SUMMARY REPORT

USB-AQUACULTURE INDUSTRY COALITION MEETING

The sixth annual USB-Aquaculture Industry Coalition meeting was held at the Town & Country Resort and Convention Center in San Diego, CA from 07:30 -12:00 on March 4, 2010. The meeting was divided into five sections, with the objective of providing an overview of the state of our domestic aquaculture and soybean industries. This report provides a summary of the presentation given at the meeting. The individual reviews were vetted and approved by each of the presenter to ensure accuracy; the wisdom shared and insights provided are theirs; the typos and incorrect verb tenses are mine.

The meeting began at 07:30, with Gil Griffis, the United Soybean Board's Soy in Aquaculture Consultant, welcoming the guests and introducing Mr. John Campen, the New Uses Program Manager for USB.

Mr. Campen said USB was established in 1991. It is presently governed by 68 board members and represents over 681,000 U.S. soybean farmers in 24 states. He said the mission of USB is to "Ensure that U.S. soy is the highest quality and most competitive in the global marketplace". Its strategy is for U.S. soybean farmers to work with the industry, such as the domestic aquaculture industry, to maximize the use of US soybeans and soybean meal throughout the world. He noted that one of USB's strategic objectives is to market 3.5 billion bushels of U.S. soybean annually by 2011. Ideally, an increasing volume of this production will be used in support of an expanding domestic aquaculture industry.

He closed by thanking the audience for their participation and support. He then introduced the opening speaker.

Mr. David Harvey, the Poultry and Aquaculture Analyst with USDA's Economic Research Service, made the opening presentation, entitled "Aquaculture Situation & Update". He defined aquaculture as "The controlled production of aquatic organisms for all or part of their life span." He said that the industry will grow due to the unintended consequences of the capture industry's reliance on advances in technologies that have made fishing more efficient and, in several cases, contributed to the over-fishing of many species. As a result, the wild-catch has been flat over the past several years and, by some estimates, is projected to decline.

At the same time, the world's human population, along with per-capita income is increasing and driving up the demand for aquatic products. The increasing gap between flat or declining supply, coupled with growing demand means that aquaculture will have to make up the difference. Contributing to its growing popularity is its ability to provide the desired product, be it fish, mollusks or shellfish, in uniform size throughout the year. These benefits favor the consumer in the form of fewer fluctuations in price and during the season when, for example, salmon are in season, a decline in the real price.

In addition, the source of some species can be locally and/or organically raised, thus meeting the increasing requirements of niche markets. Domestic aquaculture can also contribute to resolving an increasing public concern over food safety as the industry must meet complex governmental regulations and environmental oversight. Finally, aquatic products raised in captivity lend themselves to selective breeding and the desired results of faster growth with lower costs of production.

The ideal species for aquaculture are those with a high market value that can not only meet a seasonal demand when wild-catch production is not in season but whose overall demand is expanding. The candidates can also be both spawned and raised to maturity in a confined space. Ideally, they can be easily handled and will accept prepared feed, with emphasis on plant-based proteins.

Turning specifically to aquaculture in the United States, Mr. Harvey described per-capita demand for seafood increasing from about 14.9 pounds in 1998 to 16.0 pounds in 2008. Of this latter amount, 11.8 pounds was in the form of fresh and frozen, 3.9 pounds canned and 0.3 pounds cured. The majority of U.S. production is catfish.

What are the factors that will affect aquaculture production in the U.S.? In his opinion and over the short-term, they include the growth in the domestic economy and more people eating meals away from home. In addition, COOL regulations are at least making people more aware of the origins of the seafood they purchase. Finally, and with emphasis on catfish and shrimp, both active and pending federal regulations could limit imports and thus encourage greater domestic production.

In regard to catfish, which, as noted, represent the majority of domestic aquaculture production, Mr. Harvey said that a decline in sales have contributed to a lower inventory of live fish. However, higher inventories held by processors have contributed to steady prices to consumers. It was hoped that the gradual growth in domestic demand and a slight decline in feed prices will encourage a return to previous sales levels.

A major challenge to the United States' domestic aquaculture industry is competition from imports. Of the four examples he noted—tilapia, salmon, shrimp and mollusks—Mr. Harvey provided a detailed analysis of the first three. He described tilapia as a pond-raised warm-water species, grown worldwide under a variety of production methods. It could be described as the ideal species for aquaculture in that it is a hardy, disease resistant, can be grown in high densities and thrives on a plant-based diet. Its economical price and large supply has contributed to its imports growing from about 85 million pounds in 1999 to slightly over 400 million pounds in 2009.

Salmon, a cold-water off-shore fish is also growing in demand in no small part due to its increase in year-round availability and stable price. These factors have contributed to imports expanding from about 290 million pounds in 2000 to about 420 million pounds in 2008. A large percentage of these imports are farm-raised Atlantic salmon. However, unlike the other species Mr. Harvey reviewed, the United States has a viable export market for salmon, albeit in the form of wild-catch. While exports are strong, they are increasingly being out-distanced by the value of imports.

Unlike tilapia, of which nearly all is imported and farm-raised, the imports of shrimp come from both aquaculture and wild-catch. Domestic production is primarily wild-catch. The sources of imports are numerous, with emphasis on Southeast Asia and China in general and Thailand (34%) in particular. The volume of imports in 2009 was 1.21 billion pounds.

Mr. Harvey concluded his presentation by noting that aquaculture production in the U.S. should continue to expand both in volume and diversify in species as producers target specific markets. Contributing to this growth will be a slowly increasing domestic demand. He ended with a cautionary note: imports will continue to be a challenge.

Opening the panel on "Issues Facing the Industry" was Dr. Randy MacMillan, the Vice-President of Clear Springs Farms in Buhl, ID. Dr. MacMillan's topic was "Water Issues and Aquaculture." He described how competition for fresh water is historic and still problematic. It involves property rights and economic development, over which wars have and will be fought and can affect human survival.

In regard to Idaho, Dr. MacMillan said the eastern part of the Snake River Plain is the United States' primary source of trout production. Its geology began about 17 million years ago when periodic lava flows that, through eons of time, crumbled and created space for water. These waters contributed to forming an aquifer about the size of Lake Erie. About 15,000 years ago, a huge ice block broke, sending a deluge of water through the area to create what is now the Snake River. The last volcanic activity in the area occurred about 2000 years ago. The aquifer-supplied water is a constant 58$^{o}$ F and potable and thus ideal for trout production, which began in later part of the 1920's. Perhaps anticipating challenges of the future, water rights were established only eight years later.

Unfortunately for Clear Springs and other trout farms in southern Idaho, the spring water that comes from the aquifer and that is ideal for raising trout also meets the demands of crop production and related agriculture uses. These demands began about 1955 when ground water pumping was initiated to support crop production and to help offset periodic decline in precipitation.



Clear Springs has four trout farms, Box Canyon Farm and Crystal Springs Farm are their largest. Both take water from the aquifer, with both facing a declining supply as the volume of aquifer water declines due to pumping, changes in irrigation practices and drought. For example, the average annual water flow past the Box Canyon Farm spring diversion has declined from about 430 cfs in 1951 to less than 320 cfs in 2008.

