

## Major Animal-Protein Production Systems: Variables and Interactions Impacting Aquaculture

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With any kind of fish or livestock production there is a range of factors that influence the price that can be realized by the producer. Simply stated, is it supply and demand? -Basic economics? Well, yes and no. Of course supply/demand for a particular protein or product is the obvious driver, but what also influences demand and perhaps creates unwanted supply?

The supply and demand for a given animal-derived food protein is heavily influenced or driven by the supply and demand for other competing protein products, as well less obvious factors. These range from key input variability to international trade tariffs to catastrophic weather events to the effect of smart-phone gossip communities of particular age, gender and ethnic demographics. Having some idea of how all of these things can potentially influence the price producers get, as well as the target price for which producers. Be it fish, chickens or niche pork, one can use current events and the trajectory of competing protein products to hone your product selection and market-communication strategies. This also can present some insight into how the competition may be positioning its offering against your product. Let's consider a few topics:

*Consumer point-of-purchase decision making.* Put yourself in the shoes of the consumer. If that nice red steak has more eye-candy appeal or price-point pizzazz than your fish fillets, put some thought into how you may be able to develop a pairing that will get your fillets incorporated into the menu plan and purchase decision. This is why almost every large grocery store has appropriate wine pairings located around the store. From the meat counter to the fruit isle, wine is immediately available "ready-to-hand" when the consumer's main purchase triggers the purchase of the "no-brainer" quick and convenient pairing. Just reach over and grab that perfect bottle to accompany your steak, fillets or cheese sampler.

How about a coupon and recipe card for a "foolproof" grilled fish fillet and fresh-asparagus pairing near that big display of bundled fresh asparagus? Better yet, why not a small

conveniently situated refrigerator or freezer case with the fillets for the paring right there in the produce aisle? If that nice red steak still has more eye-candy appeal or price-point pizzazz than your fish fillets, then you may want to think about the situation simply in terms of that “eye-candy appeal or price-point pizzazz.” Does your label reflect the most positive attributes of your brand, do you have point-of-purchase signage or a brochure that explains your pizzazz; or do you have off-white fillets in a monotone dull-as-it-gets shrink-wrapped tray?

When considering consumer point-of-purchase decision making, keep in mind that the consumer is one of two types of consumer that goes into a food store, farmer’s market or similar venue. One is in-there and then out-of-there in a hurry person and the other is the value shopper doing some comparison shopping. Either way, consider that the consumer:

- Often is in a hurry;
- May be on a budget and value shopping;
- In most cases, is not very creative (limited culinary skill set);
- In some cases, is very creative (experimental early adopter with an advanced culinary skill set);
- Will opt for simple and quick decision-making, making them very susceptible to a visual prompt or predisposition to your product;
- May want to try something different;
- May want to try something familiar, but different (not the same as “same-old”);
- Will almost always make decisions biased toward convenience (quick and easy preparation);
- Has some fear of failure (fear of an unknown product or experience, creative humiliation, or wasting money).

The protein-use landscape is ever changing. Is it possible to predict and leverage changing trends? Well, somewhat. The food industry uses what is known as the menu-adoption cycle as a rather crude crystal ball. The menu-adoption cycle is quite simple in theory. For every product introduction and lifespan, there are four distinct phases: Inception, adoption, proliferation and ubiquity. One can vaguely tell where the product is in the adoption cycle by where one finds the product and the demographic that buys it.

If a specialty fish protein, for example, barramundi (Australian Sea Bass) is only available in a select few restaurants, it is probably in the inception phase. If it is available to restaurants and on grocery meat counters across the country via major food wholesaler-distributors, it is probably, depending upon consistency of demand, either in the proliferation or ubiquity phase. Eel for example, is in an inception phase in the U.S.; it is ubiquitous in Europe and Asia.

