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.