Processing and Marketing Aquaculture Products On a Small Scale

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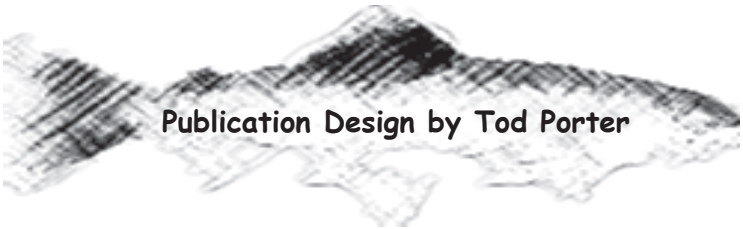

Introduction

Aquaculture, or farming of aquatic plants and animals, is a fast growing agricultural industry in the United States. While large-scale production, processing and marketing of species such as catfish, trout, shrimp and salmon are well known in states like Mississippi, Idaho, Texas, and Maine, respectively, other states are only beginning to enter this industry.

In many of these states producers are usually small scale and the farmed species are relatively unique. As a result, processing and marketing mechanisms developed for large-scale aquaculture industries are usually inapplicable for small-scale industries.

This manual is designed to partially fill this vacuum by providing information on aquaculture processing, live transport and marketing that is specifically catered to small scale production.

For example, the chapters on processing focus on hand processing and the chapters on marketing primarily investigate direct marketing and restaurant markets. While much of the information in this manual is relevant to Kentucky, the concepts presented herein also are applicable to other states, with some potential changes.

Readers are strongly encouraged to contact their state/local agencies regarding regulations about processing, live transport, and marketing of aquatic species, prior to undertaking any of these activities.

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Tilapia are placed in cages by Shawn Coyle, KSU Aquaculture.

Small scale processing of fish and crustaceans: General Information

To process fish and crustaceans for sales to wholesalers, distributors, retailers, and restaurants, one must use a processing facility that has a Hazard Analysis Critical Control Points (HACCP) plan, written by a HACCP-certified person (who need not be a plant employee). A HACCP plan is not necessary for direct sales of processed product to the end user; however, the product must be processed in an approved processing environment.

- HACCP is a food safety system based on prevention. Prevention is essential for food safety because testing every product for bacteria, chemical and foreign object contamination is impractical, time consuming, and cost prohibitive. The main HACCP components are 1) identifying potential hazards that could make food unsafe, 2) establishing and monitoring targeted control points to minimize such risks, and 3) keeping a record of the monitoring results and processed products. HACCP plans must address each product type separately, i.e., both fish and crustaceans can be processed in the same processing plant (not concurrently); however, separate HACCP plans are required for fish and crustaceans.
- There are 7 basic principles to HACCP: 1) determine product hazards and prevention methods, 2) identify control points to processing and determine which are critical, 3) determine the

minimum standards of food safety at each control point, 4) establish methodology that monitors food safety at each control point, 5) establish corrective procedures at control points that are to be employed when the minimum food safety standards have been violated, 6) keep good records of each processing activity and corrective action, and 7) establish techniques for monitoring and verification of the HACCP method in a particular processing system.

- For each identified hazard at a critical control point, the processor would implement a plan to remove the hazard, in accordance with his HACCP plan. For example, freshwater prawn tails, after de-heading, must be kept on ice in the processing plant. The processor has to ensure that the flesh temperature in the tails drops to 41°F in 40 minutes; otherwise, the tails are discarded. HACCP plans are a management tool to help processors determine how and at what phase of processing different problems can arise.

What is HACCP certification?

A HACCP-certified individual is one who has completed a HACCP Training Curriculum that complies with standards required by the United States Food & Drug Administration (FDA), such as The National

- Seafood HACCP Alliance for Training and Education. The training course is available online, with a 1-day in-house training, followed by a written examination. Each processor is required by law to implement a hazard analysis for their own

processing activities and if hazards are identified, that are reasonably likely to occur, generate a HACCP plan tailored to their specific situation. Developing a HACCP plan, changing a plan, or conducting a record review must be undertaken, by law, by a HACCP-certified individual. Although not mandatory, it is a good idea to have a HACCP-trained employee in a processing plant.

- The major steps (for Kentucky; rules in other states might vary) to starting a processing facility are:
    - The prospective processor must create building plans for the processing plant and a plumbing diagram (i.e., a riser diagram). The plans must show the placement of all equipment, tables, sinks, etc.
    - The plans are submitted to the county health department where the actual processing operation will take place. The plans will be reviewed and changes might be recommended. The plans will then be forwarded to other state agencies for their review. Some counties might charge a fee to process the plans.
    - After approval of plans, construction of the processing plant can commence. A licensed plumber must install all plumbing. A certified installer must install all onsite sewage systems (septic tanks).
    - The processor should get HACCP certified and develop a HACCP plan for the processed product and also have (on paper) Good Manufacturing Practices (GMPs), Standard Operating Procedures (SOPs), and Sanitation Standard Operating Procedures (SSOPs). While none of these plans needs to be certified by

a government agency, the state health department and the United States Food and Drug Administration (FDA) could make unannounced inspections during which all plans, and the plant workers' conformance to the plan, will be reviewed. Processors are required to maintain sanitation control records.

- If processed products are to be packaged for sales, proposed product labels should be submitted to the Food Safety Branch of the Kentucky Department of Public Health for compliance with state and federal labeling guidelines.
- The processor must apply for a food-processing permit ($75 fee for processing plant < 1,000 sq ft) from the state health department. Processing can begin after receipt of the permit.

- GMPs are a list of procedures with respect to 1) location, 2) design, and 3) operation of a food processing plant that would deter contamination (biological, physical, or chemical) of the processed product from the initial/raw product stage to the point

that the processed product leaves the plant.

- SOPs are a list of steps, designed for processing a specific product that outlines every processing activity from raw product to the final processed, packaged and stored product.
- SSOPs are a list of procedures tailored for processing of a specific food product, in a given processing plant, that outlines the various steps of ensuring sanitary conditions in the plant and safety of the food product.
- Initially, the processing plant design, equipment, waste management and fixture layout will be evaluated by the county public health department. The department of public health will also inspect the implementation of GMPs, SOPs, and SSOPs.

Labels should be used to code blocks of processed products as an aid for tracing back potentially hazardous product.

All processed products will be labeled with processing/packaging/ re-packaging location, dates and identification numbers. Labels must contain a truthful and clear description of the product ingredients, an accurate weight of the product, and safe handling instructions. Labels should also be used to code blocks of processed products as an aid for tracing back potentially hazardous product. This trace back information might be useful by possibly limiting the recall to one to two blocks of product instead of all processed products in a given time period.

Waste Disposal Procedures

Processing fish and crustaceans create both solid waste (offal) and liquid waste (wastewater). The simplest method of disposing of offal involves bringing the waste, contained in sealed trash bags, to a municipal landfill.

Another method for offal disposal is burial or composting. This requires more facilities and effort. Incineration is yet a third means of offal disposal. All disposal methods must be in accordance with state and local laws.

Wastewater can be held in sealed tanks and disposed in a water treatment plant. A septic tank, capable of handling the wastewater volume can also be used, if approved by the local health department.

All disposal methods must be in accordance with state and local laws.

Small scale processing of fish and crustaceans: equipment, and economics

Minimum Facility Requirements

- The facility (15 ft × 15ft room is sufficient) must have an impermeable floor (e.g., sealed cement floor), with a center drain, impermeable walls and ceiling. Additional features include a 3-compartment sink (with drain boards) for wash, rinse and sanitization of small hand-processing tools, a mop (or service) sink, and a separate hand-washing sink with hot potable running water, hand-washing soap, disposable towels or hot air dryer and a bag-lined trash can with a lid. The facility design must incorporate spaces that are large enough to allow workers to operate without contaminating the food products.
- The facility must be designed with limited access between the area outside where raw product is held and the main processing area to exclude insects, birds, vermin and other pests. This can be accomplished by a small window through which product can be passed to the main processing room, or an access door (for bringing in product) that can be closed. It is recommended that the personnel entry door to have a footbath for

sanitizing shoes immediately outside the door. A simple footbath can be devised from a plastic box (large enough to step in) containing a sanitization solution.

- The facility must be equipped with plumbing, sewage, electricity, and air conditioning/ heating facilities. Adequate ventilation is necessary to minimize odors, noxious fumes, steam, etc. Sewage lines carrying wastewater should go to a municipal sewer or an approved septic tank. Wastewater must be disposed in an approved septic tank or in a municipal sewage system. Freshwater prawn processors in Kentucky are allowed to pump wastewater to a pond.
- The facility must have a water heater capable of producing sufficient hot, potable water required for processing, washing and rinsing.
- The processing plant be equipped with a bathroom in the processing building (not in the processing room), with a toilet, hand-washing sink with hot and cold water, hand washing soap/sanitizer, and hand drying equipment (single use paper towels or hot air blower). The bathroom must be cleaned as often as necessary to preclude it from becoming a food contamination source.
- The processing and bathroom facilities must be well lit with electric lights using covered light fixtures. The plumbing system must be designed that no dripping, condensation, or equipment failure/ breakage might contaminate food preparation areas.
- Offal, waste, and rubbish must be contained, transported and disposed so as to minimize contamination. Offal can be buried, composted, incinerated, or taken to a municipal

landfill.

- Grounds around the plant, under operator control, must be free of food-contaminating conditions, such as: 1) improperly stored equipment, refuse, water, uncut grass and weeds, etc., that might contribute to insect and pest breeding, 2) excessively dusty roads and grounds, 3) animal/livestock holding areas, 4) inadequately drained areas, providing breeding places for insects, pests, and bacteria.
- The processing plant must have good access to road or rail transportation.