Dr. MacMillan then provided a brief primer on the highly complex and litigious issue of water rights. Riparian water rights refer to water in, under and adjacent to a piece of property from which the landowner can draw. These rights cannot be sold and no water can be moved off the property. These rights typically apply to land that receives adequate rainfall as primarily found in the eastern half of the continental United States.

In comparison, appropriated water rights apply to land where rainfall is limited and water is scarce, such as found in the dryer western half of the US. Appropriated water rights are similar to real property in that the water can be sold, transferred or mortgaged. In other words, the water is independent of the land. Because it is limited in supply, proper management by the State must occur and this is through Priority Administration. This form of state water distribution management defines the water rights as "First in time is first in right" and senior vs. junior rights. Put simply, the first to acquire the right to the water has precedence over those that come after...at least in theory.

Where there are problems, such as those of increasing concern to Clear Springs and other water users in Idaho, the litigant can make a case for relief through the initial step of water delivery call which is followed by an administrative hearing to determine the extent of injury and confirm senior and junior water rights. This is often followed by an appeal to a district court and finally the Idaho Supreme Court. The cost to Clear Springs Foods to defend it water rights was reported by Dr. MacMillan to be $300,000 annually. The effort by the company to defend its water rights has been successful but they still have not received the water they are due. They now believe working with the junior water right holders to create a "win-win" for both sides may be more fruitful.

Dr. MacMillan closed by confirming a growing reality: fresh water is a resource that is limited in supply and over appropriated. It has, is and will be a source of "water wars" unless practical solutions to better share the water and use it efficiently is found.

The next speaker was Dr. Andy Goodwin, a Professor and Associate Director of the Aquaculture/Fisheries Center at the University of Arkansas at Pine Bluff. He is also an AFS-FHS Certified Fish Inspector and Fish Pathologist. His topic was "Diseases".

Dr. Goodwin said that disease can be highly detrimental to an aquaculture farm in many different ways. It can reduce growth of the fish and feed conversion. The physical manifestations of a disease, such as lesions, can lower market value. At its worst, disease can either kill the host outright or require expensive disease treatments. These are the impacts that are usually associated with disease, but there are others that are equally important. These include the cost of complying with local, state and federal regulations, damage to public relations to a farm identified with diseased fish, legal jeopardy if a farm is found not to be in compliance, and regulatory inequalities that lead to unfair trade.

He then gave examples of these other impacts by discussing Viral Hemorrhagic Septicemia (VHS), and other important diseases. The VHS virus is causing serious concern across the United States, with emphasis on states contiguous to or near the Great Lakes. He noted that the disease is not species-specific, in that it has already affected 25 species ranging from Salmonids to Centrarchids. The disease first appeared in 2003 and is found in the waters of all eight Great Lakes states. Fortunately, VHS has yet to be found on any commercial fish farm. Unfortunately, the cost of preventing its expansion is causing serious problems for the fish growing industry in the region.

Contributing to these concerns is the plethora of regulations, all of which are expensive to implement. As an example, he quoted from an Emergency Order issued by APHIS in October 2006. The Order stated that "Effective immediately, interstate movement of certain species of live fish from specified areas in the United States is prohibited [unless they are certified VHS free by the state authority]". The rule was simple to state but the lack of detail led to states differing in interpretation of the requirements for interstate movement. To make matters even worse, state agencies began to issue their own rules to limit or prevent transmittal of the disease.

In an attempt to resolve the concerns of the fish grower and to better protect against the spread of VHS, APHIS published an interim VHS rule. Response to the rule varied greatly, but the industry agreed that requirements for a unique certificate be issued for every live shipment and a visual inspection within 72 hours of shipping would be extremely difficult and expensive, but would not actually help prevent movements of VHS virus. There were also many concerns about there not being enough aquaculture veterinarians to do the work. In regard to the cost of quarantine and eradication, Dr. Goodwin provided a specific example of Spring Viremia of Carp Virus (SVCV) that, when found several years ago on a farm, resulted in all of the fish being killed and the ponds drained and limed. The Federal and state response to this SVCV finding resulted in a quarantine that lasted 2½ years.

Turning to the cost of conformance, Dr. Goodwin described the cost of legal jeopardy for those who either knowingly or unknowingly don't follow the rules. He provided examples, in the form of court rulings from Wisconsin and Massachusetts, where farms had failed to meet the exact letter of Sate regulations and were charged with violations of the Lacey act that led to court-imposed penalties ranging from large fines to incarceration.

In regard to the competitive disadvantage U.S. fish producers face vis-à-vis foreign producers, he said that some drugs can be used overseas that are banned in the United States because they pose a risk to farmers and consumers. Foreign farms that still use these dangerous but effective drugs are able to unfairly reduce their production costs. Examples include Choloramphenicol, Nitrofurans, Fluorequinalones, malachite green and crystal violet.



His final example of the cost of disease was in the form of public relations, both to the specific farm as well as to farm-raised fish in general. In the latter case, he shared a headline from *The New York Times* entitled "Lice in Fish Farms Endanger Wild Salmon, Study Says." Fair or not, such articles certainly can and do influence public, and thus political, opinion on supporting aquaculture and eating fish derived from it.

Dr. Goodwin closed with the hope that the level of the proverbial playing field could at least be improved. He noted how pending rules from USDA to assume inspections of channel catfish, and possibly Pangasius, could reduce the competitive pressures against domestic catfish producers. In addition, a newly approved National Aquatic Animal Health Plan (USFWS, APHIS, and NOAA) has the potential to help standardize State and Federal regulations. This would be a huge economic benefit to the aquaculture industry.

The final speaker on the panel was Mr. Gary Fornshell, the Extension Aquaculture Educator at the University of Idaho. His topic was "Feed Prices".

Mr. Fornshell presented a graphic, depicting the previous and projected combined catch of feed fish to process fishmeal and the catch of food fish for human consumption as being flat between 2000 and 2030. In contrast, aquaculture grew from an estimated 45 million mt in 2000 to a projected 150 million mt during the same years. The world population, projected to increase by 1.5 billion people, will require an additional 80 million mt of seafood by 2030.

Mr. Fornshell noted that the top four farm-raised species groups in 2005 were carp (9.7 million mt), marine shrimp (4.2 million mt), tilapia (2.2 million mt) and salmon (1.8 million mt). Their demand for fishmeal, as a percentage of supply in 2003, was 15%, 23%, 3% and 20%, respectively. China is the world's largest importer of fishmeal, primarily to support its rapidly growing carp and tilapia production. While fishmeal imports are down from a 2005 high of 1.6 million mt, its purchases in 2008 were about 1.3 million mt, of which 832,000 mt came from Peru.

In regard to fish meal production, Mr. Fornshell confirmed how it is affected by El Niño events. With average production between 1988 and 2006 being about 6.3 million mt, it fell during an event in 1998 to about 5.2 million mt and 5.0 million mt in 2007. The latter was also the lowest amount of production during the reported 18 year period, suggesting the overall catch of feed fish, the primary source of fishmeal, is declining. In contrast, its cost has rapidly increased from about $855/mt in December 2005 to nearly $1,800/mt in January 2010. The price of fishmeal from Peru, the world's largest supplier, grew by 139% between 2005 and 2009. In comparison, fishmeal sourced from the Gulf of Mexico increased by 32% between 2007 and 2009.