Where a protein is in the adoption phase can determine its marketing and price points. Products in the *inception phase* are usually found in “white-table-cloth” fine-dining or ethnic restaurants; use trends result from creative originality in preparation, presentation and marketing and price points reflect the novelty and quality of the offering. Products in the *adoption phase* are can now be found in café and fast(er)-food outlets; use trends result from what is now a “genuine” or “authentic” identity that has a lower price point and more

identification with mass consumers. Products in the *proliferation phase* are usually found as standard offerings, perhaps in several forms, presentations and brands in chain restaurants and large supermarkets; use trends result from mainstream appeal and price points reflect the competition within the product group, as well as between the product group and closely competing proteins. Products in the *ubiquity phase* are usually found as on-the-go snack foods, frozen-foods, “price-buster specials” or institutional and convenience-store offerings; this is a mature product that can be found in many forms that are understood and used by a wide range of consumers.

Savvy marketers consider the audience for the product in light of the menu-adoption cycle. For example, “millennials,” today’s young college or working-class consumers, value convenience and quality. Additionally, they are plugged into social media, so the media message can make or break product perception and demand. Marketers will focus on a web or social-media presence that targets image, personal appeal, presents background on the product and information on how to best (or most stylishly) use the product. “Preppers,” who tend to be “locavore” modern-day hunter-gatherers, may be interested in the shelf-life, nutritional value or multi-application appeal of a product. “Singles,” single older-adult consumers will be swayed by quality, nutrition, portion size and ease of quick preparation.

*Competing Protein Products.* Any consumer who strives for at least a relatively decent and healthy diet makes every-day choices between what the food industry calls “center-of-the-plate” proteins: fish, beef, pork, and poultry. Within this group, supply and demand influence price; which in turn, coupled with current positive or negative media tags, influences the demand for specific products, or perhaps more accurately, how often the consumer chooses or decides to pass on choosing their personally preferred offering. In 2014 and into 2015, beef prices are very strong, this positions pork and poultry as being a better choice for more meals in the consumer food-buying cycle. Pork is coming off some price and supply volatility in 2014, and should do well in 2015.

A savvy aquaculture producer looks at this and targets their communications against the beef and pork prices, perhaps while playing up a healthier nutritional choice or more sustainable-production attributes. This is nothing new, in the past beef and pork producers employed the same tactics when bargain-price imported net-pen salmon looked to the consumer like a great “center-of-the-plate” option for summertime grilling over beef steaks and pork loins. The consumer is always willing to try a product substitution, there just needs to be ample financial or perceptual motivation to do so.

Perhaps the best look at the most timely data on the strength or weakness of competing proteins and their feed grain commodities is the USDA’s World Agricultural Supply and Demand Estimates <http://www.usda.gov/oce/commodity/wasde/latest.pdf>. This is a “one-stop-shop” source of information that provides a convenient snapshot into the give-and-take reality of the import-export world.

As for beef, the primary “center-of-plate protein” driver, we see continuation of a strong ongoing trend. Beef follows a well-established herd build-up/decline and supply/demand pricing cycle. These days, things are good for beef producers. As of the writing of this article (March 2015), the beef import forecast continued to strengthen as demand for processing grade beef remained strong and the strength of the dollar makes the United States an attractive market. Conversely, beef export expectations for 2015 were reduced due to relatively high U.S. beef prices and the strong dollar. Pork exports are lowered based on lower-than-expected shipments in January; and pork imports were raised due to the attractive U.S. Dollar, in spite of the fact that the United States market has an ample supply of domestic pork there are always huge users who will jump on a deal for imported product if the price is right. If they need it as a key input commodity protein for their product streams, it is just good business to lay in supply when the price point saves the operation large amounts of money. Currently, the situation is not quite the same for birds. The broiler and turkey export forecast was lowered as the strong dollar continues to crimp demand; but the egg export forecast was raised.