Equipment list

A small scale processing plant will invariably focus on hand processing more than mechanized processing. The following is a list of essential equipment:

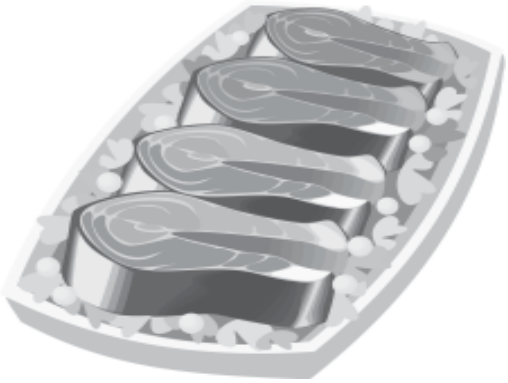
- Holding tanks for live fish and crustaceans.
- System for killing fish and crustaceans (e.g., stunning, chilling).
- Smooth, nonabsorbent, and easily cleanable processing tables for receiving fish, de-heading, scaling and eviscerating, inspecting, and packaging. Although stainless steel tables are ideal, they are not required.
- A 3-compartment, easily cleanable and non-absorbing sink for washing, rinsing, and sanitizing utensils and processing implements (e.g., knives). The sink must have drain boards on both ends.
- Washing area for processed fish and chilling tanks to let products achieve a recommended internal temperature.
- Packaging equipment with a scale for weighing products.
- Freezer to hold processed products for future sales.

- Adequate equipment and supplies (e.g., pressure washer and sanitizer) for washing and sanitizing all processing areas, tables, knives, utensils and clean-in-place equipment.

The following non-essential equipment might be useful for more mechanized processing: band saw for removal of fish heads, automatic skinner, automatic eviscerator, automatic filleting equipment, automatic labeling equipment, cryogenic freezer and metal detector.

Economics of a Small-Scale Processing Plant: Fixed Costs

The following assumes a relatively simple hand processing room designed for producing fresh headed, scaled and gutted fish. The facility is assumed to be a 15′×15′ room, part of an existing building, with a screened off outside area for receiving live fish/crustaceans. This area is assumed to contain two tanks, one for holding live fish and the other for chill-killing fish. Basket/nets are used to transfer fish from the holding tank to the chill-kill tank. The chill-kill tank contains an ice bath, and can be rolled into the processing room through an access door. Once inside the processing room, the fish are received on a table where they are de-headed and placed in an adjacent table. Here the fish are eviscerated and scaled. The fish are then washed and placed in an ice bath. Once the fish are sufficiently cold, they are placed in labeled zipped plastic bags and stored in a freezer.



Annual Ownership Costs for Building and Equipment

Item	Cost	Lifespan	Annual Depreciation	Annual Interest
Building (15′×15′) @ $50/sqft + Septic system ($5,000)	$16,250	15 yrs	$1,083	$813
Tables (4×$200), 3-compt. sink ($670)	$1,470	10 yrs	$147	$74
Freezer ($300), Ice Machine ($1,500), Air Conditioner ($200)	$2,000	5 yrs	$400	$100
Tanks ($670), packaging bags ($50), Pressure washer ($300)	$1,020	5 yrs	$204	$51
Scale ($194), knives ($70), baskets ($40), trash cans ($30)	$334	5 yrs	$67	$17
Total	$21,074		$1,901	$1,055

Total fixed costs/yr = Depreciation + Interest + Taxes & Insurance ($600) = $3,556.

Economics of a Small-Scale Processing Plant: Operating Costs

The following assumes a 1-day processing operation of freshwater prawn. Experience has shown that 800 lb of whole prawns can be processed (de-headed) in one day. Similarly, 500 lb of catfish (live weight) can be filleted in one day.

Item	Quantity (/ day)	Unit Cost	Total Cost
Live Prawn	800 lb	$5.50	$4,400.00
Labor (4 workers)	32 hr	$10.00	$320.00
Electricity	14 KWH	$0.06	$0.84
Water	180 gallons	$0.012	$2.16
Chemicals	2 gallon	$10.00	$20.00
Packaging supplies	1 unit	$100.00	$100.00
Total			$4,843

Charging fixed costs for 1 day (average per-day fixed costs), the processed prawn tails (400 lb) would cost $12.13/lb. If prawns were replaced by 500 lb of catfish processed per day (producing 300 lb of whole-dressed fish), valued at $0.80/lb, the cost of whole dressed catfish would be $2.84/lb.

Small scale processing of fish and crustaceans: example HACCP, GMP, SOP and SSOP plans

The following detailed example is intended for individuals interested in small scale processing of fish and crustaceans. Readers should keep in mind that HACCP, SOP, GMP, and SSOP plans described here should be, in the real world, custom designed for each processing facility and each product. Hence, the information presented here is only for illustrative purposes and should not be directly adopted as the basis of operations plans for a processing facility. Official HACCP plans for processing must be done by a certified individual.

As a model of a processing facility, we have adopted the 15ft × 15ft processing room, illustrated in Figure 1. This facility contains a screened area outside the processing room containing a holding tank and a kill tank. The kill tank, containing whole fish on ice, is on casters, and can be pushed into the processing room via an access door. The processing room has four tables: a heading table, a scaling/ eviscerating table, a washing, inspecting, and chilling table, and a packaging and labeling table. Each table has a trash can with lid, lined

with a trash bag; these trashcans hold solid waste. The washing table has a potable water faucet, used for washing processed fish. This table also has a plastic box/tray containing ice water, which is used to chill the processed fish.

The processing room is also equipped with a 3-compartment sink, a hand washing sink, a mop sink, a storage closet, an ice machine, and a chest freezer/ice chest. The processing room also has an employee access door that can be used to remove processed product for shipping. The employee access door has, on the outside, a sanitizing footbath in a plastic tray. Bathroom facilities are not included in the processing building, but are located nearby.

Dr.Jim Tidwell, KSU Aquaculture Coordinator, inspects a Cuban processing plant.

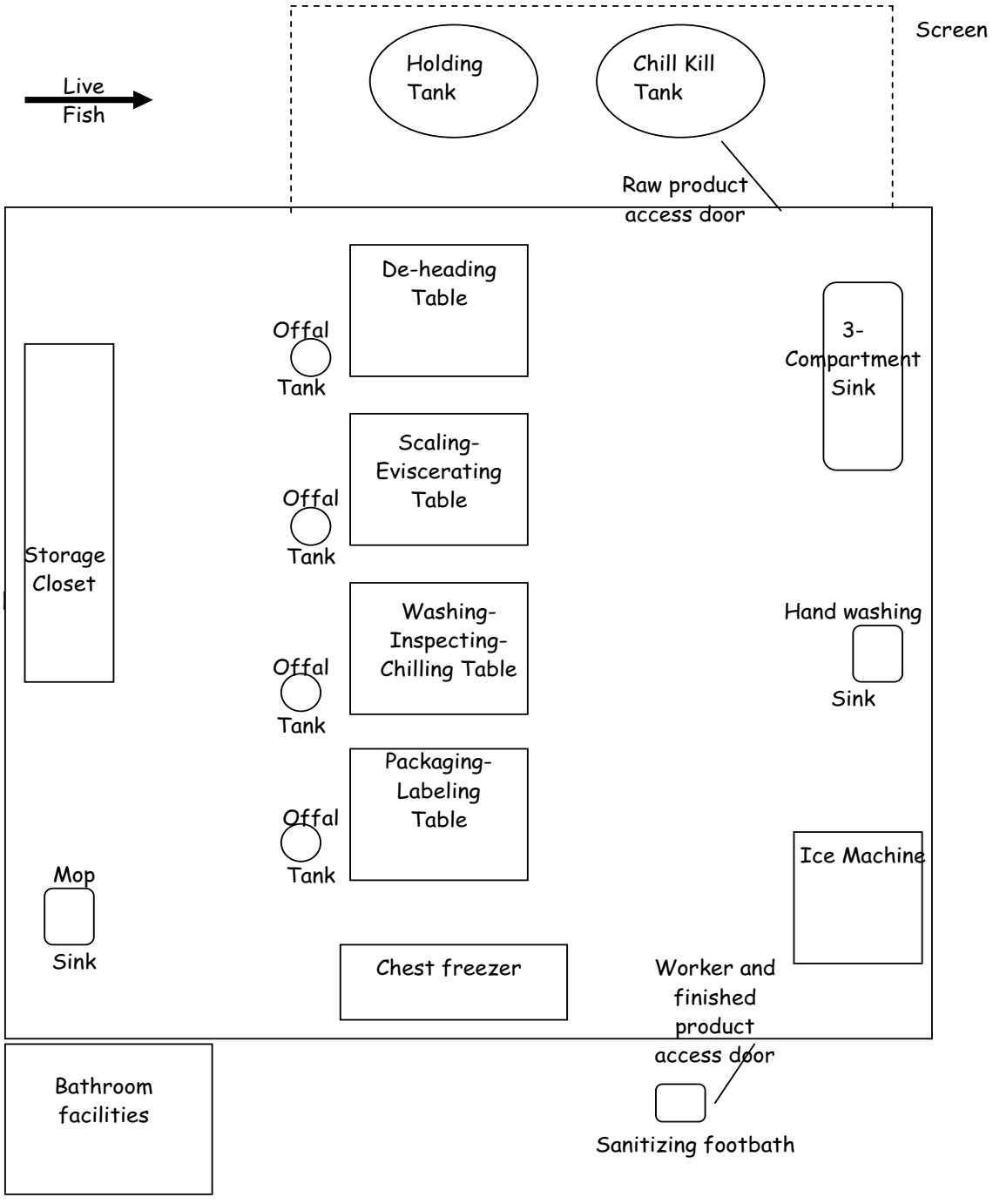


Figure 1. Schematic diagram of a small scale processing plant.

Steps to a HACCP Plan

- Describe the processed product and all raw ingredients.
- Describe the processing steps and draw an accurate processing flowchart.
- Identify processing hazards.
    - List natural hazards associated with the species being processed and at what processing step these hazards arise. The Fish and Fishery Products Hazards and Control Guide from the FDA can be used to find toxins, microbiological growth, chemical contamination, and other hazards associated with different species.
    - List other physical, biological, and chemical hazards associated with processing. For example, knife blades that are rusted or chipped are a physical hazard. Fish not kept sufficiently cold can encourage rapid growth of microbes and form a biological hazard. Cleaners, sanitizers, etc, not properly stored during processing activities can form a chemical hazard.

Identify critical control points (CCP). CCPs are processing steps that can be controlled to prevent a food safety hazard (or sufficiently reduce the hazard). Evaluate your processing steps to identify CCPs. At each CCP

- establish limits that, if violated would become a risk to food safety. These limits should be within the safe range for that product.