Some reasons for the increasing cost of fishmeal is its static supply of about 6.3 million mt/annum and, as noted, the adverse affects of El Niño during certain years. In an effort to protect future production, several key country sources of feed fish are imposing quotas on the catch. In regard to demand, as aquaculture in general and aquaculture in China specifically continues to grow, so does its need for fish meal. Adding to the cost of buying it is the increasing use for human consumption and the cost of energy to catch, process and transport.

Mr. Fornshell then described the future prospects for fishmeal. He noted that in the short term, demand from aquaculture will continue to expand. In contrast, supplies will be limited. Over the long term, demand is projected to decline primarily due to the increased use of alternative animal and plant-based proteins. In fact, this is already happening, and with some significant successes. For example, the average dietary fishmeal inclusion rate for marine shrimp declined from 28% to 20% between 1995 and 2006. During the same period, the requirement by salmon was down by 15% and the average for all marine fish by 18%.

Mr. Fornshell then reviewed the effects of feed prices on two domestic aquaculture industries, trout and catfish. In the former case, he said that while the sales price of trout in Idaho increased by 22% between October 1995 and March 2008, the cost of feed grew by 74%. For catfish, the cost of feed grew by 65% between 2005 and 2009.

An important and contributing reason for the overall cost of feed in all species of farm-raised fish is that the cost of soybean meal and corn has also increased. He noted that the price for soybean meal grew from slightly over $200/mt in January 2006 to $354/mt in December 2009. However, its price is projected to remain relatively flat, at about $275/mt, over the next eight years. For corn, the increase was about $68/mt during the same period.

Mr. Fornshell described how ethanol production is reducing the supply and thus increasing the cost of feed corn. He noted that ethanol production increased by six million gallons between 2003 and 2008, and contributed to a 200% increase in the per-capita bushel price of corn. He said that for every 1% increase in corn prices, there is a commensurate increase of 0.134% and 0.263%, respectively, in the short and long term cost of catfish feed.

Mr. Fornshell closed his presentation by describing the future prospects for US-produced corn and soybeans. For corn, it us e for ethanol should grow from 13% of total supply in 2006 to over 30% over the next ten years. However, corn prices will decline from their record high in 2008 while remaining above their average price of the past. American soybean farmers should anticipate increasing competition from Brazil and Argentina. However, as overall world demand grows, so will U.S. exports. At the same time, the growth of the domestic livestock sector will support an increase in domestic demand.

The first speaker on the "Opportunities to Strengthen the Market" was Dr. John Schillinger, the President of Schillinger Seed and Schillinger Genetics. His topic was "Redesigning Soybean Composition for Aqua Species."

He said his firm is developing new soybean varieties aimed at improving utilization in trout and salmon. The company plans to release this year a bean with a 15-20% higher protein content. In 2011, two additional releases are planned, one with a reduction in oligosaccharides and certain neutral sugars; one with a lower level of trypsin inhibitor. He noted the second cycle of the company's new line of low trypsin inhibitor soybeans is in process, with seed increases taking place for the first cycle. The goal in 2010 is to release a soybean line that is both lectin- and other key allergens-null.

Dr. Schillinger said the research, being conducted in cooperation with Dr. Rick Barrows, the USFWS Research Physiologist at the Bozeman, MT Fish Technology Center, is divided into three phases. In the first study, unheated soybean meal will be made into pellets for trout and salmon to determine how the different proteins in the meal react to heat and related factors that constitute the pelleting process. The study will compare

the binding properties of five varieties of unheated full-fat soybean meal with seven varieties of full-fat, heated meal.

In the second phase, a determination will be made of the amino acid digestibility and acceptance by the test fish on 14 unique soybean meals when compared to fishmeal and existing commercial soybean meals. The research will compare six new varieties of full-fat meals, meaning the beans have been roasted and dehulled before going through a roller mill, to compare digestibility. The unique quality of each of the varieties are: 1) high protein; 2) high protein plus low oligosaccharides; 3) mid-levels of protein but ultra low oligosaccharides; 4) low levels of trypsin inhibitor; 5) ultra-low levels of trypsin inhibitor; and 6) P-34 allergen null. The unheated meals will consist of: 1) commercially-available meal; 2) low trypsin inhibitor meal; 3) ultra-low trypsin inhibitor meal; and 4) P-34 allergen null meal.

Finally, the soybean meal that produced the best results in phase two will be fed to salmon and trout to determine which supports the best growth and development. In this study, up to eight different full-fat forms of soybean meals will be selected from phase two, with the controls being fishmeal and defatted commercial soybean meal, all fed to the fish at their standard and 30% inclusion rates. Some of the key comparisons to be determined are the effects on the fish of various levels of trypsin inhibitor and allergens with high protein plus ultra-low oligosaccharides.

He reported that additional modifications in soybean meal presently under development include beans with low phytate and those with high Omega-3 properties. He said that key SNPS molecular markers to accelerate the process of detecting the desired key straits are being used. He confirmed that all of the meal being tested comes from non-GMO soybeans.

Dr. Schillinger closed by thanking the Iowa Soybean Association and the Illinois Soybean Association for their respective funding support for the research.



The next speaker on the panel was Dr. Jeffrey Silverstein, the Aquaculture Program Leader of the Office of National Programs, USDA/ARS. His topic was “Aquaculture Research and Alternative Feeds.”

Dr. Silverstein said that under the New Science Enterprise program, several “societal challenges” and goals to resolve them have been identified. They range from global food security and hunger to food safety. With emphasis on the former, he noted production from aquaculture grew by 40 million mt in the past 20 years, by 400% in only the past 15 years. In comparison, the catch of feed fish, primarily for processing into fishmeal and fish oil has remained between 20-30 million mt during the same period. He confirmed that in spite of its explosive growth, aquaculture has many challenges to overcome to ensure an equally dynamic future. A partial list includes developing alternative feedstocks to the catching of fish to feed fish, reducing pollution and escapes from ocean cages and countering parasites and disease.

Turning to the contribution of USDA's Aquaculture Research Service to aquaculture, Dr. Silverstein said funding increased from less than $5 million in 1990 to about $38 million in FY09. . When added to funding support from NIFA and NOAA, total federal funding averages between $80-100 million for aquaculture. Dr. Silverstein said there are five key components of ARS's aquaculture program. They are: 1) genetics and genomics; 2) physiology of growth, reproduction and stress; 3) feeds and nutrition; 4) health; and 5) systems and products.

He then shared examples of how aquaculture is receiving increasing attention in the media. They include an article that appeared in *The Christian Science Monitor* on how recirculating aquaculture systems may be part of the future of fish farming. He also described a recent interview with ARS scientist Dr. Rick Barrows on NPR about research being conducted on alternative feeds.