*Input costs.* Needless to say, the importance of tracking input costs and having alternatives to critical inputs and suppliers should be regularly visited review items and future-visioning points of your business-planning strategy and critical parts of your risk-management emergency planning. Of all input costs, the basic costs-of-production (feed, labor, energy) have the most impact on break-even point and subsequent pricing. For livestock and poultry producers this can be boiled down to the corn, corn-product or corn-ethanol co-product, and soybean-meal costs. For aquaculture producers, fish meal is the critically priced protein source in their feed formulations; coupled with what is happening with the demand trajectories of the competing animal proteins that also use fish meal in their feed formulations, e.g., Asian pork and shrimp mega-production.

Any commercial aquaculture producer should run the cost-of-production scenarios for the price range of their preferred commercial feed formulation, and consider supporting feed trials that substitute less-expensive proteins to replace some of the fish-meal; or perhaps have some kind of price-stabilized bulk- or group-buying contract in place for times when costs could spike. The big idea here is that if you have a potential vulnerability, hedge your bets.

The latest USDA Corn and Soybean Crop Summaries suggest that corn and soybean supplies will remain high and prices stay reasonable; fish meal is a different story. For example, if one looks to Index Mundi <http://www.indexmundi.com/commodities/?commodity=fish-meal&months=120> a commodity tracking site, one can see that for the past ten years the fish meal price exhibits a regular one- to two-year low-high-low oscillation, but this oscillation has always existed within a constant upslope climb driven by ever-increasing international demand and ever-decreasing supply.

Historical prices tell the story. In February of 2005 fish meal was U.S.\$707.86 per metric ton, in February of 2015 it was U.S.\$2,030, having hit an all-time high of U.S.\$2,390 in December of 2014. At one point in the cycle the price doubled in five years; if you look at the underlying

upslope of the historical price trajectory on any of the commodity trading or tracking websites, it is not unreasonable to consider that within the next three to five years the fish-meal price easily could double yet again.

*Foreign Market Access.* Usually the rule is that if foreign markets are open for poultry, pork or beef (increased international demand), domestic prices usually are lower. This is a win-win that is good for the consumer and good for the poultry, pork or beef producer. However, in light of this, domestically produced aquaculture products tend to fare less well if the other “center-of-table proteins” are affordable and the aquaculture producer’s fixed costs of production are forcing them to try to compete with a high break-even price point.

The United States operates a comprehensive agricultural export-promotion system, that partners USDA’s Foreign Agricultural Service with nonprofit trade associations who represent commodity or regional interests [http://www.fas.usda.gov/sites/development/files/2013-09/market\\_development\\_eval-2010.pdf](http://www.fas.usda.gov/sites/development/files/2013-09/market_development_eval-2010.pdf). Among the programs supported by USDA are the Market Access Program (MAP) and the Foreign Market Development Program (FMD).

Following implementation of the 2002 Farm Bill, overall annual market-development spending by USDA and its industry partners in the MAP and FMD programs has grown by nearly \$250 million between 2001 and 2008, resulting in total partnership spending worldwide exceeding \$568 million a year. As one of the world’s leading agricultural exporters with, for example, fiscal year (FY) 2009 exports of \$96.6 billion, these programs play an integral role in USDA’s mission to increase U.S. agricultural exports and keep overseas market development accessible to small firms and producer groups who may not have consistent export-marketing power, policy risk or inconsistent producer cohesion or support. An example of the benefits of the work can be found in a 2013 press release <http://www.fas.usda.gov/newsroom/usda-preserves-4-billion-agricultural-exports-2012-knocking-down-barriers-trade> ; where it was noted that in 2012 the programs worked to resolved dozens of agricultural export issues. These successes were estimated to have created an additional U.S.\$4 billion in American agricultural and forestry exports while protecting roughly 30,000 American jobs.

Despite this type of documented contribution to U.S. agricultural exports, these programs have been criticized for promoting “corporate welfare.” Supporters of the programs believe that such efforts are critical to enable U.S. exporters to be competitive in the global market with other countries whose export promotion activities are partially or completely funded by their governments, and who frequently protect their producers with tariffs or less visible, but equally effective, barriers to competing imported products.

