

Redefining Freshness in Fishmeal –

RICHARD DRAVES, American Seafoods Company

A New Awareness

Pet food industry producers are seeking novel proteins to fulfill the growing need for limited ingredient diets and to bring more value to their brands. As they do, they are increasingly turning toward fish and fish ingredients to fill that space; particularly ingredients that also bring sustainability credentials and quality benefits. Fish is a high-protein, low-fat food and provides a range of health benefits for humans and pets. However, understanding what distinguishes a high quality fish or fishmeal can be daunting.

The fishing business is a global industry comprised of small to large fisheries, with cold- and warm-watered species, and a complex distribution system layered over top. In addition, fish are not a fixed, stable organism. They undergo a variety of post-mortem changes that can have significant impact upon their composition and health contribution. Fish processing can occur at-sea where fish are processed within hours of their harvest, or at distant shore plants where the harvested fish may wait days to be processed. Processing itself occurs from the tropics to much higher latitudes, adding the complexities of temperature to the pool of variables. With this complexity, meeting rising demands for traceability, volume, and consistent quality is challenging.

At American Seafoods Company (ASC), we continually search for ways to better define fish and fish ingredient quality. We directly harvest two primary species, Wild Alaska Pollock and Wild Pacific Whiting, each sourced from high volume, well-managed fisheries. We work to marry the art of fishing with science; combining technique with measurement to ensure consistent quality ingredient performance.



Wild Alaska Pollock, *Gadus chalcogrammus* is a member of the Cod family. The fishery has maintained its certification under the Marine Stewardship Council as sustainable since 2005.

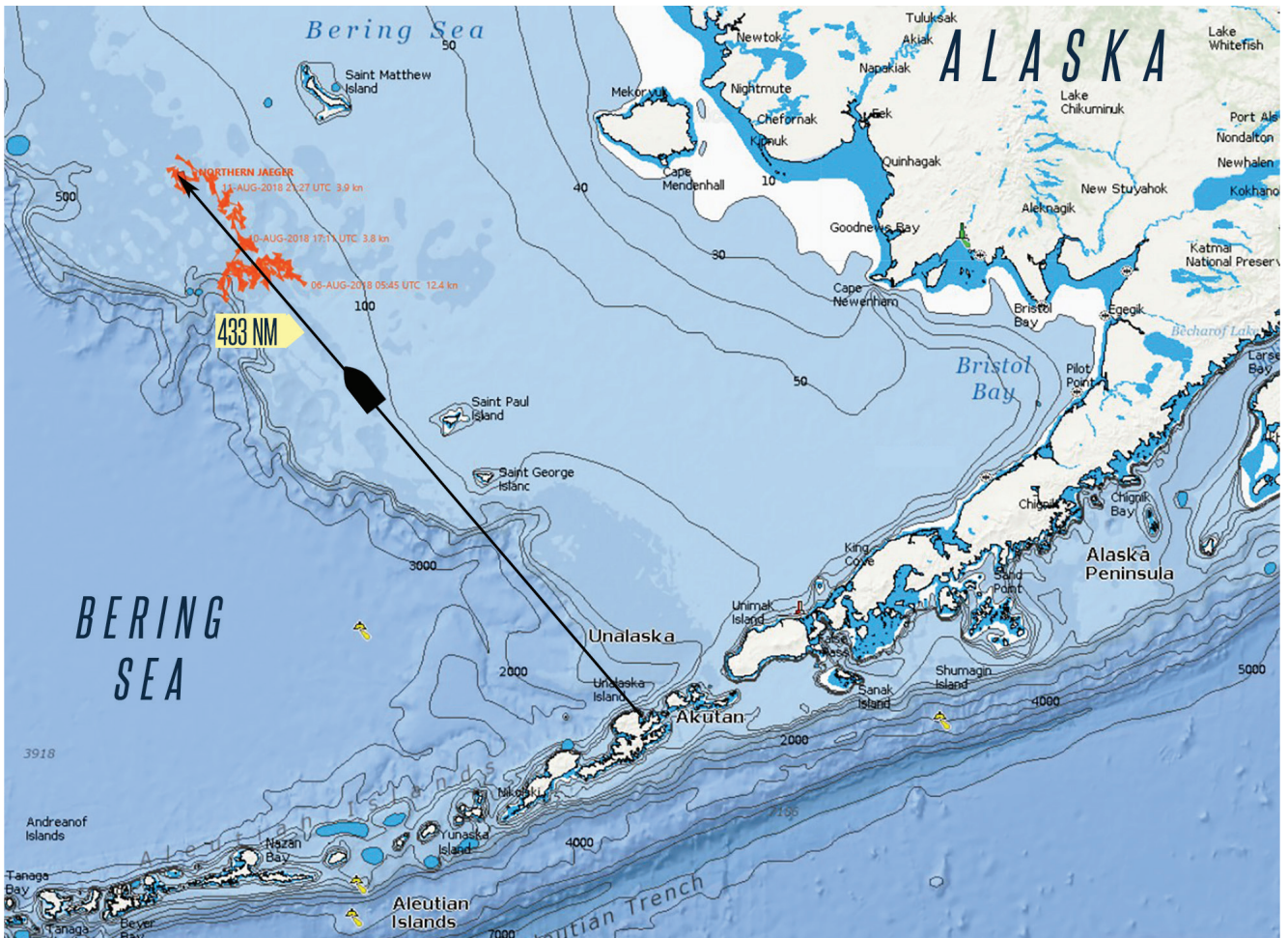
What are Biogenic Amines?