Dr. Silverstein confirmed one of the major challenges facing aquaculture is finding alternatives to the use of fish to feed fish, in other words alternatives to fishmeal and fish oil. His key point was aquaculture supported by fish-based feeds cannot continue its present level of growth. Not only are there not enough feed fish available to meet demand, the opposition from the environmental community to its use cannot be ignored. In brief, alternative plant-based feeds that can meet the nutritional needs of its recipients must be found.

Dr. Silverstein then described the Plant Products in Aquafeeds (PPA) program as a coordinated initiative to accelerate the discovery process. He said that through this program, closer cooperation among various federal departments and agencies focused on research has been established.

Parallel to the PPA program is the development of a series of publications on the nutrient requirements of fish and shrimp. Sponsored by ARS, NOAA, USB and internal NRC funds, these scientific studies are considered to be the definitive source of information for fish and shrimp researchers and producers.

He also described a joint USDA-NOAA Alternative Aquaculture Feeds Initiative that will summarize the status of efforts at both the research and commercial level to replace fishmeal. It will focus on identifying the future of research and its application to alternative feeds. It will create an action plan that will involve strategic partnerships and provide a vision for the United States' and global aquaculture feeds industry. The purpose of the project is to reduce the amount of fishmeal and fish oil used in aquaculture through the identification of cost-effective alternative sources of proteins and lipids. These alternative feeds must not only meet the needs of the aquatic animals, but also the health benefits derived by humans when consuming sea foods.

Dr. Silverstein said the initiative is important as it presents the opportunity to summarize the current status of efforts to identify alternatives to fishmeal at both the research and commercial level. He said it will focus on determining the research and development needed to identify viable feed alternatives, create strategic partnerships and provide a vision for both the aquaculture industries of the United States and worldwide.

Dr. Silverstein then turned attention to the aquaculture nutrition program of ARS. Two of its several efforts are to define the nutrient requirements of aquatic animals and to conduct evaluations of feed ingredients. Its research on evaluating ingredients will involve compositional analysis, with emphasis on amino acids. It will also conduct digestibility and growth studies. Some alternative feeds on which the study will focus include barley protein concentrate, soy protein concentrate, single cell products and fish processing co-products. The example he provided of the latter is the discards, in the form of heads, tails and offal, of fish processed for human consumption. He noted the total harvest of Alaskan seafood is about two million mt/annum, with about half of that going into seafood products for humans and the other half being "waste" or co-products. He then reviewed ARS research designed to foster development of new ingredients. One approach is the development of "gateway formulas" which are open formula feed formulations that meet basic requirements for the fish. They are intended as a jumping off point for ingredient development, a formula that can be used as a control or basal diet and used to test and develop new ingredients or diets. Some examples of gateway formula are plant based feed formulations for trout and cobia and fishmeal-free formulations for research on marine species.

He described some current and potentially rewarding research as including the testing of Schillinger Genetics-9 varieties, and research conducted by Dr. Keshun Liu on feed grade SPC that contains up to 70% protein. He said this research is under discussion with Indiana Soybean Alliance. He also described trials being conducted by Dr. Bill Wolters on Atlantic salmon, and by Mr. Mark Drawbridge and Dr. Paula Sylvia on White Sea bass. In the latter example, he said that USB is contributing support to the study.

Dr. Silverstein also shared examples of cooperation among various federal agencies in support of aquaculture. He noted that a producer at a USTFA meeting asked how the taste of trout raised on feeds with lower levels of fishmeal may taste. This simple query contributed to a taste test demonstration involving ARS, College of Southern Idaho and the University of Idaho. The results of the evaluation, in this case on red pigmented fillets, were excellent Trout farmers then expressed interest in white fillets, and further studies involving the same interdisciplinary team are underway. He confirmed this example of cooperation is and can apply to other research.

Turning to USDA's genomic research, he said it consists of infrastructure, discovery science and application of the science in practice. In the latter case, he said the unlocking of the whole genome of a species can contribute to selecting desired traits. The development of "precision management systems" will contribute to optimizing the animals' health, production and well-being. A major contributor to fish genetics will be the development of a SNP chip similar to a 60k chip now available for bovines.

Dr. Silverstein closed by confirming opportunities for cooperation in research include the greater involvement of global partners. He mentioned again the value of the PPA and the USDA-NOAA initiatives. It was his hope that successful research on developing economical, nutritional, sustainable and environment-friendly alternative feeds will contribute to building a critically needed consensus. He wanted to bring closer the day when aquaculture can be described as a friend of the ocean.

Opening the panel on "Domestic Marketing Success Stories" was Dr. Steven R. Craig. He is the Senior Scientist of the Virginia Cobia Farms, LLC in Saltville, VA. His topic was "Multi-species Aquaculture Production in Virginia."

Dr. Craig said that Virginia Cobia Farms (VCF) is a joint venture between Blue Ridge Aquaculture, described as the worlds' largest sustainable fisheries, and MariCal, Inc., a privately held animal health and nutrition biotechnology company. He described Blue Ridge Aquaculture as a leading recirculation, vertically-integrated aquaculture company. It has been in business for 15 years, with a present annual production of 4.5 million pounds. Its location in southwest Virginia is central to many urban centers with large ethnic populations that prefer to buy fish live. The firm plans to expand its production by an additional ten million pounds by 2011, with half of this new production being marketed as fillets. A longer term goal is to expand to the West Coast, where a 5-10 million pounds/annum market for live fish is envisioned.

Virginia Shrimp Farms is in the process of redeveloping its operation, starting several months ago with new technologies and grow-out production systems. Experience has confirmed the need to expand the latter and to revise the culture systems to enhance production. It will continue using hatchery and nursery technologies it developed and has proven to work.

Dr. Craig shared data on research on rainbow trout being raised at the firm's West Virginia Salmon & Trout operation. He compared the effects of three diets on the average weight in grams of the fish. The average gain was 600 grams at 54 weeks, about 720 grams at 62 weeks, utilizing all plant-based proteins in the diet with zero fish meal.

Dr. Craig provided an historical time line of Virginia Cobia Farms development. Its roots were initial research conducted by MariCal and Blue Ridge Aquaculture on cobia, which resulted in the founding of Virginia Cobia Farms in 2006. Pilot production and hatchery construction began in January 2007, with testing and technology development being conducted through March 2009. Commercial operations began in January 2010.

Contributing to its rapid development, from planning to commercial production in such a short time span, was the result of the firm's unique development plan. This included selecting and focusing on cobia instead of several species to determine which would best grow in a recirculating aquaculture facility. In lieu of building a large turn-key operation, management opted for a smaller scale of production, expanding as it gained critical information. The results have been its present system on which retrofits have been minimal and with a design that keeps stress and disease to a minimum.

Dr. Craig compared a commercial cobia diet, developed through funding support from USB, with one used at the farm. As examples, protein from fishmeal in a typical cobia diet can range from 30-35%, as compared to an inclusion rate of only 10% for the VCF diet. In comparison, the total soy inclusion rate for a commercial diet ranges from 20-30%; for the VCF diet it is over 55%. Based on *Seafood Watch Sea Food Report: Farmed Cobia,* the FIFO for commercial cobia diets is 2.2 – 3.6, comparing unfavorably to the VCF ratio of 0.83 - 0.90.

