APPLICATION OF HACCP SYSTEM TO CATFISH PRODUCERS AND PROCESSORS

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The Food and Drug Administration and other federal and state food regulatory agencies are using HACCP as an effective way to help assure that only legally acceptable food products are available in the marketplace. The primary responsibility for the safety, quality, and other attributes of the food product, however, rests with the processor, distributor, or provider of that food, not the regulatory agencies. Therefore, it is needed to develop HACCP training programs for food industries. In our case, a HACCP training video has been developed for catfish producers and processors.

In order to present the HACCP information in an effective way, the training video consists of two parts in separate cassettes. Part I is introductory and titled, Overview of HACCP System. It runs for 15 minutes. Part II is titled, Application of HACCP System to Catfish Producers and Processors, and runs for 25 minutes. Because of the time limit, we are going to see Part II today. (Video text follows from here.)

Applying the HACCP food control system to the catfish industry involves catfish farming, processing conditions, handling and storage during wholesaling, and distribution for retail sale and consumption. In part 2 of "Overview of HACCP and its Application to the Catfish Industry," we will look at HACCP systems for catfish farming and processing.

As mentioned earlier, HACCP, or Hazard Analysis Critical Control Point, is a systematic approach to food safety control. It starts with the assessment of hazards and risks associated with growing and harvesting of raw materials and ingredients, processing, distribution, marketing, and the preparation and consumption of the food. Therefore, application of HACCP to the catfish industry should start at the beginning of the food chain, the catfish farm.
For each production facility or farm, the six steps to develop a HACCP plan should be followed.

1) Assemble the HACCP team. This team should be made up of managers, processing personnel, quality control and quality assurance personnel, outside consultants, and other advisors.

2) Describe the food and its distribution. For example, a catfish farm may write a description like, "The food, live catfish, is harvested from ponds and distributed by hauling trucks to processing facilities."

3) Identify the intended use and consumers of the food. "Live catfish are purchased by the processors where they are processed into a variety of value-added products for the consuming public."

4) Develop production or processing flow diagrams. A simple flow diagram for catfish production might look like this, noting several steps in the production of catfish, such as site selection, water supply, culture system, feed supply, production, harvesting, and delivery and transport.

5) Verify the flow diagram.

6) Apply the following seven HACCP principles.

A flow diagram is developed and verified. Now we are ready to apply the 7 HACCP principles. To review:

1) Conduct a hazard analysis

2) Identify critical control points

3) Set critical limits for each hazard at each critical control point

4) Devise a monitoring system to validate critical limits

5) Establish a corrective action plan for each critical limit

6) Verify your HACCP system in 3 ways

7) Keep records at all pertinent points
Let's take one step from the flow diagram and follow it through the 7 HACCP principles. In our example, we will look at water supply. Water sources for catfish growout areas may be wells, nearby rivers or streams, or surface supplies, each of which present different problems. Well water may contain heavy metals. Streams and surface water may contain herbicides and pesticides, or other potentially harmful chemicals that pose potential hazards to the animals as well as consumers. Thus a potential hazard for water supply is harmful chemical contaminants which can be controlled through your water source. Preventive measures for this hazard include reviewing geological and hydrographic survey data and available records on water quality, and controlling point and non-point source contaminated run-off. We now have completed a hazard analysis, which is principle #1 of the 7 HACCP Principles.

Principle 2 determines if this step is a critical control point, through the use of a decision tree. Remember - loss of control at a critical control point results in an unacceptable end product. Here is a decision tree for the water supply for a catfish pond. Let's apply Question 1 of the decision tree to water supply. "Could preventive measures exist for the identified hazard, chemical contaminants in water supply?" Yes, we have already discussed geological and hydrographic reviewing survey data and available records on water quality to control point and non-point source contaminated run-off.

If the answer is yes, proceed to Question 2. "Is the water supply specifically designed to eliminate or reduce the likely occurrence of a hazard to an acceptable level?" No, water supply is not designed specifically to eliminate or reduce the hazard.

Since the answer is no, we proceed to Question 3. "Could harmful chemical contaminants occur in excess of acceptable levels or could these increase to unacceptable levels?" Yes, water supply could cause the hazard to exceed acceptable levels.

