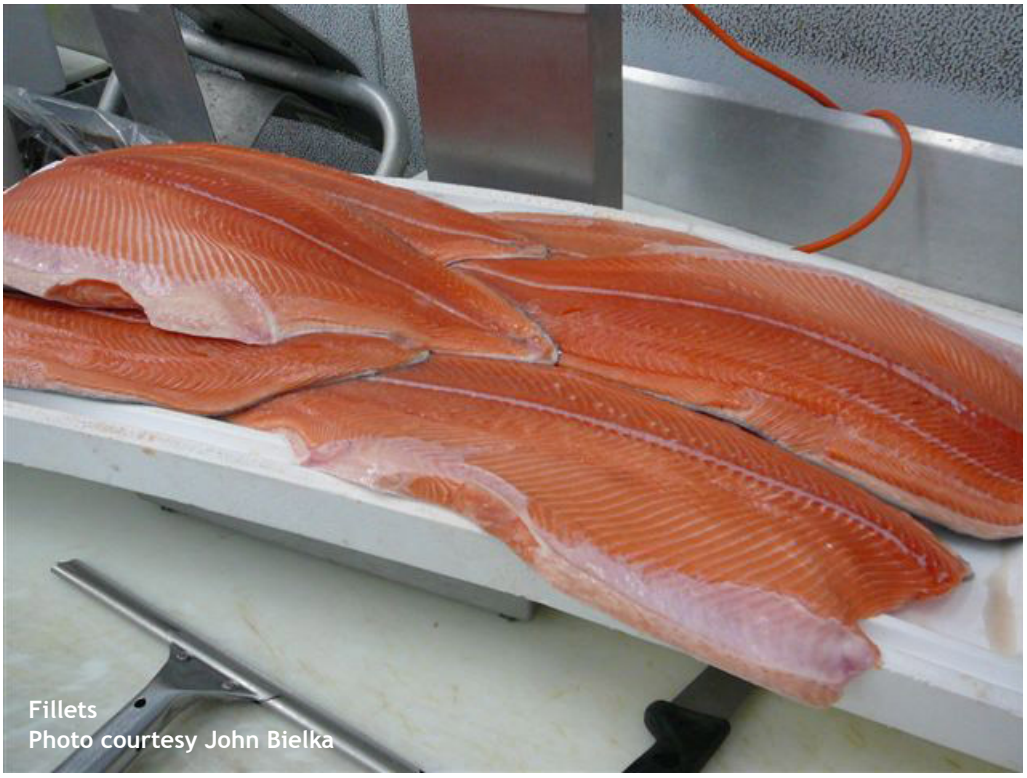
trout diets. Recently, other stabilization strategies show promise as well, such as using both lactic acid bacterial fermentation and chemical acidification on Alaskan seafood processing byproducts.

Even higher value products can be made from some of the components in the seafood waste stream. Further separation of the components of seafood processing waste can be used to create higher value specialty protein and oil products that may offer a solution to supplementing nutrient deficiencies in plant protein meals and oils being developed for use in aquaculture feed formulations. Studies in collaboration with the processing industries have involved the development of tailored protein powders, and the recovery of usable proteins from a variety of seafood processing waste streams. The human health benefits of fish oils from cold-water species, including the long chain polyunsaturated omega-3 fatty acids, are a good example of a high-value human nutrient that has been developed from this resource.

Continued research in this area promises to reduce the seafood industry's environmental impact and increase the economic viability of both the industry and coastal communities. In fact, this research is now being transferred to the industry. At least one new plant is in the design phase based on the new technologies which will recover 17 million pounds of waste a year that is currently going into the sea. Other companies are increasing the extraction of fish oils from their processing byproducts.

Soon, when you ask a fisherman or a fish farmer about how much of his product is actually used by society, he will be able to reply, "We use everything but the gulp!" It turns out that offal doesn't have to be awful after all.

Case study one



Fillets
Photo courtesy John Bielka