Dr. Craig described some of the challenges of raising fish in a recirculating system as including the high cost of energy to heat and recirculate the water and the sewerage feeds to dispose of the waste. VCF has implemented ways to reduce these costs by converting waste into algae, single cell protein and biogas through anaerobic and aerobic digestion. The former two products have commercial application, with the latter being a source of energy to operate the plant.

He then shared calculations on the generation and recovery of cobia waste from one million pounds of market size fish. They revealed that at a FCR of 1.5, this volume of cobia required 1.5 million pounds of feed. This results in a combination of biowaste of 50% of the feed load, or 750,000 pounds. In addition, 8% mortalities represented an additional 80,000 pounds. In regard to the generation of the components of waste recovery, Dr. Craig said 68% is in the form of volatile solids with a protein content of about 26%. The waste collected yields 300 liters of biogas/pound of dry waste. The environmental payoff for VCF is biogas driven electrical heat co-generation of 400,000 kWh of electricity, the heat equivalent of 2.9 million cubic feet of natural gas. Finally, the aerobic digestion of the remaining anaerobic mass yields five tons of single cell protein that is a substitute for fishmeal.

In closing, Dr. Craig said the time spent by the company on the development of its systems and test marketing of its product was time and money not wasted. He noted the modular, reproducible units contribute to rapid expansion at a lower cost of making additions and improvement. He confirmed that the use of waste is an important aspect of the economic viability of the company.

The next speaker was Dr. Steve Hart, the Director of Aquaculture of the Indiana Soybean Alliance (ISA) and the Indiana Corn Marketing Council. The topic of his presentation was “Yellow Perch Markets in Indiana and the Midwest.”

Dr. Hart described the history of yellow perch as the fish in the Friday night fish fry due to its unique properties of small size, mild flavor and firm flesh. Its popularity and demand contributed to it being an important commercially-caught fish in the Great Lakes. Production grew from 7.1 million pounds in 1950 to a peak of 35.4 million pounds in 1969. However, by 2008, the catch had declined to less than two million pounds.

In comparison, the theoretical present demand for the species should be about 72 million pounds based on historical consumption data and increases in both the population and overall per-capita consumption of seafood. However, total market supply is less than four million pounds and is mostly imported from Canada. This inequity in supply and demand has resulted in a retail price of $12-$16/pound and has contributed to increasing interest in raising yellow perch in the Great Lakes. It has also convinced ISA to conduct a series of market surveys to determine its potential demand in the state and in the region.

One of the questions asked of restaurants was would customer demand increase if offered an "Indiana Fresh Farmed Brand" with various defined attributes. In response to the attribute of freshness, 68% of those responding said demand would increase. On a scale of 1-5, with 5 representing very interested, three locally-popular species were ranked. The before and after branding ratings for hybrid striped bass increased from 3 to 4. For black bass, the ratings were 2.5 and 3.8; for yellow perch they were 2.8 and 3.6. In comparison, 87% of groceries said branding would increase sales. Using the same rating scale, hybrid striped bass increased from 2.5 to 3.6; black bass from 2.3 to 3.5, and yellow perch from 2.8 to 3.6.

In another study, ISA sought to determine interest in farm-raised fillets when dining out at three different types of restaurants, they being defined as casual, family and fine. Five species were considered, the three described above plus tilapia and largemouth bass. Those responding ranked yellow perch second in potential demand for casual and family dining, in both cases behind tilapia, and fifth for fine dining. However, of the total number of those responding, 53% expressed an interest in the fish, thus ranking it second to tilapia among the five choices.

Focusing only on those who expressed interest in each of the five species, the sales potential for yellow perch was determined to be 4.6 thousand pounds per restaurant, which, with a market price of $8.17/pound, was valued at $37.6 thousand. In both estimates, yellow perch again ranked second to tilapia.

Dr. Hart then described how selected attributes would impact market price. Of particular interest were the attributes of 'certified' and 'fed a diet containing soybeans grown in the Midwest instead of fishmeal'. In the former case, 51% of those responding said they would pay a little more, with 19% stating they would pay a lot more. None said they would pay less. In the latter case, the response was 30% and 21%, respectively, with 7% saying they would pay less. Receiving the most price-negative responses were the attributes of 'locally grown' and 'direct from grower'. The percentage of those saying they would pay less was 21% and 26% respectively.

Dr. Hart summarized the research by noting that efforts are being made to understand better the demand curve for yellow perch and its potential volume of sales. He said ISA wants to learn more about the entire structure of the supply chain to determine where its funds can be more effectively invested.

Turning to the status of yellow perch aquaculture, he said the production reported in the 2005 aquaculture census of 110,000 pounds was low. He confirmed that the species has recently received national attention with the opening of Bell Aquaculture in Albany, IN, a firm that has begun to grow and market it. Their production is projected to be 15 million pounds by 2015.

Dr. Hart closed by confirming research needs to be conducted to define the specific nutritional requirements of the species. Initial information indicates it is somewhere between trout and catfish. ISA is working with Purdue University and Bell Aquaculture to answer this question. He described the results at the end of two months of the feeding trial confirmed yellow perch consuming a diet of 25% hi-pro soybean meal was out performing the standard commercial diet, which is a ration formulated for rainbow

trout/steelhead . The trial will continue until the fish reach market size. It will follow with taste tests to determine if the final product meets or exceeds consumer expectations. Other trials, using soy protein concentrate, are also being conducted to determine the effects of higher levels of soy on yellow perch production and yield.

The next and closing speaker on the panel was Mr. George Nardi, the Founder and Chief Technology Officer of Great Bay Aquaculture. His topic was "Cod Farming in The Gulf of Maine."

Mr. Nardi said Maine is an excellent state for aquaculture due to its 3,500 mile coast line, all of which is within a day's driving distance to market of 150 million potential customers. Maine has both a strong marine heritage, ranging from traditional cod fishing to modern universities and regional technical support and expertise. Finally, it has an existing and underutilized salmon infrastructure that can be expanded.

He shared a Google Earth photograph of the section of the Gulf of Maine where the company's Preble Island cage site is located. The cod are raised in 9 3,000 $m^3$ surface cages and in an offshore AquaPod net with a diameter of 30' and a volume of 500 cubic meters. It is where the company is growing a quality product while at the same time being a good neighbor within the community it is located. He said the company is investing in salt water recirculating systems, breeding programs, nutritional and hatchery advancements, offshore cage technology as well as fish health.

Great Bay's Atlantic cod genomics and selective breeding program is part of a broader scale effort involving numerous Canadian universities, provincial governments and private organizations led by Genome Atlantic. Advancements in the on-shore hatchery, in which selected broodstock are used for egg production, include improved live feed enrichment diets, the elimination of algae culture and the reduction in live feed. The hatchery also utilizes salt water recirculation systems.

In the grow-out operations GBA is using commercial diets with partial fish meal substitution and is currently collaborating with the University of New Hampshire which is conduction cod feeding trials using soy meal and soy protein concentrates as partial fish meal substitutes for fish meal. Cod appear to be a species which will perform well with a reasonable level of substitution with plant based proteins.