Therefore, proceed to Question 4, which asks, "Will a subsequent step eliminate the chemical contamination or reduce the likely occurrence to an acceptable level?" No, therefore water supply is a critical control point.
From Principle 2, we proceed to Principle 3, establishment of critical limits. In the case of our example, harmful chemical contaminants in water supply, regulatory tolerances already exist for some pesticides and heavy metals. It is appropriate to establish critical limits that do not exceed regulatory tolerances.

Principle 4 requires establishment of a monitoring system. A monitoring system might consist of regularly checking the water supply source for content levels of metals, pesticides, herbicides, or other chemicals that pose a potential threat to the water supply.

Your corrective action, Principle 5, should define what you do when a problem occurs. For example, "If the water supply has levels of pesticides greater than regulatory tolerances, then sample the fish for pesticides in the edible flesh." Your corrective action would then detail your sampling plan, required analyses, alternate decisions for the use of the product, and the correction of the hazard in the water.

Principle 6 sets forth 3 verification activities for your HACCP plan. For this step, water supply, you would routinely verify that your critical limits meet regulatory tolerances, that your water supply still comes from the same source, and that analyses are properly documented and recorded.

Record keeping is the last principle. Retain records related to water supply, such as analyses, observed changes, verification activities, corrective actions, and disposition of product. Records must be signed by appropriate personnel and management.

This completes the seven HACCP Principles for one step, water supply. Many of the seven HACCP principles have already been applied to other steps in catfish farming. Let's take a quick look at these other steps.

First, Site Selection. Several factors should be considered in site selection. A study of the history of the previous use should be made. For example, it would not be appropriate to construct a catfish pond on a former landfill site. If a land use history is not available, then a minimal site survey should be conducted. Site selection is not considered critical if critical issues would be covered under the step, water supply. Water supply, which is step two, has been covered.
Three, the Culture System. Several types of culture systems are used in the growing of catfish. In addition to ponds, the culture systems include raceways and cages. Various types of equipment are used, equipment in a hatchery such as equipment for water filtration, water aeration, feed truck and feeding. Since the equipment itself is safe for the intended use, the major concern is the construction materials used and coatings that may be applied that could produce chemical contamination. Approved construction material and coatings should be used, construction of the equipment and facilities should be checked, and after installation, all equipment should receive regular and proper maintenance. This step is not critical.

Four, the Feed Supply. Feed and additives to the feed such as vitamins and antibiotics are major elements in finfish aquaculture. Additives in feed, as well as the feed itself, can be custom processed or "off-the-shelf." Depending on the process and process controls, the feed is subject to chemical and microbiological contaminations such as aflatoxin. Feed suppliers are presently regulated by law for labeling and proper addition if approved additives and antibiotics are used. This step should be rated as being critical.

Five, Production. Production includes selection of brood stocks, egg production and fertilization, hatching, fingerling rearing, and growout of adult fish. Practices in the industry vary. Each step in the production process has potential hazards that could affect the safety of the end product. Most important are chemicals that the fish may ingest throughout their life history that can accumulate in edible tissue through improper operation. These range from antibiotics to herbicides. Potential contamination from accidental oil spills or contamination outside the culture area could also create a potential hazard, such as human pathogen contamination of fish.

Six, Harvest. Techniques for harvesting adult fish depend on the type of growout facility. In most cases, the harvest process introduces no hazard to the product. Most problems are with monitoring when the fish should be harvested and controlling feed prior to harvest, which relates to the previous step, production. Harvesting is not a critical control point.

Seven, Delivery and Transport. After catfish are harvested, proper care should be taken during transportation. Chemicals or antibiotics are not used in transport. This step is not considered critical.
So the potential critical control points in catfish farming are water supply, feed supply, and production. A generic HACCP model for catfish farming that further describes these points is available. This model includes HACCP Principles 1, 2, 4, and 7. With the addition of the missing HACCP principles, your HACCP team can adapt this model to your individual facility. Models also have been developed for processing raw and breaded fish. Now that we’ve applied the six steps to creating a HACCP plan to catfish production, let’s look at catfish processing.

Again, a HACCP team will be assembled and will describe the food and its distribution. While each facility’s specific description will be different, the approach will be similar and should include product types processed at the facility and their distribution. The identification of the intended use and the consumers of value-added catfish products again will be similar among facilities. Such a statement might read, "Processed catfish products are intended to be fully cooked and consumed by the general public."