Most trade experts agree that the U.S. open-access programs, and free-trade in general, provide benefits to the entire farm sector and all aspects of the American and international economies. Sometimes related Foreign Agricultural Service (FAS) support programs dovetail with trade agreements to help foreign producers and exporters in other countries as a way to advance U.S. foreign policy by promoting better local economic and human health, self-sufficiency, technical skill development and political stability.

At first glance it would appear that we are creating competition for our own producers, but usually these programs create greater import opportunities for other exported U.S. commodities and improvement in the overall market creates greater overall demand. Increased diversity in the market results in more stable and predictable markets that benefit all producers. Opponents counter that increased exports usually result from some other existing market condition rather than government-assisted expenditure and that government assistance is unnecessary.

With respect to aquaculture and seafood products and competing food and input proteins, the changing landscape is monitored by FAS. Reports and briefings on general policies, key trade data and special features on specific problems impacting markets are available online <http://www.fas.usda.gov/commodities/fish-and-seafood>.

International trade and global markets can be fascinatingly complex. One aquaculture example of this is the Asian, Korean and to a lesser extent, European, demand for specialty foods from eel. East coast U.S. harvesters have long collected juvenile eels to sell for grow-out in foreign aquaculture facilities. The technical difficulties of producing young eels in captivity keeps world aquaculture producers dependent on these increasingly limited fisheries, and mushrooming demand has resulted in increased monitoring and regulation of the fishery, as well as increased concern about the sustainability of the resource and present harvest quotas.

In the past, U.S. interest has solely been with exported juveniles; while we imported a goodly amount of the finished product back from those same countries. This is essentially a situation where the grow-out producers reap the considerable value addition to the eel and its processing. Currently, there is strengthened interest in developing a U.S. domestic eel industry, complete with, if technically possible, the captive rearing of juveniles. Driven by Japanese-American and Korean-American populations and the expanding “foodie” horizon of many educated affluent American consumers, interest in sushi and related products is resulting in demand that is underscoring the need for sustainable domestic production of the eel from the juvenile through to consumer-ready value-added products.

This domestic demand may result in North American eel production and production of Unagi Kabayaki (a Japanese-American steamed and barbecued sushi dish) and Jung uh gui (a traditional Korean dish) for domestic and high-value export products. Other U.S. aquaculture producers are working on Nori (micro-algae) farming for the same markets. There are many other examples in the aquaculture realm of how international factors affect almost every area, from Alligator hides to shrimp to tilapia fillets; it seems that in international seafood, nature (and trade economics) abhors a vacuum.

*Strength of Currency and Government Action.* All global-market factors are in some way interrelated. One of the most important effecting any protein product is the strength of the U.S. Dollar and its relationship to competing currencies in countries to which we export; as well as the political and economic relationships those countries have with one another. The value of

any currency is influenced by trade itself (surpluses as well as deficits), as well as how major commodities like grain or petroleum are positioned.

The 2015 Spring Issue of the respected food industry journal *Urnner Barry's Reporter* [http://www.urnnerbarry.com/reporter/issues/ReporterV10N2\\_WEB.pdf](http://www.urnnerbarry.com/reporter/issues/ReporterV10N2_WEB.pdf) has an excellent article on the unforeseen variables that affect poultry pricing. The author discusses how a strong U.S. Dollar can be either good or bad, depending on other influencing factors. If the dollar strengthens (the foreign currency weakens), exported-poultry values weaken. Not long ago the strong U.S. Dollar in the face of a devalued foreign oil market forced poultry exporters to discount their products to stay in their markets. Conversely, a weakened Dollar usually drives the demand of these same markets for "cheap" imported product.