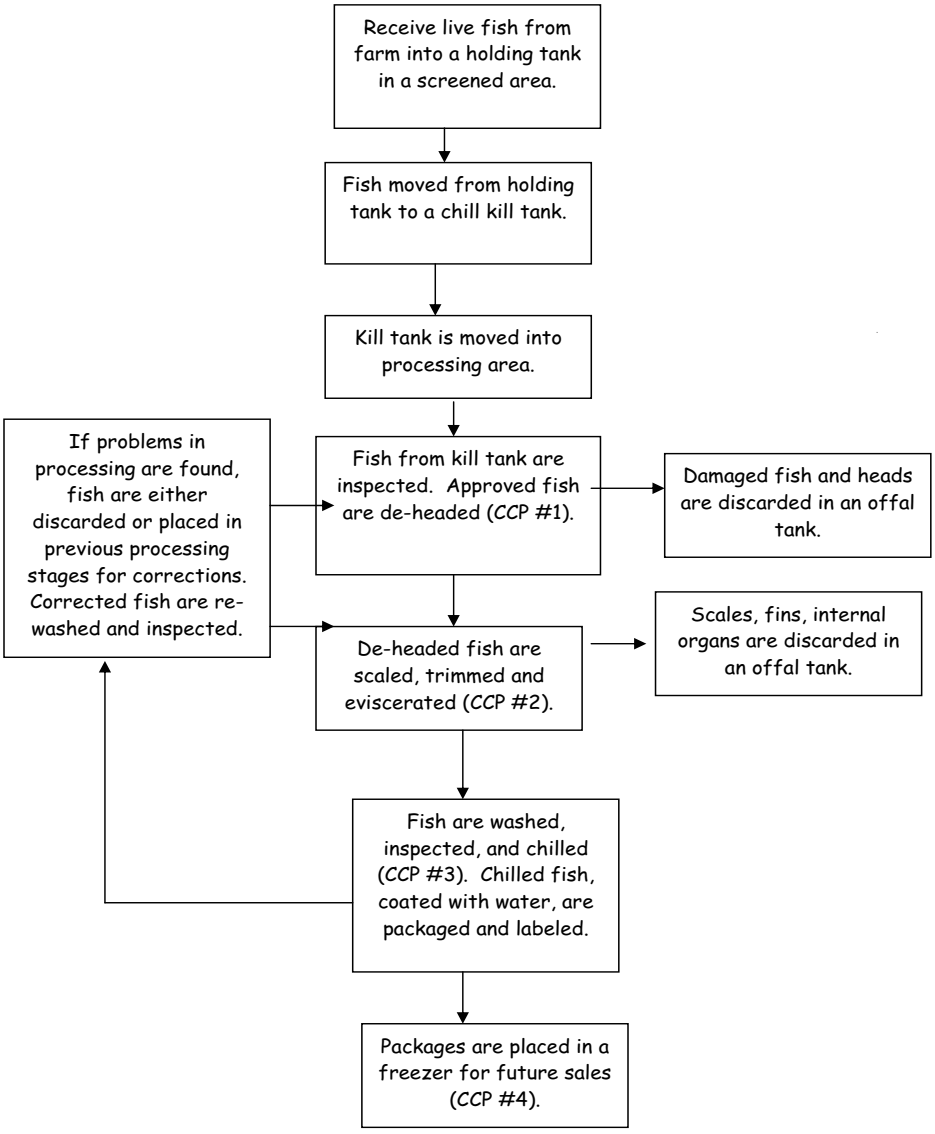
- Monitoring, corrective actions and record keeping: establish methods of checking if the processed food is within safety parameters at each CCP. For example, processed fish must be kept cold (41°F or less) to slow microbe growth. One must check fish body temperatures after processing, at sufficiently high frequency, to ensure that the fish remains adequately cold and safe for consumption. If the safety parameters are violated, corrective steps might be feasible; for example, if processed fish does not get to be sufficiently cold, the operator should add more ice and re-check temperature. If correction of safety violations is not possible, the affected batch of product should be discarded. All monitoring and correction activities must be recorded. These records should contain dates, times, and product batch numbers, along with facility manager's initials. Such records are crucial for tracking product for recall, and identifying the area of failure in maintaining food safety. Records should be kept for at least 1 year for refrigerated products and two years for frozen product.

Example HACCP Plan

Joe's Fish Processing is developing a HACCP plan for scaled and gutted hybrid striped bass. The following information is needed for the HACCP plan:

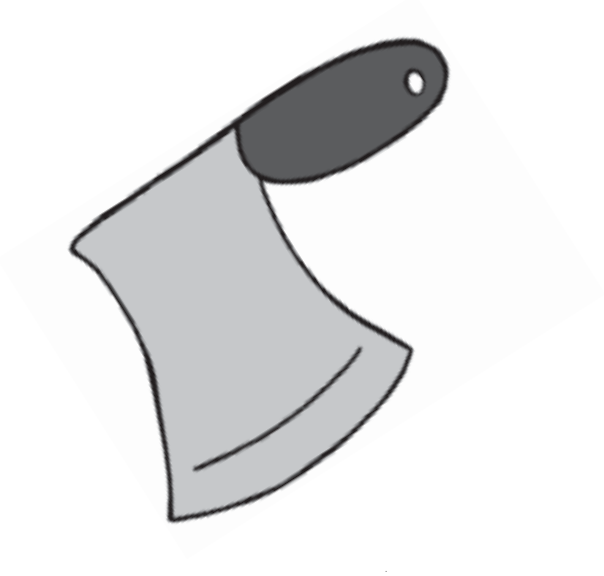
- Name & address of the processing plant.
- Processed Food Description: Scaled and Gutted Hybrid Striped Bass
- Identify market name or Latin name of species, such as Hybrid Striped Bass.
- Fully describe the finished product; e.g., Gutted frozen fish.
- Describe the packaging type; e.g., Labeled, zipped plastic bags.
- Method of Distribution and Storage: distributed on ice and stored under refrigeration.
- Identify Intended Use and Consumers: Restaurant sales.
- Develop a Flow Diagram Illustrating the Processing Steps.

Processing Flowchart



- Identify potential hazards related to processing specific species.
    - Physical hazards: 1) foreign materials in packaging materials, 2) foreign materials put into the chill kill tank when moving bass from the holding tank, 3) animals and dust entering the processing area when the kill tank is moved into the processing room, and 4) chipped/rusted cutting surfaces.
    - Biological hazards: processed fish is not sufficiently cold in the given time frame (41°F or less in 40 minutes).
- Record all identified hazards in a Hazard Analysis Worksheet (example attached).
- Indicate safety limits for each hazard and corrective measures, when safety limits are violated.
    - For example, for the physical hazards, the safety limits are 1) no foreign materials in packaging, 2) no other animals or plants are introduced to the kill tank, other than hybrid striped bass, 3) no entry of animals and dust when the raw product access door is opened, and 4) no damaged cutting surfaces. These are taken care of in the SOP and SSOP and are not CCPs.
    - The biological hazard safety limits are that the processed fish must be cooled to 41°F (or less) in 40 minutes after processing, and kept at 41°F (or less) until sale. This is a CCP.
- Monitor hazards to check if safety limits are violated, and associated corrections.

- The plant manager must inspect all packaging materials and remove any foreign objects, prior to bringing the packaging materials into the processing area.
- Operators moving fish from the holding tank to the kill tank, must verify that only hybrid striped bass is moved: any other animals and plants must be physically removed.
- Operators must keep the raw product access doors closed at all times, except when moving the kill tank inside and outside the processing room. If a significant dust or animal contamination occurs, the processing operations must be halted and the processing room cleaned according to the SSOPs.



- Operators must check all cutting surfaces (as per SOPs), as often as necessary. If the blades are damaged, they should be replaced before continuing processing activities.

- Operators must monitor the body temperature of processed fish in the chill tank. Only fish that have reached 41°F (or less) in 40 minutes can be packaged. Fish body temperature should be checked after 20 minutes and if 41°F is not achieved, more ice should be added to the chill tanks, and the fish body temperature should be re-checked. This is a CCP.

Hazard Analysis Worksheet for Hybrid Striped Bass Processing.

Process step.	**Potential hazards introduced, control, or enhanced at this step.**	**Does this potential hazard need to be addressed in HACCP plan? (Y/N)**	**Justify the previous decision.**	**What measures can be applied to prevent, eliminate, or reduce the hazard shown?**	**Is this step a critical control point (CCP)? (Y/N)**
Receiving packaging material	B: None C: None P: Foreign materials	P: No	Plant manager must check materials before introduction in processing area.		No
Storing packaging materials	B: None C: None P: Foreign materials	P: No	Packaging materials will be stored in a clean, dry storage locker.		No

Check Temperatures As Required

Process step.	Potential hazards introduced, control, or enhanced at this step.	Does this potential hazard need to be addressed in HACCP plan? (Y/N)	Justify the previous decision.	What measures can be applied to prevent, eliminate, or reduce the hazard shown?	Is this step a critical control point (CCP)? (Y/N)
Receiving raw product	B: None C: Chemicals and drugs in the pond in which the fish lived P: None	C: No	Plant manager must require fish supplier to certify that the water in which the fish have been raised was free of chemicals and pesticides. All drugs used were approved by the FDA for use on food fish.		No
Moving product from holding tank to kill tank	B: None C: None P: Foreign materials	P: Yes	Other animals and plants put into holding tank might be a source of contamination.	Operator must inspect holding tank and only move bass into kill tank.	No
Moving kill tank into processing area	B: None C: None P: animals & dust entering processing area	P: No	Tank operator ensures that no animals enter processing area during product entry.		No

Be aware of all potential hazards!