Next, a flow diagram is developed. Let’s follow through with the raw fish flow diagram and the step, "Shipment." Shipping is the process of removing packaged product from frozen or chilled storage and loading onto transport. While there are multiple hazards with shipping, the hazard of decomposition will be addressed here. To prevent decomposition during shipping, adequate thermal protection, proper re-icing and container temperature, control of product loading, and loading only when the truck is at a proper temperature would be essential measures to take. This covers HACCP Principle 1.

For HACCP Principle 2, the critical control point determination, we will use the decision tree. Remember - loss of control at a critical control point results in an unacceptable health, wholesomeness, or economic fraud hazard at the product’s end-use. Let’s look at Question 1.

Question 1, "Could preventative measures exist for the identified hazard?" Yes, we have identified some preventive measures.

Since the answer is yes, we go to Question 2, "Is the step specifically designed to eliminate or reduce the likely occurrence of a hazard to an acceptable level?" No, shipment is not designed specifically to eliminate or reduce product decomposition.
Following the decision tree, Question 3 asks, "Could contamination with the identified hazard occur in excess of acceptable levels or could these increase to unacceptable levels?" Many catfish processors that have stringent preventive measures in place at this step would answer no, "This is not a critical control point."

Some, however, might answer yes and then proceed to Question 4, "Will a subsequent step eliminate identified hazards or reduce the likely occurrence to an acceptable level?" Yes, the distribution is a subsequent step. If a distributor receives an inferior product, in this case decomposed fish, he will reject it and return the product. Rejection by the distributor and subsequent recall of the product by the processor can disrupt a firm's operation and business. Recall of the product will reduce the frequency of decomposed catfish being shipped. Thus, "shipment" is not a critical control point. Since shipment is not a critical control point, Principles 3, 4, 5, 6, and 7 would not need to be done for this step.

Other steps in the processing of raw and breaded fish are critical, however. Let's look at the raw fish flow diagram again and briefly discuss each step.

**Receiving.** Live catfish are delivered to a processing plant and unloaded from a delivery truck into raceways. Hazards are unacceptable odor, off-flavors, and decomposed dead fish. This step is regarded as being critical.

**Stunning.** Catfish are laid on the conveyer belt. While the belt is moving, live catfish are stunned by electric shock. No hazards were identified for this step, and it is not a critical control point.

**Heading and Gutting.** Fish are headed and gutted. Gut contamination from bacteria and incomplete removal of viscera are the hazards. This step also is not critical.

**Washing.** Fish are washed with clean water. Hazards are contamination and microbial build-up. This step is not critical.

**Sorting and Grading.** The fish are sorted or graded depending on the weight of the fish. Contamination might occur, but the step is not considered critical.
**Primary Processing.** Fish are washed, skinned, filleted, chilled, candled, trimmed and boned. Hazards include bacterial build-up, time temperature abuse, contamination, and decomposition. Depending on your facility, at least one of these activities should be considered critical with critical limits, monitoring and corrective actions established.

**Additives.** Depending on the type of product, different types of additives are used for fillet or restructured products. Hazards are the use of microbiologically and chemically contaminated additives, the use of unapproved additives, and the abuse of approved additives such as phosphate. This step is regarded as a critical control point.

**Grade and Sizing.** Products are graded and then packed for fresh product or frozen product. Hazards include bacterial contamination and incorrect sizing. While not critical, if grades are marked on the labels, be sure to follow through when the final product is labeled.

**Pack, Weigh, and Label.** The products are packed, weighed and labeled. Examples of hazards at this step are short weights, incorrect labeling declaration such as size grading, extraneous material, and microbial contamination. This step is regarded as a critical control point.

**Freezing.** Individually quick frozen and blast frozen products have hazards such as incomplete freezing, dehydration, and contamination. This step is not a critical control point.

**Glazing.** Glazing the frozen product with water has such hazards as overglazing, which could lead to economic fraud, microbial contamination, and the use of unapproved additives or abuse of additives. This step is not critical.

**Packout.** Products are packed in cartons and stored for shipment. Some hazards at this step include product misidentification, underweight cartons, and extraneous material. Packout is not considered critical.

This flow diagram is general and your HACCP team must tailor it to your individual plant. Your facility might not have all of the steps listed here, or they might have more. In some facilities, some steps might be critical that are not critical in others. However, the HACCP team can make these determinations and apply all of the HACCP Principles to your critical control points.
Besides processing critical control points, the HACCP team must also include sanitation critical control points in the HACCP plan. Sanitation controls cross-cut throughout the plant, where processing controls are process step specific.