Fish quality and healthfulness is significantly affected by changes that occur immediately post-mortem. These changes are initially dominated by autolytic activity followed by the formation of specific spoilage organisms that ultimately influence the quality of the end-product. (Olafsdottir 2005). Internally, we refer to this period as ‘fish age’ and define it as the time from when the fish is pulled from the water to the time processing begins.

To control this most important variable we operate vessels that bring the processing to the fish, rather than have the fish come to the processor. Our vessels move about the fishing grounds following the schools, catching them, and then processing them directly on board. While not unique globally, this type of operation is rare, due to the complexity of running both a fishing operation and a food-processing factory on the same vessel. This vertical operation enables us to more directly manage fish quality. Instead of days-old fish, we utilize hours-old fish.



Catcher-Processor American Triumph At-Sea Operation



Summer Fishing Operations for Alaska Pollock in the Bering Sea

Above is a chart of the fishing operations (in orange) for the Northern Jaeger from August 6-13, 2018. The black line represents the distance from the port to the fishing grounds, a trip that takes roughly 30 hours in calm seas.

What does all this mean for the pet food industry? Fishmeal, the marine ingredient most used by pet food processors, is estimated to be in 25% or more of dry dog and cat food recipes (The Dog and Cat Food Ingredient Center). With the variations in fish age that occur in fishing and fishing operations globally, it stands to reason that fishmeal quality can be highly variable. This can lead to undesirable variability in pet food performance.

Traditionally, producers report histamine levels in fishmeal to reflect the quality of the product. A quick survey of published fishmeal specifications finds histamine levels vary from 50 to 1500 ppm. While there are no limits for pet foods, FDA has set guidance limits for histamines in the edible portion of fish at 50 ppm for humans (FDA, Chapter 7 and 8, Fish and Fishery Products Hazards and Control Guidance – Fourth Edition). However, this measure has limitations.

Histamine is an important biogenic amine, formed from the breakdown of the amino acid histidine by the combined action of time, temperature, and specific enzymes. Histamine formation is typically associated with scombroid fishes, tunas, mahi-mahi, marlin, and bluefish, however the FDA adds herring, anchovy, mackerel, menhaden, sardine, and shad to this list for human foods. (FDA, Chapter 3, Fish and Fishery Products Hazards and Control Guidance – Fourth Edition). While generally associated with fish, histamine and other biogenic amine formation also occurs in chicken and meat by-product meals.

In humans, food-derived histamine is associated with non-allergenic food intolerance and food poisoning. At high concentrations histamines are a risk factor for food intoxications, which may lead to food intolerance. (Chung, 2017) This health concern could be magnified in companion animals as they are exposed to the same foods over a long period of time.

But the problem is not just histamine. While histamine is the most well-known biogenic amine in fish, other amines such as putrescine and cadaverine are significant as they act to enhance the histamine reaction. (Ruiz-Capillas 2011) A fourth biogenic amine, Tyramine, causes a dose-dependent increase in blood pressure in animals. (FAO 2012) Very fresh fish generally have little to no biogenic amines. (Wu, et al 2009) Given the combined effects of these biogenic amines, it appears that reporting histamine level alone does not provide a complete picture of raw material freshness.