Process step.	**Potential hazards introduced, control, or enhanced at this step.**	**Does this potential hazard need to be addressed in HACCP plan? (Y/N)**	**Justify the previous decision.**	**What measures can be applied to prevent, eliminate, or reduce the hazard shown?**	**Is this step a critical control point (CCP)? (Y/N)**
De-heading fish	B: None C: None P: broken/ rusted cutting blades	Yes	Damaged and rusted blades can introduce metals and harmful chemicals into processed fish.	Operator inspects cutting blades as often as necessary. Damaged or rusted blades are discarded. Pass affected product through a metal detector or discard.	Yes CCP #1
Scaling, Eviscerating	B: None C: None P: broken/ rusted cutting blades	Yes	Damaged and rusted blades can introduce metals and harmful chemicals into processed fish.	Operator inspects cutting blades as often as necessary. Damaged or rusted blades are discarded. Pass affected product through a metal detector or discard..	Yes CCP #2
Washing, inspecting	None				
Chilling	B: Fish have not reached 41°F (or less) in 20 minutes C: None P: None	Yes	If not sufficiently cold, rapid microbe growth is possible making fish unsafe.	Operator must check fish temperature frequently. If fish are not sufficiently cold, operator must add more ice and re-check temperature, until the fish are cold.	Yes CCP #3
Packaging, Labeling	None				
Storing	B: Fish are not sufficiently cold in storage C: None P: None	Yes	This might encourage rapid microbe growth and become unsafe for consumption.	Operator must check freezer/refrigerator temperature frequently, and adjust it to keep fish sufficiently cold.	Yes CCP #4
Shipping	None				

Monitoring and Remediation Procedures at CCPs

HACCP Plan Form

(1) CCP	(2) Significant Hazards	(3) Critical Limits for each Control Measures	(4)	(5)	(6)	(7)	(8) Corrective Action(s)	(9) Verification	(10) Records
			Monitoring						
			What	How	Freq	Who			
1	Broken or rusted cutting blades	No broken or rusted blades	Damaged blades	Visual	Every 20 mins	Manager	Replace blades; pass affected product through metal detector or discard	Review record daily; pass processed product through a metal detector	SOP records
2	Broken or rusted cutting blades	No broken or rusted blades	Damaged blades	Visual	Every 20 mins	Manager	Replace blades; pass affected product through metal detector or discard	Review record daily; pass processed product through a metal detector	SOP records
3	Rapid microbe growth	Fish must reach 41°F (or less) in 20 minutes	Fish temp	Thermo -meter	Every 20 mins	Wash/ chilling station operator	Add more ice and re-check temp. If 41°F is not reached in 40 mins discard product.	Reviews temp records	SOP records
4	Rapid microbe growth	Fish must reach 41°F (or less) in 20 minutes	Fish temp	Thermo -meter	Every 20 mins	Manager	Lower freezer temp. If 41°F is not reached in 40 mins discard product.	Reviews temp records	SOP records

Example Standard Operating Procedures (SOPs)

- The raw product, live hybrid striped bass, must be produced in an area (or ponds) where there is no contamination (such as pesticide runoff) to the extent that fish will be deemed dangerous for consumption, in accordance with established tolerance levels.
- There will be five primary work areas in the processing plant: 1) receiving/ holding / chill killing area, 2) de-heading area, 3) scaling/ eviscerating area, and 4) washing/ inspecting/chilling, and 5) packaging and labeling area.
- Receiving holding / chill killing area operations (1 person): Live fish are to be delivered to a holding tank, located in a screened area next to the processing room, containing de-chlorinated potable water at room temperature. Fish from the holding tank are moved by a basket to an adjacent tank containing an ice bath for chill killing. The operator must inspect the basket to prevent transferring of anything else other than hybrid striped bass to the kill tank. Fish are kept in the ice bath in the kill tank for 15 minutes (sufficient chill kill time for hybrid striped bass). An access door is opened to the processing area and the chill tank is pushed into the processing area. The access door is then closed. Once all the fish from the chill tank are processed, the empty tank is wheeled out to the holding tank for the next batch of fish.

- De-heading area operations (1 person): whole fish are removed from the kill tank and placed on the de-heading table. Fish that are deformed, diseased, or sufficiently damaged to be unfit for human consumption, are discarded. The fish head is removed using a hand-saw (food processing quality); a mechanical, food grade, band saw can also be used for faster head removal. All cutting blades are inspected for breakage, rust and deformities. Damaged blades are not used for processing. SOP records of blade condition are kept for every batch of product. If damaged blades are found, pass affected product through a metal detector, or discard. Discarded fish, heads, and other offal are kept in an offal can (e.g., trash can, lined with a trash bag, and having a closeable lid). The de-headed fish are passed to the adjacent table for scaling/ eviscerating operations.

Scaling/eviscerating operations (1 person): fish from the de-heading table are scaled using a knife. All cutting blades are inspected for breakage, rust and deformities. Damaged blades are not used for processing. SOP records of blade condition are kept for every batch of product. If damaged blades are found, pass affected product through a metal detector, or discard. The scales are discarded into an offal tank. Fins are trimmed/ removed from the scaled fish by a knife and the offal is put into an offal container. The fish are then eviscerated by cutting open the stomach cavity with a knife and removing internal organs by hand; resulting offal is discarded in an offal tank. The fish are then placed in an adjoining table for washing / inspecting/chilling and packaging.

- Washing/inspecting/chilling/ operations (1 person). Headed, scaled, trimmed and eviscerated fish are first thoroughly washed using cool potable water. The waste water falls in a sink and in conveyed to a wastewater tank. Washed fish are visually inspected for problems associated with processing. Problem fish are either discarded, or passed to one of the previous processing steps for corrective actions. After such corrections, the fish are again washed and inspected. If the fish passes inspection, it is placed in an ice bath to chill their body temperature to 41°F within 40 minutes (checked every 20 minutes). Fish body temperature is monitored by inserting a food grade steel thermometer into the flesh of three randomly chosen fish in the ice bath. If any of the fish did not achieve the requisite temperature, more ice is added to the ice bath and fish temperatures are rechecked. If fish is still not 41°F within 40 minutes, discard affected product. HACCP records are kept for temperature of every batch of product.

- Packaging and labeling operations (1 person): if processed fish achieve the above temperature in the given time, they are individually packaged, weighed, and labeled. Packages are then placed in a freezer as the final processed product. Check product temp in freezer after 20 minutes. If product is not 41°F, or less, lower freezer temperature. Recheck fish temperature after 20 minutes. If fish have still not achieved 41°F, or less, discard product. Keep HACCP records for freezer temperature for every batch of product. Once processing is completed, the freezer holding the processed product may be transported to the sales site.

Example Good Manufacturing Practices (GMPs): Building and Facilities

- Grounds around a food plant, under operator control, must be free of food-contaminating conditions, such as: 1) improperly stored equipment, refuse, water, uncut grass and weeds, etc., in the area surrounding the processing building, that might contribute to insect and pest breeding, 2) excessively dusty roads and grounds, 3) inadequately drained areas, providing breeding places for insects, pests, bacteria, etc.
- Processing plant design and construction must facilitate sanitary operations and maintenance. This includes: 1) floors, walls and ceiling must be constructed of impervious material that can be easily washed and sanitized, 2) plant must be designed to keep out insects, vermin, birds, and other animals, 3) air

conditioning, heating, electrical, and plumbing systems must be designed that preclude dripping, condensation, or other contamination possibilities due to equipment failure/breakage, 4) sufficient space must be allocated to rooms, aisles, etc., to allow plant workers to operate without contaminating the food products, 5) adequate lighting must be provided in all areas used by plant workers, 6) adequate ventilation is necessary to minimize odors, noxious fumes, steam, etc.

- Processing plants must be equipped with sanitary facilities that include: 1) sufficient potable water (hot & cold) for washing and processing operations, 2) approved wastewater disposal system (municipal sewage system, septic tank system, or constructed wetland system), 3) offal, waste, and rubbish must be contained and disposed so as to minimize contamination and odors, and prevent the waste becoming an attractant to insects and vermin.

- Plumbing must bring adequate water for washing and processing, properly convey sewage, must not leak or otherwise become a source of food contamination, and allow for sufficient floor drainage in area where water is openly discharged in either processing or cleaning operations.

- Adequate toilet and hand washing facilities for plant workers, with posted notices requiring workers to wash hands with soap/detergent and hot water.

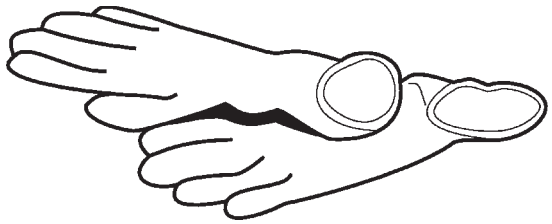
Example GMPs: Sanitation Practices

- General plant maintenance. Use safe, approved cleaning and sanitation agents, which shall be stored in places that will preclude splash, dust accumulation and contamination of food products
- Prevent animals from contaminating food at any stage of processing
- Sanitize all utensils and surfaces touched by the product, as often as necessary. All utensils and processing equipment must be washed and sanitized prior and subsequent to processing operations and also during the processing operation, if deemed contaminated. Non-product contact surfaces should be cleaned as often as necessary to prevent accumulation of dust, dirt, food and other debris. Single use material, such as plastic and paper material must be properly stored and disposed after use.
- Wash and sanitize hands before start of processing and after every time workers leave the processing area. Sanitize hands as often as necessary in the processing area.
- Individuals with diseases, sores, boils, etc., should not work in the processing plant or engage in any activity that might contaminate the processed products.
- No smoking, gum chewing, or carrying items such as toothpicks in the mouth or have items (e.g., pencils and cigarettes) behind ears. No eating or drinking in processing areas. Avoid using hands to touch or wipe face,

glasses, body, etc. Leave processing area during excessive coughing or sneezing.

- Personal hygiene is vital for processing operations.

  - Wear hairnets and be clean-shaven, or use a beard net (snood) to cover facial hairs. Keep hands and fingernails clean. Keep fingernails trimmed.
  - Do not wear any jewelry in the processing facility.
  - Wear clean clothing at the start of processing and keep clean during operations. Wear disposable plastic aprons and replace them as often as necessary. Do not have pockets above the waist and do not carry any items above the waist (e.g., pens). Wear sweaters/ sweatshirts below the outer garment. Sweaters and other clothing should be short haired and lint free.
  - Wear disposable food grade plastic gloves at all times. Replace gloves if they are torn and/or dirty.



  - Wear clean, low-heeled shoes that do not expose any part of feet.

Example GMPs: Equipment Use

- All equipment must be suitable for food processing, can be cleaned, sanitized, and maintained. Equipment must be so installed such that the facilities surrounding the equipment are accessible and can be cleaned.
- All equipment, utensils, food contact surface and machinery used in, and around, the processing plant must not contain PCBs (Polychlorinated biphenyls). This does not include sealed electrical equipment, such as transformers and condensers.