He compared the amount of juvenile cod stocking in Canada with the United States. For example, the former grew from 400 in 2006 to a projected 650 in 2010. For the U.S., they were 50 and 300, respectively. However, the present economic recession has severely reduced this growth, with them falling from an expected 550 to 100 last year in Canada, while remaining static at 150 in the U.S.

Mr. Nardi shared a timeline for the future of cod farms in the New England region that begins with integrated multi-tropic farms located near shore and land-based production. Coming next will be larger hatcheries and the development of cooperative production and marketing between and among single small, individual farms. The final region to be developed will be large scale offshore production.

To achieve this goal, the new industry must avoid conflict between cod, as caught by fishermen, and cod, as raised in cages. Farm-raised cod must be viewed as a complement to, as opposed to competition with, wild-caught fish. Farm-raised cod must also meet important standards, meaning yields are high and quality consistent. Cod farming must ensure the continuation of a working waterfront that supports its evolution "from fishing to farming."

Mr. Nardi said that the prevailing, but slowly changing, bias about cod in New England is that it is a low cost staple food. This attitude limits markets for farm raised production in the region, at least for now. Regardless, effort is being made to encourage local demand by promoting its low carbon footprint, especially if grown in integrated multi-tropic sites.

In contrast, markets outside the region view cod as a comparable in quality to other white fleshed fish. It is these markets to which Great Bay wants to sell more of its production. It wants to add value to the fish through promotion. The company will seek niche markets, such as meeting the demand for live fish. Great Bay also wants to respond to organic market demand and to document its production as sustainable.

Opening the panel on "Coalition Building" was Mr. David Wilson, a USB board member and an Alabama soybean farmer. The topic of his presentation was "Working Together: Soybeans & Aquaculture." Mr. Wilson introduced himself as one of over 600,000 American soybean farmers who want to support the domestic aquaculture industry and, with it, to grow and be more profitable.

He said the United States continues to be the world's largest producer of soybeans, with a 2010 crop year projected harvest of 88.4 million mt, or 33.9% of the world total. In comparison, Brazil and Argentina will have a projected combined total of 114,500 million mt, or 46.5% of the total. Some reasons for the large U.S. crop, anticipated to be an all-time record, are the 76.4 million acres projected to be harvested coupled with record yield of 44 bushels/acre.



He shared two graphs, one depicting projected U.S. and Argentine soybean exports to gain only marginally through 2015. In contrast, exports from Brazil should significantly increase. For soybean meal, U.S. exports are also projected to grow only marginally, albeit at lower levels than soybeans. Some export demand is projected for Argentina, with even more significant export growth for Brazil

Mr. Wilson confirmed that the vast bulk of the U.S. soybean market is overseas because that is where the significant majority of fish and shrimp are grown. He noted that U.S. soybean farmers began promoting soy-based feeds in China almost 20 years ago. Today, China is the world's by-far largest customer for soybeans in general and soybeans used for aquaculture in particular. In contrast, our domestic aquaculture market is small and requires the support of everyone to help it grow. The United States needs to reduce its dependence on imported seafood, which represents 80% of domestic supply and created in 2009 a $9.4 billion negative balance of trade.

He noted the estimated use of soy-based protein for all aquafeeds grew from an estimated 2.4 million mt in 2005 to a projected 5.2 million mt, again as protein, in 2015. Another study estimated that seven million mt of soybean meal will be used in aquaculture in 2010.

Turning to the contribution of U.S. soybean farmers to aquaculture, Mr. Wilson said that through the national soybean check-off they are investing nearly $1.4 million in 2010 in the United States in direct support of the domestic aquaculture industry. Of this amount, $400,000 is to fund research and promotion. He divided the support into six categories, beginning with marketing and which, as described above, is primarily conducted outside the country.

For research, he said studies are being conducted to refine diet formulations of soybean meal, soybean oil and lectin in farm-raised marine shrimp, and to replace fish oil with stearidonic acid soy oil in Seriola. Work with cobia involves determining the optimal combination of SPC and soybean meal to replace fishmeal, and to define the maximum inclusion ratio of soybean meal to soybean oil in California sea bass and yellowtail.

In regard to education, state soybean associations are being encouraged to promote the importance of aquaculture at their meetings and to describe to their congressional delegates how increased domestic fish and shrimp production can contribute to increased soybean demand. He said the link between soy and aquaculture is being promoted at key trade shows such as the present WAS conference.

Under the category of partnering with industry, some example Mr. Wilson shared were conducting a jointly-funded outreach program with NAA, and providing leadership to the Plant Products in Aquafeeds program. Farmers also want to build stronger the USB-Aquaculture Industry Coalition.

The final category of support described by Mr. Wilson was industry competitiveness. With the goal of increasing the competitiveness of U.S. soybeans, the QUALISOY™ program was established. It is a collaborative effort with the soybean industry to develop a better quality soybean that will reduce the environmental impact of livestock, including fish and shrimp, which consume them. The Global Opportunities Program ensures the U.S. soybean industry continually strives to develop and implement a strategic view of the global soy marketplace and to respond proactively to it.

Mr. Wilson closed his presentation by confirming the overall objectives of American soybean farmers are to expand overseas markets, build domestic demand and become more competitive. In the latter case, work is being done to develop a soybean with increased yield, improved amino acid profile and either reduced or negated anti-nutritional factors. A goal is to create and expand markets for U.S. soy in aquaculture.

The next speaker on the panel was Ms. Linda O'Dierno, the Outreach Specialist with the National Aquaculture Association (NAA). Her topic was "Outreach with NAA."

Ms. O'Dierno shared data from the National Marine Fisheries Service that graphically confirmed major challenges and opportunities facing the United States' aquaculture

industry. Based simply on population growth, the domestic demand for seafood will grow dramatically during the next fifteen years. If consumers were to follow new dietary guidelines that encourage increases in seafood consumption, the projected demand would double. In contrast, the U.S.'s supply, described as its harvest less exports is projected to grow only marginally through 2025. Since the wild harvest has reached maximum sustainable yield, no increases are projected. This presents an unprecedented opportunity for growth in aquaculture. The challenge is to strengthen the industry so it can meet the growing demand for seafood.

She then shared details on research she conducted that provides some background to this challenge. She said seafood is a confusing commodity with over 1,000 different species of finfish and shellfish commercially available. Production methods vary with the cultures in which they are raised. These facts, along with information provided by anti-aquaculture groups, create confusion among domestic consumers about the sustainability, environmental impact, and wholesomeness of farm-raised seafood.

Ms. O'Dierno said the trend among American consumers is to buy locally grown products and to place emphasis on the freshness of seafood. They are concerned about the safety of imported products but prefer to pay the lowest price possible when buying any food. Those opposed to aquaculture take advantage of these trends, with emphasis on safety, through media releases that represent agenda driven science, and in which confirming the veracity of the data presented no longer seems to be an obligation of the reporter. To the contrary, the greater the exaggeration, the greater the potential to draw attention to it and to the medium in which it was presented. While many such stories can be refuted, it is both expensive and time consuming to do so. As a result, the aquaculture community's defense of itself and its products is lacking.