Examples of sanitation controls include such things as premises, building construction, lighting, ventilation, water supply, ice, disposal of waste, restrooms, construction and repair of equipment, cleaning and sanitizing procedures, chemicals, and personnel. These sanitation elements can be classified into minor, major, serious, or critical defects depending on their severity. Specific definitions for severity of defects are:

**Minor Deficiency**: not in accordance with their requirements. This is not major, serious, or critical.

**Major Deficiency**: inhibits general sanitation. Deterioration of product quality is not serious or critical.

**Serious Deficiency**: prevents proper plant sanitation. It may result in a tainted, decomposed or unwholesome product, but this is not considered critical.

**Critical Deficiency**: results in an unwholesome product. It presents health and safety threats. Sanitation critical control points most often involve:

- Ventilation systems that allow condensed water to collect over exposed product.
- Water supplies that are not accessible, subject to contamination, not clean, and not approved by an appropriate authority.
- Ice not made from clean water.
- Improper use of chemicals such as insecticides, rodenticides, unapproved chemicals and sanitizers.
- Personnel not taking precautions to prevent contamination of foods.
With the incorporation of process and sanitation critical control points in your HACCP plan, the plan is ready to be implemented. Remember, no plan is foolproof and expect to frequently verify and modify your plan, at least in the beginning.

In conclusion, HACCP systems must be designed by individual producers and tailored to their individual processing and distribution conditions. HACCP systems are designed and function in a manner consistent with the stated goal of preventing potentially hazardous products from reaching consumers. A HACCP system can be implemented by following the six steps to create a HACCP plan. Include your HACCP team.

The seven HACCP Principles are part of that six-step plan, including the definition of a critical control point and the Decision Tree. Training is essential in implementing your HACCP plan.
AQUACULTURE INDUSTRY ISSUES

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I'm just going to talk about catfish industry trends and touch on a few different things. Some of it may relate to food safety; some of it to what I will call economic safety - staying in business.

There it is right there - channel catfish. It's a durable fish that's been grown commercially in the United States for many years. I guess it began to be a little bit of an actual industry in the early 70s. Our major production states are Mississippi, Alabama, Arkansas and Louisiana.

Here are some catfish ponds in the Mississippi Delta. Of course as many of you know, the Mississippi Delta is the largest producing state. We have close to 100,000 acres of commercial ponds. A good part of that is devoted to food fish ponds. Generally speaking, it takes two pounds of feed to make a pound of fish and I'm sure that many of you know these things already. I am just going to touch on the background in the industry and how we got to where we are.

Catfish harvesting is now open year-round. We do have our higher levels of processing in the Lent Season which is coming up now. We have seen, though, processing level off over time. It used to be extremely low in the winter months, November and December, when everybody ate turkey and ham. Well, this November and December, we are probably around 33-35 million pounds each of those months so it's really coming around.

Here's a shot of some testing on processed fish. That looks like value-added products that are being tested for various reasons. Let me kind of mention something here a moment about food safety. The catfish industry would be nowhere today if it had not adhered to basic sound food safety/food quality techniques. Many of the plants have voluntary USDC inspection. The whole inspection picture seems to come and go but with what Congress is doing, we may have another inspection bill that will come up this year. In any case, the processors by and large give the fish as good a "going over" as they possibly can. Many of them have the USDC inspectors on board to come in on a regular basis. The FDA of course, comes in and does its own inspections from time to time so processors want to put out a quality product.
In thinking about Jin Kim's comments on the HACCP program a little while ago, Monday I was down in Wisner, Louisiana at the Cargill Fisheries Plant. Cargill has just been certified as the first seafood processing company in America under the new HACCP program under the National Marine Fisheries Service. Now that's not just a fresh catfish processing plant, that is the first seafood processing plant in the country, and they should be applauded for taking that big step. I think you are going to see perhaps more processors getting involved in that program.

Everybody likes to eat broiled catfish, and baked catfish, and microwaved catfish, and this-and-that, but fried catfish actually is "still the franchise" as some people say. The industry did a poll a few years ago where consumers were asked how they prefer their catfish, and fried was number one.

We processed 457 million pounds live weight in 1992. We have just grown tremendously in volume. Some years we didn't make any money at all - we lost money, but the volume has continued to increase. What will happen in the next 10 to 12 years remains to be seen. The consuming public is still turned on to catfish - the more they know about it, the more they understand it, and the more they are going to eat of it. Generally speaking, that 457 million pounds of live fish translates to about 232 million pounds of processed product.