Example GMPs: Production and Process Controls

All plant operations, e.g., receiving, inspecting, killing, processing, packaging, and storing, must be under the supervision of a manager responsible for maintaining sanitation standards. Apply the following precautions: 1) raw ingredients must be inspected to determine if they are wholesome and fit for subsequent human consumption, 2) raw materials must be washed to remove contaminants, and the wastewater must not be re-used for any other washing activity, 3) containers of raw product (e.g., fish tanks) must be inspected to assure that they are not a source of contamination, 4) ice used in the plant must be made from a potable water source, and it must be handled in a sanitary manner, 5) food processing areas must not be used to process animal feed or inedible products, unless

- there is a reasonable assurance of no contamination of human food, 6) packaging processes and materials must be so chosen that they do not contribute to product contamination, and 7) meaningful labeling of product with processing location, dates and identification numbers are essential for recalling contaminated product

and determining the cause of contamination.

- Prior to shipping, the processed product must be packaged in a durable manner, i.e., the packages must be clean and should not rupture under normal shipping conditions. The processed products must also be kept sufficiently cold during transportation.

Example Sanitation Standard Operating Procedures (SSOPs)

- The processing plant manager must monitor the following sanitation control issues and keep records of monitoring and correction activities: 1) water safety checks, 2) condition and cleanliness of food contact surfaces, 3) prevention of cross contamination/ control of worker health conditions, 4) maintenance of hand washing and bathroom facilities, 5) protection of food packages from contamination and proper labeling of packaged products, 6) proper labeling, use and storage of toxic chemicals, 7) ensuring employees involved in processing do not show signs of medical problems, and 8) exclusion of physical hazards such as damaged equipment, pests, and windborne contaminants.
- Sanitation procedures at startup:
    - Sweep and mop floor and remove all physical debris from the processing area including the live fish delivery area (Figure 1).
    - All equipment, tanks, tables, sinks, floor, walls, doors, and ceiling must be 1) cleaned of any physical debris, 2) washed with potable water and an approved cleaner, 3) rinsed

with potable water, and 4) sanitized with an approved sanitizer (unscented bleach and water mixture will work, except on aluminum; in this case use an aluminum-safe sanitizer).

- De-chlorinated, clean, potable water must be used for live holding (i.e., live tanks).
- If any equipment requires disassembly, each piece is removed and washed, rinsed and sanitized, as described above.
- Monitoring and record keeping:
  - The plant manager must monitor the cleaning process and check items on a sanitization list indicating a complete and thorough cleanup operation. This must be documented.
  - All processors must keep records outlining activities performed, in accordance with the SSOPs, to maintain sanitation in the processing plant.
  - If the manager finds inadequate cleaning of any part or equipment has taken place, he/she must require re-cleaning (i.e., washing, rinsing and sanitization) of that part and equipment, prior to marking it off on the checklist. The manager should sign and

date the checklist and enter a batch number for the processed product on all sanitization checklists, which represent the batch of product currently being processed. This batch number should also appear on the labels of the processed products.

- Sanitation procedures during processing operations:
  Workers should remove all jewelry; wear clean, intact, hairnets, aprons, gloves, and facial hair covers (snoods). Workers should also wear clean clothing and shoes that have low heels and cover their entire feet. Hands, arms, gloves, and shoes must be washed with hot water and sanitized as often as necessary. A sanitization tray can be used to clean shoes. Workers should follow the above self-cleaning and sanitization process, every time they re-enter the processing area. No eating,

- chewing, smoking, or drinking in the processing area. No pets should be brought into the processing area.
- All knives, blades, tables, and other equipment should be inspected for rust, chipping or damage. Damaged equipment must be replaced prior to their use in processing food.
- All inedible by products of processing, such as offal, must be kept from contaminating the edible products. Store inedible by products in labeled offal containers (e.g., bag-lined trash cans with lids).
- Monitoring and record keeping:
  - The plant manager must check that all workers are keeping the above sanitation guidelines. A sanitation checklist should be created for workers and equipment and the manager should allow processing to begin and continue as long as all items on the checklist are sanitary.
  - If a worker's hygiene and cleanliness is not up to the above standard, the manager must require the worker to follow the above sanitary procedures or leave the processing area.

- Sanitation procedures after processing operations:
    - Processing area (floors, walls, ceiling and drains) is cleaned of all debris and washed with potable water at 140°F (or higher) using a pressure washer. Following the washing, the processing area is sanitized using an approved sanitizer and following the manufacturer's directions.
    - All equipment (tables, sinks, knives, utensils, etc.) are cleaned following the same procedures as in the preoperational sanitization routine.
    - Monitoring and record keeping:
        - The plant manager must monitor the cleaning process and check items on a sanitization list indicating a complete and thorough cleanup operation.
    - If the manager finds inadequate cleaning of any part or equipment has taken place, he/she must require re-cleaning of that part and equipment, prior to marking it off on the checklist.

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Successful live hauling requires specialized equipment.

After acclimating the water in the truck tank, tilapia are moved quickly from the truck into the pond by Shawn Coyle, KSU Aquaculture.

Live transportation of aquatic animals

Live hauling fish and crustaceans is an important aspect of production and marketing. Often juvenile animals must be transported live to production ponds, and food size fish or crustaceans need to be transported live to specialty markets. Successful live hauling requires specialized equipment. This can be done without excessive difficulty by small-scale producers provided transport density is limited and distances are short. Successful transportation hinges on minimizing stress on the animals, without making the live hauling system prohibitively costly. The following points are important to consider prior to live hauling fish and crustaceans.

Water Quality Management

Water quality management is paramount in live transportation of aquatic animals. Low oxygen concentration and build up of toxic waste products such as ammonia and carbon dioxide can be fatal to fish. Stocking density (number of fish/ gallon), water temperature, pH, and trip duration contribute to stress and mortality. For good water quality management, use the following suggestions:

- Cool (>70°F for tropical fish; 55-60°F for warm water fish; 45-50°F for cool water fish), uncontaminated well water is best for transport. Pond water, with heavy algal blooms is unsuitable for hauling fish, unless the transportation distance is short. Prior to use, well water should be aerated and

degassed to raise the oxygen concentration.

- For best results, warm water fish should be held for two or three days (coldwater fish should be held longer) without feed prior to transport. The water temperature should be gradually reduced (10°F every ½ hour) to the hauling temperature by adding cooler water.
- Aeration: comparing commonly used systems
    - Proper aeration of hauling water is of paramount importance for good survival. As a rule of thumb, dissolved oxygen levels should be at least 5 parts per million (ppm) for warm water fish (7 ppm for coldwater fish).
    - More oxygen can be held in cooler than warmer water. It is important to keep water cool and insulated against sudden temperature fluctuations during transport.
    - Pure oxygen diffusion is the most common method of aeration. In many modern live transport systems, pure oxygen from tanks is piped to the tanks where it is bubbled through diffuser hoses or air stones on the tank bottom. Oxygen is typically used in two forms: liquid oxygen tanks (LOX) or compressed gas (welding grade). The LOX tanks are cheaper (per unit volume of oxygen) than compressed oxygen. However, the initial cash outlay for LOX tanks is much higher than a single compressed oxygen cylinder. LOX tanks are typically used in long distance live hauling. Compressed oxygen is suitable for smaller live transport outfits (i.e., pickup truck based live hauling). These oxygen bottles can be rented from welding shops. The hauling truck must be

equipped with a minimum of two bottles, with one always kept full for emergency aeration. Oxygen tanks should be secured to the truck for safety purposes.

- A 12-volt DC agitator, or aspirator can be used if the tank stocking densities are low. In a recent survey of Federal and State fish hatcheries throughout the country, it was discovered that every Federal and State hatchery oxygenated their transport tank hauling water with compressed oxygen in order to ensure safe dissolved oxygen concentrations. None used mechanical aerators to oxygenate the water, yet some did use mechanical aerators, in conjunction with pure oxygen, for the purpose of degassing dissolved carbon dioxide and as backup aeration while transporting live fish.

- Water pH is a vital parameter for successful transportation. Typically, the pH of tank water should be between 7.0 and 7.5; higher pH will increase the toxicity of un-ionized ammonia dissolved in the water. Carbon dioxide (CO_2) production lowers the pH; high dissolved CO_2 levels (> 20 ppm) affect a fish's ability to absorb oxygen. To control high CO_2, the tank water must be well agitated. Live haulers must allocate ½ hour

Sodium bicarbonate and calcium chloride will increase the alkalinity and hardness of water, respectively.

acclimation time for each unit difference in pH from the production and hauling water. This is vital in avoiding a pH shock.

- Maintaining proper hardness and alkalinity (50-100 ppm) is important in improving survival of aquatic animals during transport. Sodium bicarbonate and calcium chloride will increase the alkalinity and hardness of water, respectively. If needed, adding 5g of sodium bicarbonate and 30 g of calcium chloride to 100 gallons of water would raise alkalinity by 10 ppm and hardness by 50 ppm, respectively. Sodium bicarbonate buffers the water against wide pH fluctuations that can severely stress fish and crustaceans.
- Feed metabolism of fish and crustaceans increases ammonia levels in water. Un-ionized ammonia (NH_3) is toxic to fish/crustaceans at fairly low concentrations (0.05 ppm chronic and 1 ppm acute). The toxicity of ammonia increases with pH and temperature. Hence, to reduce the buildup of NH_3, the water must be kept cool and warmwater fish/ crustaceans must not be fed for 48-72 hours before transportation. Water exchange during transport may be necessary to reduce total ammonia (un-ionized and ionized) in the water.

Use of Chemicals in Live Transportation

The most common chemical used is common salt (sodium chloride), which helps in lowering stress of the aquatic animals. Typically, the amount of salt added is 0.5%, or 1lb per 25 gallons. Non-iodized salt, such as canning salt, should be used; feed grade salts have anti-caking agents that can be toxic to aquatic animals.