This is of course true for producers in other countries too, and sometimes results in situations that trigger government intervention. *Seafood News* <http://www.seafoodnews.com/Story/967505/Russias-Federal-Fisheries-Agency-Proposes-Export-Duties-on-Fish-If-Domestic-Prices-Too-High> recently ran a story concerning sky-high domestic seafood prices in Russia. Due to ongoing political sanctions against Russia, the continuing devaluation of the ruble in late 2014 made producers in many Russian industries raise domestic prices in rubles to reach the global level in U.S. dollars. Russia's Federal Fisheries Agency recently suggested that it will place export duties on fish if domestic prices are too high for consumers, Ilya Shestakov, Director of Trade Authority told reporters, "We will introduce it if fishermen are unable to come to terms with processing companies." In other words, we are warning you to "play nice" or the government will step in and set a price control. Governments are well known for doing this to protect an industry or their domestic consumers due to a currency weakness or trade imbalance. In the Russian seafood situation, both factors are in play.

*Government Policy, Food Safety Issues.* Government actions can also influence a protein product directly or through what is done to influence and other protein commodity or a program unrelated to food production. In the U. S. the USDA regularly triggers purchases for national school-lunch programs to shore up a particularly weak market. Of course, what positively influences that particular market, especially if it is a commodity protein, may negatively reverberate in others. In the worst situations, political differences, international unrest or instability, and their resulting international incidents, can trigger trade-wars resulting in reciprocating tariffs, duties and quotas.

Domestic issues also can result in government action. Any government may act on an actual or simply perceived public impact of a product-related health or quality issue and trigger some sort of government intervention. For this reason, all aspects of food-safety and the risk-management associated with maintaining product integrity throughout the supply chain is of paramount importance.

Hollyer et al. 2009 reported that foodborne diseases were annually responsible for approximately 76-million illnesses, 325,000 hospitalizations, and 5,000 deaths. These issues

were estimated to annually total between U.S.\$10B and U.S.\$83B in pain and suffering, reduced productivity, and medical costs. Increasing national awareness of the necessity for prevention, identification and resolution of food safety hazards within all protein systems has placed a very public focus on public-health prevention and emergency-action decision making.

At the least this has resulted in added inspection and marketing costs; at the extreme, it has resulted in quarantines, product recalls and similar catastrophic loss of market share. We have seen this with Mad Cow Disease in cattle; Chronic Wasting Disease in farmed-venison herds; salmonella in poultry, vegetables and comminuted (ground-meat) products; and quality or environmental concerns resulting from tainted feed inputs that have impacted imported farmed shrimp, net-pen salmon and many other food products.

Additionally, national awareness and resulting policy debates have placed an emphasis on sustainable production. Always a great goal for any production system, the sustainability movement also has produced politically adversarial well-funded action groups that have targeted biotechnology and food companies and their genetically-modified plant and animal products or overall production systems. In some cases, public-health concern over the sustainability of a system and its effects on populations may result in legislation or legal action that can change an entire production landscape.

Currently in the Midwest, there is increasing concern regarding the overuse of manure and chemical fertilizers for the “continuous-corn” ethanol-production system and the human-health effects of the run-off nitrates in drinking water. In January 2015, in Iowa, this concern resulted in the filing of a major lawsuit by the city of Des Moines against agricultural producers in three counties upriver from the city. This lawsuit could play out in farm fields across the nation. Both agriculture experts and environmentalists are closely watching the case, which they say could bring to a head a decades-long national fight over non-point water pollution that originates from cropland that may be hundreds of miles away from those most severely impacted.

A host of other issues may impact preferences for a given protein. Transportation is an important sustainability-linked issue. With respect to aquaculture and aquaponics, local production alleviates some of the energy burden of fueling fishing fleets and powering the infrastructure of cross-country refrigerated or frozen transportation and storage systems. Transportation and fuel are infrastructure necessary, not only for food transportation, but also for production of feed and other inputs necessary for protein production systems.