Now one reason catfish achieved tremendous growth was because of a lot of marketing efforts by the Catfish Institute. It by no means is the only marketing effort that has gone on in the industry in the last several years, but they have probably done the biggest job and spent the most money. This is an ad that appeared in a number of magazines probably about three years ago. The Catfish Institute, as you may know, is a nonprofit entity set up by three feed mills in Mississippi, and they contribute $6 per ton for every ton of feed they sell to the Mississippi producers. This particular promotion does promote Mississippi catfish. Millions and millions of consumers all over the country in the last several years have seen this so this has helped educate people about farm-raised catfish.

Before I leave this slide, I will mention something about the Catfish Institute, and this is something that is almost "hot off the press." The February paper is not out yet. They have decided to make a formal appeal to feed mills and parts of the catfish industry outside of Mississippi to try to enlist them in the Institute. They want to drop the Mississippi designation and come out with a national generic program for farm-raised catfish. Of course, they have to get money, and they have to get contributions from the other feed mills. I wish them success because I believe we still have a long way to go in educating the public
about farm-raised catfish. You need good generic promotions at the same time the processors are doing their own brand of promotions. Here's something the Catfish Institute put together and I think that was on "Good Morning America" probably about three or four years ago.

Basically what this slide shows is growth or commercial acreage I think from July 1988 on up to July of 1992. You can see it happen there - late 80s, 90s - the tremendous growth in acreage. Everybody was jumping as catfish prices were good in '88, '89, and '90. But now it is starting to come down. The industry basically overproduced in '90, '91, and '92 and brought prices down. A lot of farmers could not "hack it" so some of them got out of the business. I just got the new quarterly USDA report on Monday - the quarterly survey of producers, and if I had another bar on that to represent January '93 it would show that the acreage has continued to come down. I think we had a high of 166,000 acres probably two and a half years ago. Now we are at 155,000 acres - so we are losing some acres - we're having something of a shake-out you might say.

Low cost. I am going to switch gears now and talk a couple of moments about how we got here and move into what's coming down the road. I will add one more thing about how we got here, and this gets to the quality issue. Farm-raised catfish is the kind of a product that the American consumer likes because it's nutritious. It is moderately priced, you can do a lot with it, and it just fits the bill. The fish itself is why people buy it.

I think this industry is going into a real low cost period. We overproduced, brought prices down, some people are exiting the industry. These farmers are going to have to get lean and mean, and cut costs where they can. Each processor is going to have to get lean and mean, and I can see this happening now. The processors, especially the bigger ones, are moving toward new ways of processing fish or at least as much as they can to lower that cost in the plant and the farmers are doing the same thing.

There's a lot of ground that we still have not covered in low cost production at the farm level. We have to get the price of raising a fish down. We have to get a fish that can perhaps grow faster, and we have to get our feed costs down just wherever we can to save a penny here or there.

Harvesting is one area certainly where we can save money. You know, getting the fish to the consumer is not an easy job. Catfish, unlike a lot of other particular animal industries, can't be seen except during feeding or when you harvest them. Whereas with other animals, you can. So it's always a difficult process to get exactly what the consumer wants in terms of size.
Now, there are some things going on in the industry right now that are focused on harvesting, sorting, grading procedures because you can save money at both ends of it - processing and farming. If you got all kinds of different sized fish at the plant, you are going to have to pay someone to sort them out manually, and it's very inefficient. The big fish do eat more than their share in the pond. This is a problem that is just now getting some attention.

That is a basic plant scene there. I put that in just because processing efficiency is becoming a real buzz word in the industry. I think the attitude is coming over to where poultry has been for many years, and that is keep the product moving. Once it stops someone is going to have to come back and move those boxes of fish. So try to take a lot of the manual labor out of it and move toward automation.

More intensive farming. That's definitely going to happen. It is already happening in many places. Get the most you can out of each acre; of course, that creates a lot more production problems. You are going to be feeding more in the pond, and just all kinds of problems shape up when you increase your stocking rate from 3,000 fish per acre on up to 15,000 fish per acre. So it is just going to be an intensive "hands-on" program.