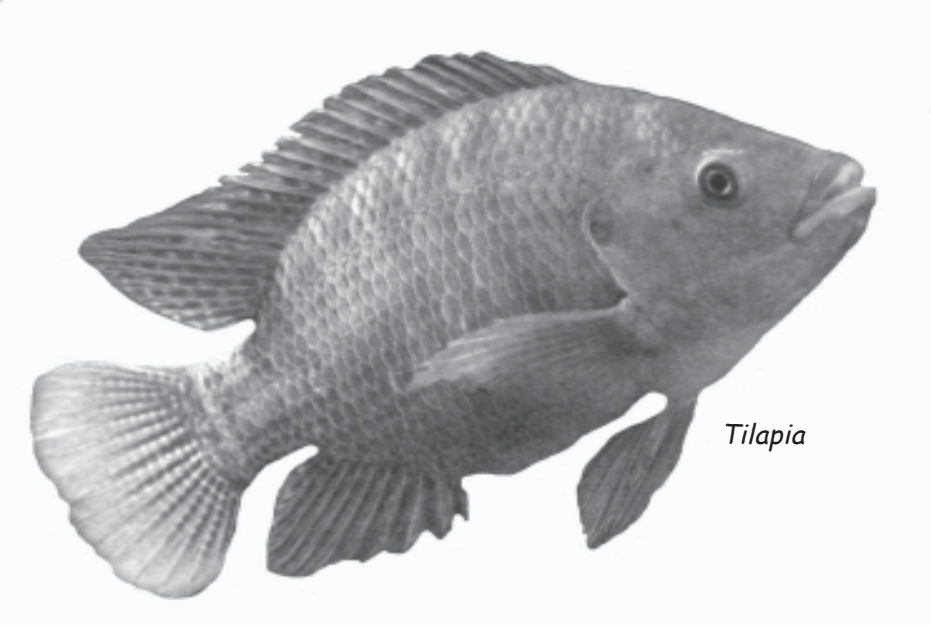
Use of chemical anesthetics has also shown to help sensitive fish/ crustacean cope with transportation stress. MS-222 (or Finquel, or tricaine mathanesulfonate) is one FDA approved anesthetic, which when applied at 0.06-0.25 g/gallon of water induces sedation in fish. A caveat to using anesthetics is that MS-222 has a 21-day withdrawl time and sedated fish are liable to get injured from being bounced around during transportation. Live haulers without thorough knowledge in the use of anesthetics should refrain from their use if they are transporting small volumes of fish/crustaceans over short distances (4-5 hour travel time).

Transporting fish in bags

When transporting fish fry, crustacean larvae, juveniles, or very small volumes of adults, fish and crustaceans can be transported in bags containing water and pure oxygen. Although this method is economical, there are certain constraints.

- Bags need to be at least 3mm polyethylene construction. Bags should not be made to hold large volumes of water, i.e., in excess of 2 gallons.
- Usually double-bagged.
- Bags must be placed in an insulated container such as a Styrofoam box.

- Since water in bags is not mechanically aerated, an atmosphere of pure oxygen at 50-75% of a bag's volume must be maintained to allow adequate diffusion.
- The carrying capacity of bag transportation is a complex parameter that is dependent on species, size of animal, water quality parameters, and shipment distance (time). Here are some examples for transporting warm water fish in a bag containing 2 gallons of water at 55-60°F, on a 12-hour trip: either 1) 1-2 lb of eggs, 2) 0.9-3 lb of swimming fry, 3) 1.8-6.0 lb of 3-inch fingerlings, or 4) 3.0-6.5 lb of large fish. Carrying adult fish/crustaceans in bags is a gamble: many aquatic animals used in aquaculture have spines or sharp body parts that can tear bags.



Tilapia

- Bag handling tips:
    - First add 1.5-2 gallons of cool water. Check water quality and add chemicals (e.g., salt) to keep water parameters within acceptable limits.
    - Add fish/crustaceans to the water following the above loading rates.
    - Deflate bag to remove all air and refill bag with pure oxygen up to 75% of the bag's volume.
    - Twist the mouth of the bag, and double it over itself, and seal it in a manner that prevents the release of oxygen (several heavy duty rubber bands work well). Place this bag inside another bag and seal the second bag.
    - Place the bags inside an insulated shipping box.

"Every Detail in Transporting Fish/ Crustaceans is Important."

Transporting fish in tanks

Tanks are obviously more durable than bags, and should be used for larger fish/crustaceans. The design of a live transportation tank is important with respect to direct costs (i.e., construction and operating costs) and indirect costs related to stress and survival of the aquatic animals. Experience with live transportation has

showed that (1) tanks should be constructed out of fiberglass, polyurethane, or aluminum, and (2) tanks should be more rounded and less angular.

Polyurethane tanks are lighter, while fiberglass tanks are more expensive and easier to repair.

Rounded tanks are more suitable for transporting fish/crustaceans than tanks with corners for the following reasons: rounded tanks are 1) less heavy than comparable tanks with corners, i.e., hold the same volume of water, 2) promote better water circulation, 3) have less sharp edges where fish/crustaceans can hurt themselves, and 4) allow more rapid release of fish/crustaceans than rectangular tanks.

Large tanks can be a liability because of large volumes of water surge during transport, which could damage fish/crustaceans and cause driving accidents. Large tanks must be equipped with baffles to reduce the surge effect. Large tanks can also be more easily damaged than smaller tanks from flexing of the truck bed. As such, several smaller tanks may be preferred over a single large tank, depending on the size and species of fish.

Tanks must be equipped with large top doors for easy loading. Tanks should also have large side drains for easy discharge; an inside sliding gate over the drains is preferred which will allow removal of the outside drain caps without simultaneous discharge of water and fish. Drains should be located on one side of the truck. Tanks should also have a sloping bottom and the drains must be flush with the lower end of the tank bottom to permit complete drainage with minimum effort.

<u>Loading Rates</u>

Loading rate (or stocking density) refers to the number of fish/

Freshwater prawn

crustaceans that can be safely transported per gallon of water. Loading rate can be calculated by the weight of animals divided by the difference of the volume of water in the tank and the volume of water displaced by the fish. Some publications report that the volume of water displaced by every 100lb of fish is approximately 12 gallons. Since multiple variables simultaneously impact transportability of aquatic animals, the live hauler needs to be well acquainted with the acceptable loading rates for specific species of fish/crustaceans. The following table lists loading rates of some species of live aquatic animals that are commonly transported in Kentucky.

Species	Loading rate (wt. /gallon)
Minnows	0.7-1.0 lb/gallon
Goldfish	1.0-2.0 lb/gallon
Prawns	0.10-0.25 lb/gallon
Catfish (1.25 – 1.5 lb fish)	0.2-6.0 lb/gallon
Hybrid striped bass (2 lb fish)	0.15-1.5 lb/gallon
Trout (8-11 inch fish)	0.5-3.5 lb/gallon

Tips on Fish and Crustacean Handling

- Aquatic animals are crowded, stressed, and often disoriented during live transport. Fish and crustaceans become increasingly susceptible to physical injury, latent disease, and osmoregulatory problems. Do not load sick fish/crustaceans.

- Hardiness of animals is species and size specific: for example, catfish and tilapia are hardier than hybrid striped bass during live transport. Smaller fish will tolerate transport better than larger fish. Adjust water quality and loading rates with respect to the species being transported.

Closing the net on largemouth bass in a pond at Rooster Run, Kentucky.

- As a rule of thumb, do not load fish/crustaceans during the warmer times of day.
- Ensure that the tank water is near oxygen saturation. Carry a dissolved oxygen meter, a 12 V submersible pump, and emergency aeration equipment.
- Always avoid temperature shock (both in loading and unloading): the tank water temperature should be close to the temperature of the water where the fish are being held at the loading site. To lower water temperature by 10°F, one should apply 0.5lb of ice/gallon of water.

  The ice must not be made from chlorinated water.
- Withhold food from fish / crustaceans for at least 2 days prior to transportation.
- After harvest, if possible, allow fish/ crustaceans to rest in holding tanks for several hours before loading on a live haul truck. Acclimate fish to the transport water before loading and to the receiving water at the delivery site. If the temperature difference between loading and receiving water is more than 3.6F, change the temperature of the water in which the fish currently reside at a rate of less than 9F per hour by pumping in the receiving water.
- Disinfect handling equipment such as dipnets, to minimize potential infection.

Acclimate Water

gooseneck trailer with two 350-gallon tanks. A one-ton pickup truck can carry a 400-gallon tank, or pull a gooseneck trailer with three 350-gallon tanks. A tractor-trailer system can carry up to 5,000-gallons of water.

- A pickup truck-gooseneck trailer combination is very flexible because the truck can be used for other duties, and the trailer (with hauling tanks) can be lent out or rented out to individuals requiring intermittent live hauling capability.
- Pickup trucks used for live hauling should have 4-wheel drive. Trailers must be equipped with their own braking systems (electric brakes).
- Equipment list and associated cost for a live hauling system comprising of a ¾ pickup truck, with a single 300-gallon tank.

Equipment	Lifespan (years)	Cost
4x4 Truck	10	$33,000
Aluminum tank	10	$3,780
Chute ($180); Lid latches ($200)	10	$380
Diffuser grids and hoses	3	$350
Agitators	3	$220
DO meter, test kit, pump	5, 1, and 2 years, resp	$1,800
Total		$39,710

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Acknowledgements

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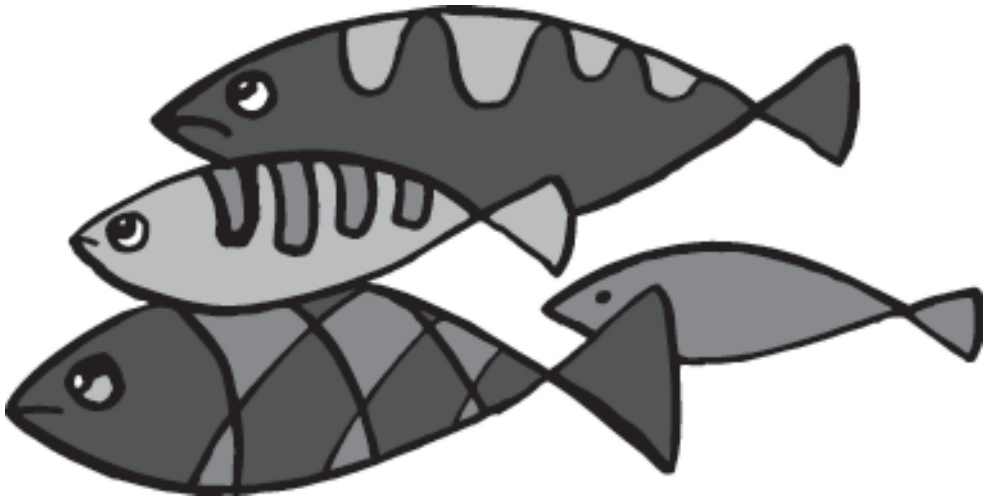


Selling freshwater prawns at Kentucky food festivals

Freshwater prawn culture is a relatively new small-scale agricultural industry in Kentucky. Production costs of freshwater prawn are currently too high for this product to become competitive in traditional marketing channels (e.g., wholesale or retail markets) that are importing low-cost prawn from Asia. Despite this handicap, the local product has freshness to its advantage. While restaurants and grocery stores have generally been unwilling to pay a premium for fresh prawn, over frozen prawn, individual consumers are often intrigued to purchase a freshly harvested product. This has been the basis of the most successful market currently available to most prawn farmers: pond bank sales. However, food festivals can also be profitable outlets for local prawn in the near future. Many festivals emphasize local products and festival attendees come searching for novelty items. This bulleting will describe the underlying issues in organizing a hypothetical prawn festival: 1) regulations, 2) equipment, 3) costs and profitability, and 4) potential recipes.