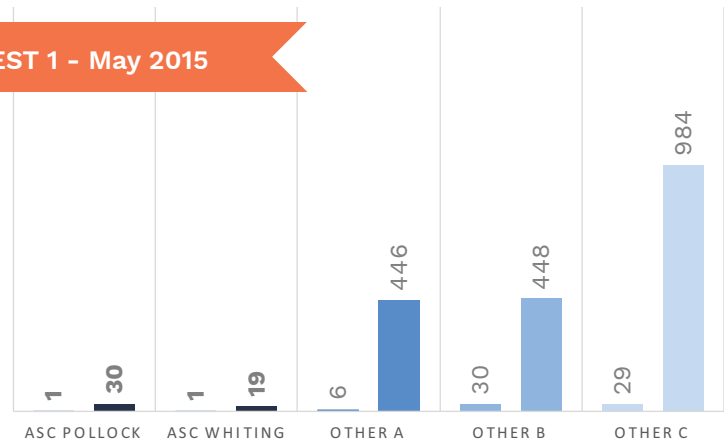
Various studies in aquaculture and production animals have demonstrated overall improved performance when subject animals are fed low biogenic amine fishmeal. Typically, these studies compare an 'average' quality fishmeal to a 'high quality' fishmeal, using histamine levels of around 250-350 ppm and higher for the average material and levels of around 150 ppm for the superior quality material. Now this gets interesting. For years, American Seafoods has been testing the histamine level in the fishmeal we produce at sea. Because of the absolute freshness of the raw materials used, our histamine levels are nearly always less than 2.5 ppm.

To further quantify the impacts of histamine and low total biogenic amines, we undertook three rounds of testing using commercially available meals. Concurrent tests were conducted on American Seafoods fishmeal produced at sea and the results are displayed at right.

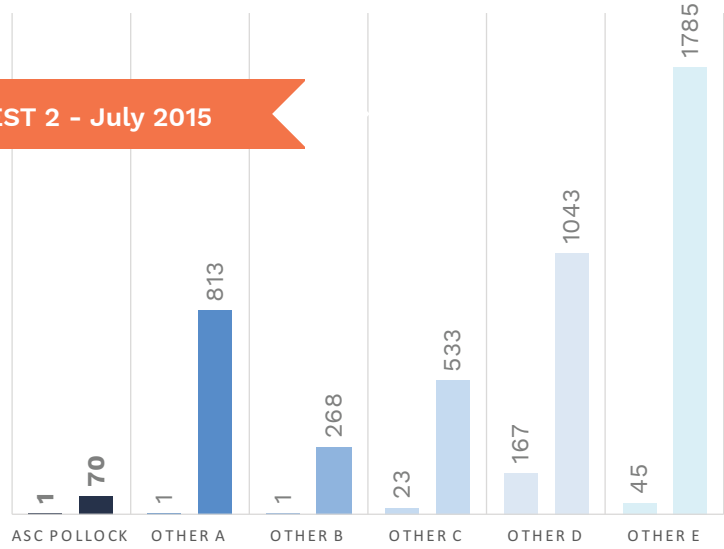
For histamine, our two species (ASC Pollock and ASC Whiting) were less than 1ppm, while the five other species demonstrated levels from 1 ppm up to 167 ppm. On total biogenic amines, the differences were more extreme, with our two species ranging from 19 ppm to 70 ppm, where the five others ranged from 268 ppm to 1785 ppm.

Histamine and Total Biogenic Amine* Content of Commercially Available Fishmeals (in ppm)