She shared some examples of scare tactics employed by the anti-aquaculture forces. The FarmedAndDangerous.org website carried a report with the title "Ingredients for extinction?" It disparaged Safeway's support for farmed salmon as a disaster for wild salmon production. The reason given was sea lice from salmon farms could infect wild salmon and thus destroy a traditional and important industry. While the report focuses on salmon grown and caught in British Columbia, it creates fear among American readers about purchasing any farm-caught seafood. It also contributes to opposition in the United States to growing salmon in U.S. waters. Another negative ad, this from the "pure salmon campaign" showed a picture of a pregnant woman, with the sub-heading that ""Ocean-farmed" salmon can be dangerous to your health."

She also shared comments ranging from reports in the *New York Times* to the *San Francisco Chronicle* on the dangers of consuming seafood, with emphasis on its allegedly high levels of mercury. Ms. O'Dierno summarized these articles and consumer comments by confirming the need for the domestic aquaculture industry and all those that do and can benefit from it to help set the record straight.

She said we need to develop a proactive industry with the basic task of ensuring the American public hears positive stories from numerous and diverse sources about U.S. aquaculture. We need to involve respected parties and opinion leaders who can tell the story, ranging from dieticians and chefs to restaurant associations and civic groups. And

soybean and fish farmers. In her view, we need to create an aggressive and proactive outreach initiative to educate and communicate a positive message about aquaculture before negative publicity is released. This means building alliances through participation in trade shows, where the pro-aquaculture message can be delivered, where false claims can be refuted, and where attendees can have their questions answered. Some examples include the International Boston Seafood Show, the National Restaurant Show, the American Dietetic Association Conference and the Food Marketing Institute.

This necessary and long-needed initiative began recently when USB, representing the domestic soybean industry, and NAA, representing the domestic aquaculture industry, joined forces to recapture, retain and grow their respective markets by building consumer awareness. Their objectives are: 1) promote the sustainability of U.S. aquaculture; 2) describe the economic and societal contribution it make to our lives; and 3) promote the quality and health-giving benefits of U.S. farm-raised seafood.

An example of work being accomplished through the joint USB-NAA outreach program is the development of talking points in the form of questions and answers on U.S. farm-raised fish and shellfish. The purpose of such releases is to provide members of the industry effective answers to questions they can anticipate being asked not only by the media but by their customers. This is a tool for which they have confirmed a need.

Ms. O'Dierno also described a series of ten workshops either conducted or planned in 2010 and several planned for 2011. At each, the topic will be "Saving Your Business and Your Markets." Each will focus on four key issues: practices, presentations, promotion and the press. The objective is to empower the industry with accurate information ranging from the environmental soundness and sustainability of aquaculture to the wholesomeness and safety of aquaculture products. In brief, the workshops will help train those attending how to present knowledge they already have about an industry in which they have a vested interest.

In an effort to create a multiplier effect for its outreach program, USB and NAA plan to mobilize like-minded resources. For example, they will work with other aquaculture organizations, such as the shellfish growers, to promote the outreach program at its annual meeting. They will also place greater reliance on technology by developing user-friendly websites aimed at consumers, as well as Twitter, Face Book, blogs and distant-learning.

Ms. O'Dierno closed by describing the five messages the public needs to hear. They are: 1) U.S. farm-raised seafood is sustainable; 2) U.S. aquaculture is critical to the nation's food security; 3) fish and shellfish farm-raised in the U.S. must meet rigorous standards for both product wholesomeness and environmental impact; 4) U.S. aquaculture provides healthy, affordable food for American families; and 5) U.S. aquaculture contributes significantly to the American economy and the vibrancy of local communities. It is a message that needs to be stated and repeated until fully understood and supported by the American consumer. The USB-NAA outreach program is an important step in accomplishing this goal.

Next on the panel was Dr. Jesse Chappell, the Extension Fisheries Specialist & Associate Professor, Department of Fisheries and Allied Aquaculture at Auburn University. His topic was "Commercial Production of Channel Catfish (*Ictalurus punctatus)* and Hybrid Catfish (*Ictalurus punctatus x Ictalurus furcatus)* Utilizing an In-Pond Raceway System in West Alabama". Working with Dr. Chappell on the project was doctoral student Travis W. Brown and Dr. Terry R. Hanson. The project is partially funded by the United Soybean Board.

Dr. Chappell said the project concept is to develop a more competitive catfish production model in which the technological advantages of recirculation aquaculture are combined with the lower cost of pond aquaculture. The objective is to improve production efficiency that emphasizes local competitive advantages. The plan is to increase fish survival to greater than 90%, enhance the FCR to better than 1.7:1 and reduce the per-unit cost of gain, of energy and of labor. It will also ensure greater control over inventory and utilize other production by-products and resources.

He shared pictures and schematics of the systems. Some key aspects of the fixed floor design and layout include: 1) a system footprint of 100' x 45', or 0.1 acre strategically located in a six acre earthen pond; 2) six raceway cells of 37' x 16' x 4' ; and 3) a fish culture area of 1,619 cubic feet, with dimensions of 25.3' x 16' x 4'. A 1.2 rpm paddle wheel powered by a ½ hp VFD motor will allow for the exchange of water every five to six minutes. Supplemental aeration is supported by a 1.5 hp regenerative blower with diffuser grid. Water containing manure slurry is collected through a trough located at the tail end of each raceway.

The catfish involved in the study were fed several times per day during the warmer months with the aim of enhancing survival and maximizing feed efficiency. The feed allowance was based on the total fish biomass in the raceways, the average size of the fish and the water temperature. The fish were sampled every 30 days to determine average weight and length to weight measurement.

Dr. Chappell shared two tables of data on the results of stocking and harvesting of channel catfish and hybrid catfish in three raceways each. The number of fish stocked was 55,051 and 57,604, respectively. The average size of the channel catfish was 0.277 lbs. at stocking and 0.927 lbs. at harvest. The growing period in each cell was 96, 239 and 250 days, respectively. For hybrid catfish, the average stocking size was 0.53 lbs. at stocking and 1.38 lbs. at harvest. The growing period in each cell was, respectively, 147, 220 and 193 days.

Over a 220 day growing period, the production of both the channel and hybrid catfish was 69,095 lbs., or 11,516 lbs. /acre. In addition, 8,680 lbs. of tilapia, at 1,447 lbs. per acre, and 4,789 lbs. of paddlefish, at 798 lbs. per acre, were grown. The mean survival rate and FCR for both species of catfish was 83.7% and 1.50, respectively. The survival rate for the tilapia was 100%, and 85.9% for the paddlefish.

A simulated model of the production model at full productivity described a total weight stocked of 14,698 lbs., with total production of 79,560 lbs. or 13,260 lbs. /acre production of all channel catfish and co-culture fish. The survival rate was 78.0%, with a FCR of 1.74. For all hybrid catfish with co-culture fish, total weight stocked was

22,345 lbs., with total production of 131,022 lbs. or 21,837 lbs. per acre and the survival rate and FCR was 89.1% and 1.36, respectively.