That's a shot at the Stuttgart Fish and Wildlife Service Lab there. They do a lot of good work. They are trying to do research on a number of projects and farm-raised catfish to help the producer. We have a lot of great research programs going on. You have people here at Auburn University. You have the Fish and Wildlife Service's expanded facility in Marion, Alabama. You have places in Mississippi and Louisiana, so there is an awful lot of work going on there.

Greater awareness of catfish. I showed you a few moments ago how awareness helped us to get to where we are today. We have a long way to go though. I feel like there is a new climate for a farm-raised catfish. Catfish right now still enjoys a great positive image in most places; places where it doesn't is because they don't understand it. Processors are doing better work in their marketing efforts and there are just a lot of good positive things going on right now.

Here are some ads that we shot out of a recent issue of Seafood Leader showing new products. That particular magazine goes to seafood buyers all over the country. That's Southern Pride here in Alabama - same magazine. Here is one out of Mississippi - America's Catch, Gourmet Catfish, here's one for Delta Pride. On Delta Pride, they recently came out with a gumbo. I don't know if anyone has seen it in the supermarkets, but it is sold for retail and food service.
*Delta Pride* also recently launched a series of co-merchandising efforts whereby they identify themselves with famous nationally known other brands. In December they had a promotion with Lee & Perrins for a holiday catfish dip. Here's a new one they just did with Martha White cornbread mix that goes in tandem with the gumbo promotion, so it works very nicely.

I'll stop here. Catfish is truly a national product. It is a product that enjoys a good reputation but one we have to continue to work on; food safety/food quality - that's number one, and as we develop conferences like this, I think we are all going to continue to do good work with catfish. Maybe next year we'll do 500 million pounds and before long we'll do a billion pounds. I hope so anyway. Catfish are here to stay.
INTRODUCTION:

The break-out session was a brainstorming discussion with a group (representing 7 Universities, FDA, USDA-ARS, Alabama Fish Farming Center) to identify issues and concerns relative to the microbial aspects of aquacultured products safety:

I. Present status/microbes with which we are concerned

II. Future concerns of the industry relative to product safety (from microbial standpoint)

III. Researchable goals during the next few years

I. PRESENT STATUS:

The initial discussion centered around how best to address the many aspects of aquacultured product food safety, such as:

- From "farm to fork," or just selected aspects (production, processing, marketing, etc.)

- Raw vs. cooked, ready-to-eat products

- All species vs. individual species

The consensus of the group was to limit discussion to processing operations (i.e., we don’t have control on what happens in the production phase)
There is not much of a problem with raw products in the U.S.; there is very little consumed raw; most is frozen which kills organisms

Aquacultured products have a good safety record so far. Why?

- Rapid spoilage rate of fish ... before pathogens are produced (i.e., short shelf-life)

- Many buyers (of products) have microbial market specificaions

- In general, products are cooked before being eaten

- Processing practices help eliminate some of the problems (i.e., skinning, washing, etc.)

- Marketable forms of product:
  - Greatest percentage is frozen which kills organisms
  - Fresh products used quickly (and not a large percentage of raw product marketed)

- Industry structure (i.e., larger processing plants designed to reduce contamination)

Many potential spoilage/pathogenic organisms are "naturally-occurring" in production waters, and may come into the processing plant along with the fish:

1. *Vibrio*  
2. *Salmonella*  
3. *Listeria*  
4. *Aeromonas*  
5. *Camplyobacter*  
6. *Mycobacterium*  
7. *Clostridium*

There was some concern that "resistant" bacteria (pathogens) may show up due to the use of therapeutants.

Comments limited to catfish, trout, and crawfish for this discussion
II. CONCERNS RELATIVE TO PRODUCT SAFETY

General concerns with regard to regulatory rates of FDA, NMFS, and USDA

- Regulatory clarification of raw vs. cooked, ready-to-eat products (especially crawfish)

- Clarification of regulatory posture relative to *Listeria* and *Salmonella*

- Regulations relative to water availability, discharge, and treatment (such as chlorination, bromination, ozonation, iodination)

Special concerns for certain segment of population who may be more susceptible to microbes:

- Expectant mothers
- Very young and/or very old persons
- Those whose immune systems may be compromised

Imported products and how they fit into the picture, i.e.,

- Microbiological quality
- Inspections
- Special restrictions

Most of raw-consumed products are shell-fish (i.e., oysters)

- Better management/monitoring of production areas
- Can we develop new methods of preparation?