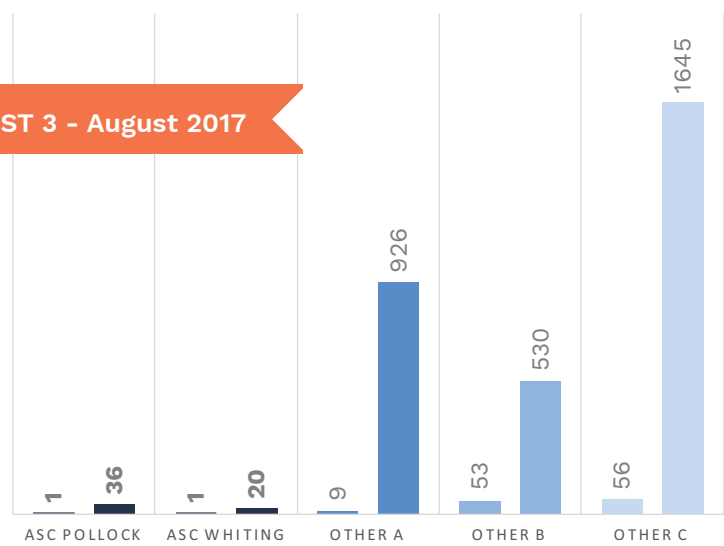
TEST 1 - May 2015



TEST 2 - July 2015



TEST 3 - August 2017



*Total Biogenic Amines = Sum of Histamine, Putrescine, Cadaverine, and Tyramine

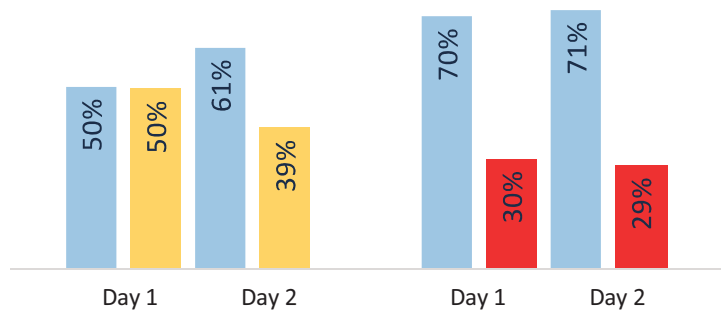
The Consequences on Cat and Dog Feeding Preferences

The next step in our investigation was to determine if total biogenic amine content could be correlated to palatability. Would dogs and cats demonstrate a preference for kibble incorporating fishmeal produced from fresh raw materials? We formulated standardized diets differing only in the type of fishmeal. Finished kibble was then shipped to a test kennel, for standard two-bowl testing. Both cats and dogs significantly preferred American Seafoods Low Biogenic Amine meals over the control.

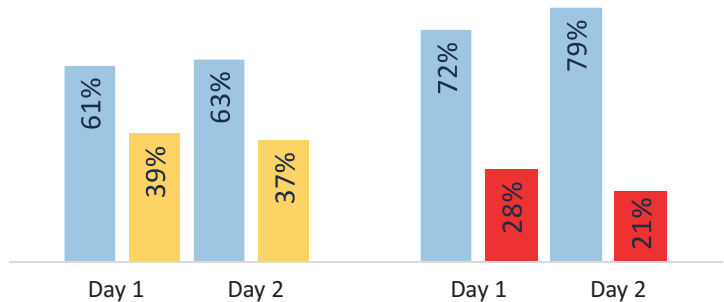
From the data we conclude that fishmeal, produced at-sea on-board American Seafoods vessels demonstrates superior freshness when compared to other commercially available fishmeals, and offers better palatability as well. This superior freshness, with total biogenic amine content well under 100 ppm, sets a new standard for fishmeal and offers the highest quality and likely the healthiest fishmeal available to the pet industry today.

Ultimately, it is important to understand there are measurably higher quality, fresher fishmeal products that provide healthier more palatable options. These products are available in the US, from US managed fisheries, in significant quantities throughout the year.

Cat Consumption Ratio Alaska Pollock (in blue) v. two other species



Dog Consumption Ratio Alaska Pollock (in blue) v. two other species



p = <0.05 for all tests; Population: n=20

Results from two dog and two cat trials comparing the performance of Alaska Pollock formulations against two other species. The Pollock based kibble significantly outperformed the other species, supporting our hypothesis that companion animals are sensitive to the quality of the raw materials used in fishmeal production.



American Seafoods with headquarters in Seattle, Washington, and operations in Dutch Harbor, Alaska, manages the operations and sales of fishmeal, fishoil and other quality frozen items. These fine products are available to the pet industry today. Our products come from certified sustainable fisheries, are 100% made in the USA and completely traceable to the source.

Olafsdottir, Gudrun, "Volatile Compounds as Quality Indicators In Fish During Chilled Storage: Evaluation of Microbial Metabolites By An Electronic Nose", University of Iceland, Icelandic Fisheries Laboratory, 2005

The Dog and Cat Food Ingredient Center

FDA, Fish and Fishery Products Hazards and Control Guidance – Fourth Edition

Wu, T.H., et al, "Effects of Delayed Processing of Pink Salmon By-Products on Fishmeal Quality", Journal of Aquatic Food Products Technology, 2009

Chung, B.Y., et al, "Effect of Different Cooking Methods on Histamine Level in Selected Foods", Annals of Dermatology, 2017

Ruiz—Capillas, C., et al, "Biogenic Amines In Seafood Products, Chapter 42", Handbook of Seafood and Seafood Products Analysis, 2009

FAO/WHO, "Public Health Risks of Histamine and other Biogenic Amines from Fishery and Fishery Products" Meeting Report, 2013