Food Festivals: Overview

The basic idea of a festival is selling cooked prawn directly to people, in a consumer-friendly environment. For example, the Kentucky State Fair attracts large crowds. This fair has a special food court on which a temporary vending site can be established.

Kentucky also hosts several annual festivals that are centered on food. For example, the Bourbon Festival in Bardstown, KY, attracts people from all over the world. Lexington, KY, hosts a harvest festival during fall of every year. Vendors can rent booth space at festivals and sell cooked prawn.

Other festival ideas include on-farm festivals, which tend to work better if the producer has a faithful clientele, in addition to an effective advertisement campaign. Restaurants, particularly seafood restaurants, can also constitute superb festival sites. Restaurants can advertise prawn festivals around special occasions such as the Kentucky Derby, Mardi Gras, and popular football or basketball games.

A food festival requires a few basic components: 1) advertisement to inform the public of the festival, 2) a convenient location for customers to travel (i.e., not too distant from population centers); the location must also have sufficient cooking/ seating space, in addition to convenient sewage and garbage disposal facilities, 3) advanced planning with respect to equipment and utensils, food storage and preparation techniques, etc., such that all food vending activities are in accordance with Kentucky's Food Establishment Act and State Retail Food Code, 4) recipes and preparation that are appetizing for customers, and priced adequately to simultaneously offer profit to sellers and value to buyers. The most likely prawn

festivals in Kentucky will involve a temporary food-vending site, i.e., food prepared under a tent, or in a booth. Hence, much of the information in this bulletin will focus on temporary food vending operations.

While the initial notion of a prawn festival involves the cooking of freshly harvested prawn, Kentucky's health regulations prohibit processing of prawn at the cooking site. The prawn being cooked must either be alive (along the lines of a Cajun-style crawfish boil), or whole head-on, or processed and packaged in a HACCP-approved processing facility. If processed, frozen prawns are to be used, the festival time can be spread throughout the course of a year, instead of being restricted to the fall harvest season.

Festival Sites

Temporary Food Units

Temporary food vending is a relatively simple affair (Figure 2). At a minimum, it can consist of a tent where food is stored, prepared and sold. Here are some of the basic equipment needs.

- Tent with sidewalls/screens to exclude dust, insects and pests.
- Freezer equipped with thermometer to keep prawn and other frozen, perishable food cold.
- Hot and cold potable (drinkable) water tanks with faucet.

- A wastewater tank and solid waste bins with lids (e.g., trash cans).
- A propane grill and burner for boiling and frying purposes; propane tanks.
- Stainless steel utensils for holding prawn during boiling and frying. Stainless steel spoons and spatulas for cooking and food handling.
- Two food display tables and disposable containers for holding cooked prawn (e.g., disposable aluminum foil trays with covers).
- Three plastic containers/ buckets for utensil washing. A hand washing station with a minimum of a water cooler with spigot and a catch basin. Bottle of bleach for sanitizing utensils, hand washing detergent and paper towels.
- Disposable hairnets, gloves and aprons.

The above list does not include additional equipment for preparing side items such as a rice cooker, customer seating, or entertainment. A potential problem of using a temporary unit involves inclement weather: sudden storms can contribute to contamination. Consequently, temporary food operators should cook small batches of food, commensurate with their customer volume. A temporary food-vending unit can operate for a maximum of 14 days, and it must close for 30 days before returning to the same site. Operators should contact the health department in the county of the festival well in advance of the event(s).

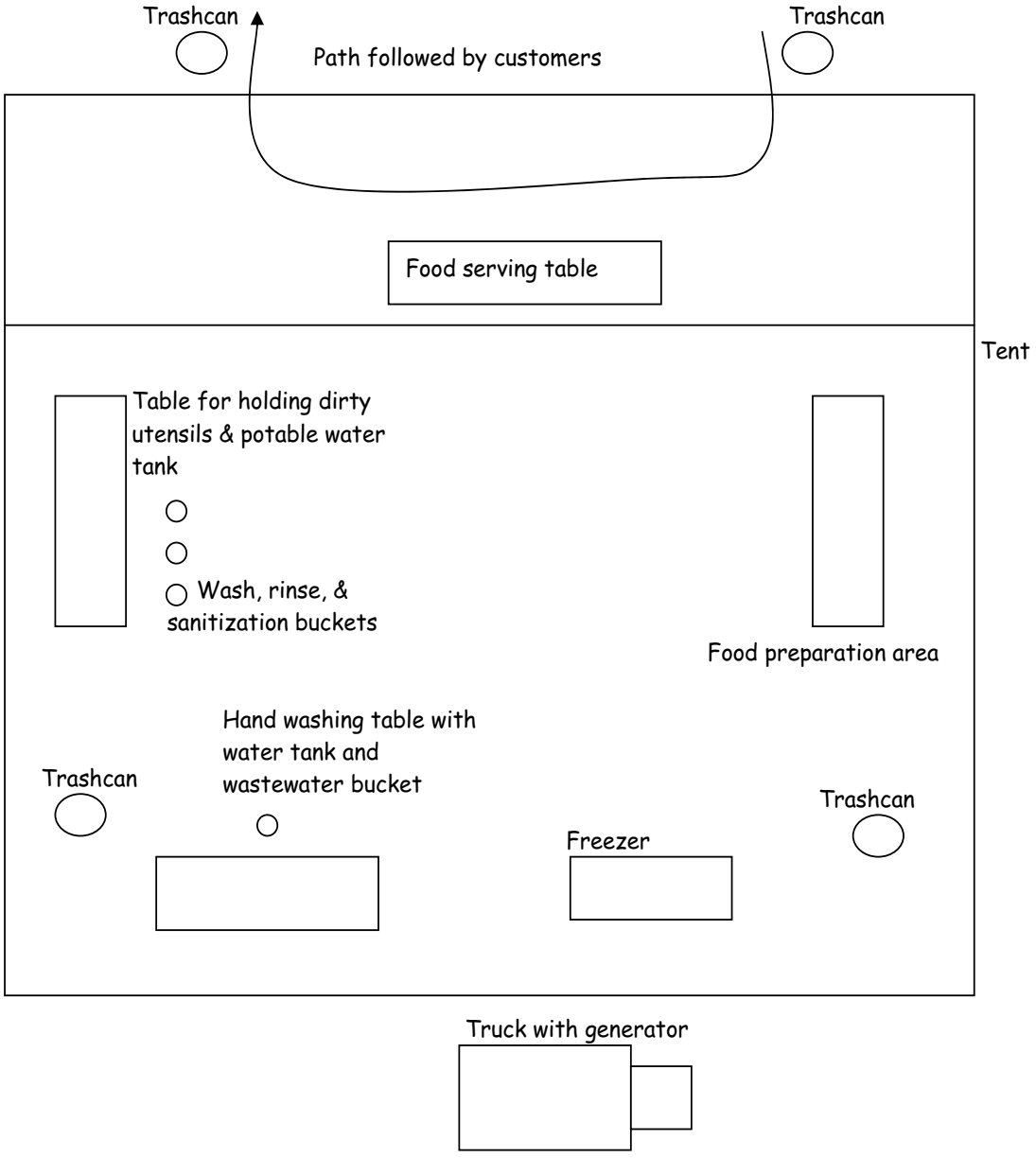


Figure 2. Schematic diagram of a temporary food-vending unit

Statewide Mobile Food Unit

These are trailers equipped with cooking facilities, hot and cold potable water (under pressure), plumbed 3-compartment sink and hand washing sink, wastewater tank which is 100% larger in capacity than the freshwater tank and impermeable ceiling, walls and floors, that are easy to wash and sanitize. The cooking area is ventilated (usually with an exhaust fan) and screened off to prevent contamination from dust, wind, and pests. These trailers are usually equipped with propane tanks, a generator, lights, freezer (for product storage), and air conditioner. Statewide mobile units can operate at a site for a maximum of 14 days. These units must carry a statewide permit at all times. More information on the permitting process and inspections can be obtained from your county health department.

The benefit of using a statewide mobile vending unit is convenience and ease of mobility, i.e., the trailer, which can be easily transported, is well equipped with a freezer, plumbed sinks, and kitchen in close proximity to expedite the cooking and post-festival cleanup process. Obviously, these units are much more expensive than a temporary food vending site, which is indicative of the type of use required of a statewide mobile unit. While these trailers can be rented, at a fairly high cost, most individuals using a statewide

mobile unit typically purchase their trailers. These individuals are usually career food vendors that use the statewide mobile units in multiple fairs and festivals every year. Kentucky prawn might be sold to such individuals, who would sell cooked prawns in festivals for profit.

Restaurants

Restaurants equipped with certified kitchens can be used for prawn processing and preparation for direct consumer sales. Due to its convenience and intrinsic advertisement value, it stands to reason that one would use a popular restaurant as a festival forum where producers can bring harvested prawn and consumers can enjoy the cooked product in a comfortable atmosphere. Some restaurants tend to have specials during popular events such as the Kentucky derby, major sporting events and Mardi Gras, which can be easily modified to a prawn festival that would draw large crowds.

Regulations

The following is a compendium of various regulations available in Kentucky's Food Establishment Act and State Retail Food Code that are intended for the safety of both buyers and sellers in food festivals. Copies of the above bulletin can be obtained from county health departments or the Cabinet for Human Resources, Dept. for Health Services, Food & Cosmetics branch, 275 East Main St., Frankfort, KY 40621.

Much of the information presented here is taken directly from the government bulletin.