Concerns about evolving processing technologies and how they will address the reduction of pathogens and spoilage bacteria
III. RESEARCH GOALS

Development of better processing technologies, such as:

- Smoking
- Pasteurization
- MAP, CAP
- Irradiation (UV, gamma ray, etc.)
- Additives, chemical tests
- Advanced and emerging packaging materials
- Vacuum packaging may be a problem; there is a need for more microbial work with this packaging method

Validation and verification of Hazard Analysis Critical Control Points (HACCP) methodology in processing settings

- Development of specialized HACCP methodologies for each species
- Determination of the effects of evolving processing technologies on the critical control points and microbes of concern, particularly with increased automation

New product development and quality control

For aquacultured products to be "safe," what are the minimum tolerance levels for microorganisms?

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Athens, GA 30602

The Southern Regional Aquaculture Center (SRAC) Aquaculture Food Safety-Residues Project was discussed by each objective.

Objective 1

Survey and review data bases for pesticide, metal, and pharmaceutical residues and develop a database for chemical contamination in farm-raised channel catfish, crawfish and rainbow trout.

Explanation - Agencies to be surveyed include FDA, EPA, USFWS, state agencies and universities, industry and other suitable sources. Mississippi State University (MSU) has established a database for residues in food products and animal feeds. Survey information would be submitted to the MSU Center. Data will be collected and reviewed followed by recommendations for additional analyses.

Comments - Concern was expressed about the various institutions and the quality of existing residue data. Does the data differentiate between wild and aquaculture produced species? It is perceived that existing residue data is not adequate.

Objective 2

1. Develop guidelines and protocols for a residue monitoring program at a processing facility.

2. Coordinate these guidelines with existing quality control programs in a processing facility.

3. Establish protocols for sampling, sample analysis and interpretation of data.

Comments - The Food and Drug Administration is considering the need for a training workshop concerning analytical methods and protocols.
Objective 3

Develop educational materials for producers and processors concerning the safe use of chemicals in or around production and processing systems.

Explanation - The development of these materials will depend upon information developed in the other objectives. Printed and visual materials will be developed based on the needs of the industry. The Project Steering Committee will prioritize these funds at the end of the first project year.

Comments - Other groups and agencies are developing educational materials and programs related to quality assurance. These SRAC materials will be designed around a quality assurance program.

Objective 4

Adapt, develop and disseminate a chemical application record-keeping system for aquaculture producers. A recording form and user-friendly computer software will be developed. The purpose of this system would be to help limit residue problems and potential liability.

A record-keeping form and computer software will be developed that will have the flexibility to be used by catfish, crawfish and trout producers.

Comments - In the development of a Quality Assurance Program, record keeping will be an important tool for the producers.

Objective 5

To determine the fate of residues from the farm through the processing plant to a product which would be prepared by the consumer. The fate of pharmaceutical and pesticide residues in channel catfish will be determined in a series of experiments conducted by several participating institutions. In addition, analytical methods for selected pharmaceutical compounds will be developed and evaluated for aquacultural products. These methods will be developed from established procedures which have not yet been adapted for catfish products.

Objective 6

Conduct additional sampling of channel catfish and other aquaculture products to improve the data base. Because of the related costs, additional funds may be needed from industry and/or federal sources.
Other Comments and Issues

- The Residues Working Group reached a consensus that this project will support industry Quality Assurance initiatives.

- If this project identifies any problems in an individual operation or industry-wide, it is our responsibility to inform the individual(s) involved and work with them to solve the problem.

- Selling the idea of a Quality Assurance Program to the farmers may be a problem because farmers may perceive that imports do not have to comply in areas of drug and chemical usage.

  It was recommended that FDA develop materials to educate producers of their ongoing activities to regulate and inspect imports.

- Concern was expressed about some aquaculture chemicals and drug advertising that implies their legal use and availability to the farmer.

- Concern was also expressed about chemicals, pesticides and drugs used in farm and recreational ponds. Any management recommendations would have to comply with FDA and/or EPA regulations.

  Note: Low priority enforcement chemicals could be used on game fish species if applied according to FDA regulations.

- It was pointed out that the INAD process may over commit region’s research facilities and divert them from other research projects. It was suggested we may want to try to coordinate INAD projects in the region through the new INAD Coordinator at Michigan University and through SERA-IEG-9.

- It was recognized there is a need for the SRAC Residues Project to communicate with FARAD. Their objectives are different but complement SRAC project objectives.
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