Dr. Chappell said the cost of actual production after only 220 days was $0.71, earning a net return/lb. of $0.03 for both species of catfish. For tilapia, the cost was $0.05/lb. and a net return of $2.95. The cost of production for the paddlefish was $0.20/lb., earning a net return of $2.30/lb. In comparison, the simulated full production economic model described a cost of production of $0.66/lb. and an estimated net return of $0.41/lb. for all channel catfish and co-culture fish. For all hybrid catfish and co-culture fish, the amount was $0.53/lb. and $0.43/lb., respectively.

He summarized the results of the research using fixed floor and floating raceways. He said improvement needed include modifications on the waste removal system and the concurrent production of advanced fingerlings and stockers in other on-site raceways to ensure their immediate availability and low cost. The next step in the research is to operate the systems with 100 – 130 gram stockers over a longer period to gain more in-depth economic information.

Dr. Chappell then turned to the second part of the research program, it being further development of fixed floor and floating production systems. Significant features of the raceway models (either fixed floor or floating designs) are high efficiency, low maintenance water movers. He said their many advantages over traditional ponds include an improved survival and FCR, reduced energy and overall costs, staggered stocking and harvesting, and co-culturing with other fish species. In addition, the systems offer a smaller footprint for overall and disease management, elimination of avian predation and enhanced inventory control. It also allows for the capture of the nutrient by-products of production in filter-feeding species or solids traps.

The disadvantages of the systems are the higher initial construction and development costs along with a different management mentality and skill-set compared with traditional production methods. Regardless, the evolved model developed by the Auburn research team is now ready for commercial application and will be aggressively extended to the commercial grower community.



The evolved modular design can be adapted to the size of the production pond. It produces stockers, food fish and other species while completely eliminating bird predation. It is designed to remove a significant percentage of solid waste produced. In brief, it enhances survival, feed efficiency and return on investment. He said the cost of a basic unit, that will annually produce 140,000 lbs. of fish, is $28,000 - $30,000. It requires a minimum of a six acre pond and will operate with a minimum of ¾ hp of aeration per acre-foot, or a total of ~20 hp, for aeration and mixing. Evolution of the system is on-going.

Dr. Chappell closed by describing some of the management challenges involved with such a system. They include pond stratification and potential nutrient buildup. In the former case, he said this usually occurs in the spring and can be a problem for up to two weeks. It can be resolved with the use of a 1.5 hp “White Water” airlift unit. In the latter case, the technology of waste removal is being developed; however, no production problems have so-far occurred.

The closing speaker on the panel and of the meeting was Dr. Terry Hanson, an Associate Professor and Aquaculture Economist in the Department of Fisheries and Allied Science at Auburn University. His topic was "Pond-to-Plate Project ($P^3$)". This project is also partially funded by the United Soybean Board.

Dr. Hanson described the importance of the project as being a step toward building back the domestic catfish industry. He shared a graph showing how the volume of processed catfish declined from about 670 million pounds in 2003 to about 460 million pounds in 2009. This significant decline is due to foreign competition, the high cost of inputs, especially feed, inefficiencies in the production system, and the lack of overall standards and best management practices in product quality and control. He noted that as demand for domestically-produced catfish fillets has declined due, in part, to competition from imported catfish and tilapia, overall fish consumption trends in the U.S. are on the increase.

In response to these problems, the Pond-to-Plate project was established to assist the industry to improve its production efficiency, product quality and demand/marketing practices. In the latter case, a project objective is to replace the present practice of market push of products into consumers' hands, to one of growing and processing the catfish into products that consumers are demanding, i.e., a market pull situation. With market pull, the second unit of production will be made only after the first unit has been sold. The ultimate goal of the project is to create a modern livestock industry for catfish comparable to the modern domestic poultry industry.

He said there was a large amount of initial work done in developing the project that involved the active participation of members of the catfish industry at a series of discussion and planning meetings. One meeting took place at Auburn's Technical Assistance Center (ATAC), with an additional three ATAC-facilitated meetings in West Alabama. About 30 representatives of catfish producers, harvesters, transporters, processors and buyers were invited to each. They came together to define their problems and decide what changes were considered necessary and of high priority. In these meetings it became apparent that development of best management practices (BMP) and standard operating procedures (SOP) needed to be developed and enforced to have consistent, quality products that could effectively compete with international imported fish. The meetings also emphasized the absolute need for everyone to work together if success was to be achieved.

Dr. Hanson said the meetings were organized around the LEAN manufacturing approach to problem solving. It was defined as "A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection." Those attending the meetings focused on value stream management and brainstorming how to reduce waste, with emphasis on unproductive work and downtime. The participants broke into five LEAN teams and developed SWOT (Strengths, Weaknesses, Opportunities and Threats) analyses of the catfish industry, from hatchery through consumption.

He broke the analyses into its four SWOT component parts, and then described the key findings from each. Some of the strengths of the catfish industry defined by the teams are an environmentally friendly and safe product with a history of strong research and development support. Catfish have good appeal among customers, especially in the Southeast, Southwest and Mid-West, and are sold through such key retailers and distributors as Wal-Mart and Sysco throughout the country.

In contrast, some weaknesses of the industry are a lack of standards that result in inconsistent quality. Customers have an image of catfish as a bottom feeder, suggesting it is not a high-quality product for which there is no real depth of loyalty. Adding to the consumers perceptions is the fact that catfish is a generically-branded product, with which they have limited knowledge on how to prepare.

Dr. Hanson said the catfish industry's opportunities are the ability to improve product quality and consistency through the application of BMPs and SOPs, as well as making improvements in packaging and new consumer-oriented products. The industry recognizes that seafood consumption is increasing and there are untapped markets for catfish, especially outside the traditional regions.

Threats include the reality that oftentimes the relations between processors and producers are not in the overall interest of the industry. They know the economy is suffering and imports continue to increase. They recognize new fish diseases can create new problems, that product image can be improved, and that consumers can easily find other species of fish to purchase in lieu of catfish.

He described the five areas on which the five LEAN teams wanted attention focused. They are: 1) product consistency and production systems management; 2) consumer awareness; 3) packaging and product development; 4) branding and imaging; and 5) by-product development and utilization. The teams then defined their overall goal, which is to grow the catfish industry in size and profitability. Their vision is to increase the per-capita consumption of U.S. farm-raised catfish from 0.87 pounds to 1.25 pounds by 2015. Their mission statement is to "Provide a consistent, safe, high-quality product that exceeds customer expectations and provides profit for all sectors of the U.S. farm-raised catfish industry."

Dr. Hanson closed his presentation by confirming the successes of the ATAC-hosted meetings. The participants not only developed BMPs and SOPs for quality and efficiency, they recognized the need for their application to ensure greater control over production and to maximize profitability, while producing consistent, high quality catfish products that consumers demand. Finally, the industry representatives acknowledged the critical importance of working together to achieve success.

The meeting ended at 12:00, with plans to reconvene in New Orleans at the 2011 WAS conference. On behalf of the United Soybean Board and America's soybean farmers, I hope you can join us.

Gil Griffis
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United Soybean Board
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