It should be noted that plant proteins and their even higher-value protein isolates used as alternatives to meat proteins or as extenders are influenced by many of the same factors discussed above. These protein products are important ingredients in the food industry from baked goods to beverages. They play important roles as key meat-protein product extenders or concentrated, perhaps lower calorie, protein alternatives to meat. Soy, milk and wheat protein products often function as texturizing components, binding agents and shelf-life extenders, as well as contribute essential nutritional fortifications. As a particular animal protein increases or



decreases with supply and demand, so too affected are the plant protein inputs or extenders for its prepared-food value-chain.

Sustainability may focus on a particular product. For example, in 2010 there was considerable public-policy debate concerning genetically engineered salmon. Genetically engineered salmon with better conversion ratios are a GMO (Genetically Modified Organism) that environmentalists fear could escape and interbreed with wild-stock fish, disrupting the natural species genome. Additionally, the aquaculture production of salmonids and similar “high-feed-conversion” species, dependent upon high fish-meal diets, generally are considered non-sustainable in light of current trends in world competition for fish-meal protein for aquaculture feeds.

Fish meal is a great example of how many of the factors we have discussed can influence the supply, demand and price of a commodity and the proteins that it can impact. China is the world's largest importer of fishmeal, so in the short term any change in their consumption levels will have an impact on price levels. In 2008, China's pork industry faced a health problem (blue ear disease) which significantly decreased production levels. The consumption of fishmeal for pork feed decreased and with it so too did the market price for fish meal.

Currently, China's pork industry has recovered, but other major protein industries use fishmeal. One is the shrimp aquaculture sector; in recent decades there have been several instances where international shrimp markets have been impacted by weather issues and disease. If a large typhoon impacts south China it can seriously impact the aquaculture industry; the disrupted production reduces the demand for fishmeal, reflected in a decreased world fishmeal market price. Of course, this usually benefits other Asian aquaculture and pork producers.

As we have seen, weather, disease and similar risk-management issues can impact any protein-production system, so too of course, human error. No one really has any idea how global climate change will influence the direction of world protein-consumption trends, but in 2011 the world got a good look at how economies can be impacted by a major catastrophic natural event coupled with egregious human error. In this case, the tragic 2011 earthquake and accompanying tsunami in Japan and destruction of the Fukushima-Daiichi nuclear power. <http://www.thefishsite.com/articles/1141/shrimp-market-report-may-2011/#sthash.L85rhhBJ6.dpuf> or <http://www.thefishsite.com/articles/1141/shrimp-market-report-may-2011/>

Japan is the world's single largest importer of fish and fishery products. In the short term, the damage to infrastructure and the disruption of transportation and electricity transmission negatively impacted the import/export, production, distribution and consumption of all chilled and frozen products. The earthquake and tsunami destroyed many fishing zones, vessels and related processing infrastructure, thereby reducing Japan's ability to catch and locally produce fish and value-added fish products.

Fishing ports near the Fukushima-Daiichi nuclear power facility have experienced voluntary and government-mandated fishing bans due to possible ocean contamination from possible leaked contaminants. This resulted in changes in international seafood supply, demand and consumer preference. For example, in 2013 South Korea placed an import ban, and a major expansion of existing restrictions, which prevented 49 species of fish from Fukushima from entering Korean markets. A handful of other bottom feeding species from the broader region, nearly 600-miles of coastline and its coastal fishing communities, also were banned.

This created a trade situation between Japan and Korea. In the face of Korean perceptions of contamination, the Japanese government established extensive environmental and catch monitoring programs to ensure product safety and protect the economic viability of fishing communities. These programs were not only designed to get product back to Korean distributors (high-value export markets), but also reassure very concerned Japanese consumers now highly suspicious of wild- and local-caught seafood due to the Korean actions.

Of course, the critical element when marketing is product perception. As we have seen, this can be affected by any number of natural and human elements, the menu-adoption cycle, product price-point and creative marketing. The question asked in the beginning of this article was, simply stated, "Is it the basic economics of supply and demand that influences the price that can be realized by the producer?" --Well, yes and no.