Food Storage and Protection

- Food shall be wholesome and free of spoilage. All crustaceans (i.e., prawns, shrimp and crayfish) used must be live, whole head on or processed in an approved environment. All crustaceans (fresh or frozen) must be packed in non-returnable, food grade containers (e.g., plastic zipped bags; no garbage bags) with appropriate labeling. Live seafood and unprocessed whole crustaceans on ice can also be cooked in festivals, provided there is no spoilage of the food products.
- Food must be always protected at any stage prior to consumer sales from any potential contamination, physical (e.g., dust, flooding, condensation), chemical (e.g., toxins, unsafe additives), or biological (e.g., micro organisms from pests).
- Potentially hazardous food must be at 45°F (or below) or at 140°F (or above) at all times, except during preparation and serving. Such food stored at 45°F (or below), must be kept in a refrigerator or freezer with a thermometer, recording the temperature at the warmest area within a 3°F level of accuracy. Potentially hazardous food stored at 140°F (or above), must be checked with a thermometer, recording the

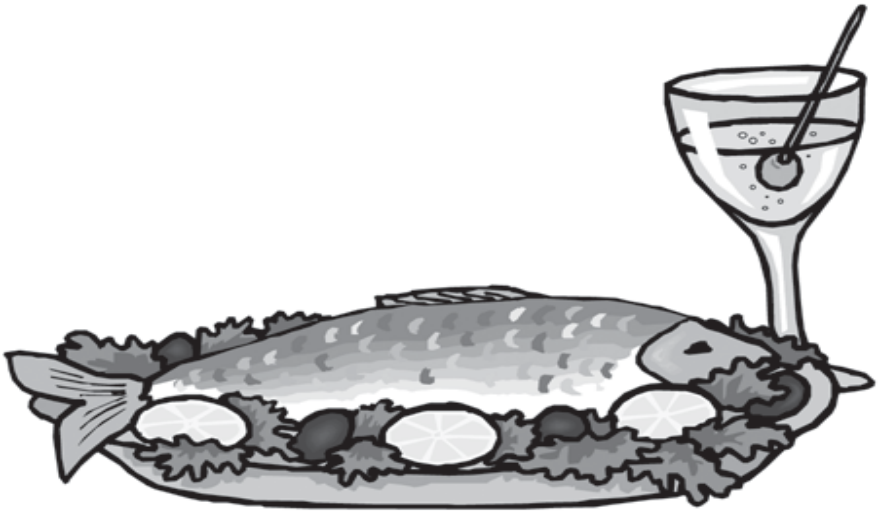
- temperature within a 3°F level of accuracy, for consistent internal temperature of at least 140°F.
- Frozen foods must be stored frozen at a temperature at 0°F (or below).
- Food, if removed from its package, must be stored in impervious, non-absorbent, clean, and covered containers (e.g., Tupperware containers with a snap top lid). Breads and rolls can be kept in containers covered by linens or napkins. Food must not be stored in contact with un-drained ice, under exposed sewer/non potable water lines (except for automatic sprinkler heads), or in restrooms.
- Food not requiring further washing before cooking must be stored separately from food requiring further washing before cooking.
- Cleaned and sanitized equipment must be kept in a splash-free location at least six inches off the ground to facilitate air-drying.

Food Preparation

Prawns can be cooked using a variety of recipes. Recipes used successfully in past festivals included grilled, boiled, and fried prawn. Prawn sold at a temporary food-vending site (e.g., a booth in a festival) cannot be processed there. Either live prawn, whole head-on prawn on ice or prawn processed and packaged in a labeled container from a HACCP-approved processing site can be used. If processed prawns are your choice, they have to come from a permitted, HACCP-approved processing site. If unprocessed head-on, prawns are used; they will have to be either live or fresh on ice. Fresh unprocessed prawns on ice can be used; however, there are some restrictions: 1) the prawns must not be

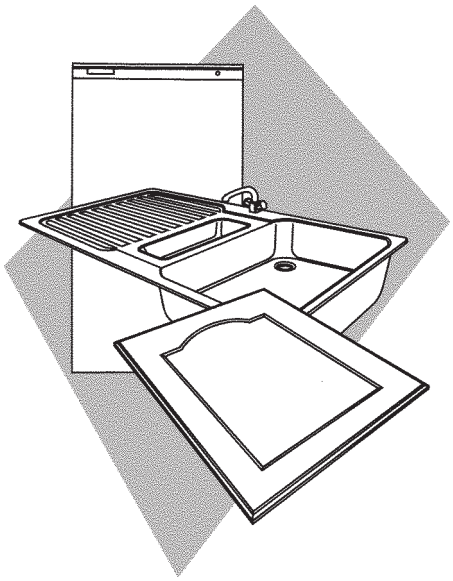
processed, i.e., no body parts removed, 2) they must be continually kept on ice until they are cooked whole for consumer sales, 3) if stored overnight, they must be kept whole in a clean freezer at a temperature of ice (32°F) for less than 12 days, 4) the freezer must be dedicated to storing prawns and sanitized to prevent contamination, and 5) if prawns are stored at a off-festival site, the Department of Public Health must inspect the freezer and general area and certify the storage area as a Food Storage Warehouse (permit cost: $75/yr, if storage area is less that 1,000 sqft). All food sold at a temporary vending site must be prepared on site, i.e., no home prepared foods can be sold.

Potentially hazardous food (e.g., prawn) that have been cooked and refrigerated must be reheated rapidly to (at least) 165°F. Hot food holding facilities (e.g., steam tables) cannot be used for rapid reheating. Metal stem-type thermometers (within a 3°F level of accuracy) must be used to ensure that potentially hazardous food has reached the proper internal temperature.



Food Display and Service

- Potentially hazardous food (e.g., cooked prawn) must be kept at either 45°F (or less) or 140°F (or more) during display and service.
- During display and service food must be protected from contamination. Keeping cooked food under a closed lid will accomplish this.
- Utensils, such as spoons and tongs, must be provided for handling food to reduce chances of contamination. Such utensils can be kept in the food container while not being used (handles must be stored out of the food).
- Use of disposable items (e.g., disposable aluminum foil trays, plastic forks, knives) is required to reduce contamination. Reuse of soiled tableware is prohibited.



Equipment and Utensils

Multi-use equipment and utensils must be nonabsorbent, corrosion resistant, and safe for food service. Smooth, easily cleanable, stainless steel is preferred. Wood is prohibited as a multi-use food contact surface, except for hard maple, which can be used as cutting boards, salad bowls, baker's table, etc. Safe plastic and rubber like materials that resist breakage or chipping and can undergo regular washing and sanitization are allowed for

- multi-use purposes. Cast iron can be used as a multi-use food contact surface if it is heated (e.g., grill or skillet).
- All equipment must be free of dents, chips, tears, etc., and be amenable to easy cleaning and sanitization. All food contact surfaces must be available for inspection with minimum disassembly, which can be accomplished by using simple hand tools such as mallet, screwdrivers, etc. All surfaces that can potentially be splashed with food must be smooth, nonabsorbent, free of dents/ crevices, and easily cleaned and sanitized.
- Sinks, dish tables, and drain boards must be self-draining. Ventilation hoods must not allow grease and condensation to drip onto food.
- No equipment must be installed near exposed sewer lines, non-potable water sources, or any other contaminating source, except for automatic sprinklers.
- Portable equipment use is encouraged for temporary food units. Non-portable equipment must be sealed to a table, floor or mounted on legs that are at least 4-6 inches off the floor.
- All working spaces must be sufficiently unobstructed to allow employees to work without contaminating food or food contact surfaces with clothing or unintentional personal contact.

Cleaning and Sanitization

- A simple sanitization agent can be made by a solution of unscented household bleach and clean water (1-capfull per gallon of water); being immersed in this solution for at least one minute can sanitize utensils.
- Tableware, cooking equipment/utensils, and food contact services must be cleaned and sanitized after each use and following any interruption of operations in which contamination might have occurred.
- If an equipment, utensil, or food contact surface is used for preparation of potentially hazardous food continuously, throughout the day, then all such equipment, utensils and food contact surfaces must be cleaned and sanitized a minimum of every four hours. Hence, for uninterrupted food service, multiple batches of utensils are necessary such that a clean batch of utensils is always available.
- Food contact surfaces of grilles, griddles, cavities and door seals of microwave ovens must be cleaned and sanitized at least once per day. All food contact surfaces must be kept free of encrusted grease and other accumulated wastes. Nonfood contact surfaces must be kept clean as often as necessary to keep them free of dust, food, and other debris.

- Cleaning cloths must be kept dry and clean; these cloths must not be used for any other purpose. Moist cloths used for cleaning must be rinsed frequently and must be stored in a sanitizing solution between uses.
- To use a 3-compartment sink, utensils must be first flushed (all debris scraped off) and then washed in a hot detergent solution (at 95°F, or higher) in the first compartment, rinsed in the second compartment, and sanitized in the third compartment. In temporary food vending situations, three large plastic containers or buckets can substitute for the 3-compartment sink. The sink compartments/buckets must be large enough to permit complete immersion of utensil in the solution. The washing, rinsing and sanitization solutions must not be allowed to get excessively dirty; they must be replaced with clean solution as often as necessary. Wastewater must be collected in a tank for proper disposal.
- Washed and sanitized equipment must be air dried or stored in a self-draining area, at least six inches off the ground. Stored equipment must not be in the vicinity of chemical, biological or physical contamination.

Employee Practices and Cleanliness

- Employees must not consume food, drink or tobacco products in areas that could contaminate other food, equipment, and utensils.
- Employees must handle soiled tableware and leftover food in

such a manner to minimize contamination of their hands. Use of food service gloves is recommended, but not required. Replace soiled gloves as often as necessary.

- Employees must maintain a high degree of personal cleanliness, remove insecure jewelry, and keep their hair and body covered by use of hairnets, snoots, gloves, and aprons to minimize chances of contamination.

Lavatory, Waste Disposal and Sewage

- Lavatories should be conveniently located nearby the food preparation area, utensil wash area, and adjacent to toilets. Lavatories must have a hand washing station (for temporary events: water cooler with a spigot and a catch basin), soap/ detergent and disposable hand towels/air dryer. Common towels are prohibited.
- Sinks used for food preparation and utensil cleaning cannot be used for hand washing.
- Garbage must be kept in insect proof, rodent proof containers, which can be lined with plastic bags.
- Garbage containers must have tight-fitting lids that must be kept closed, when not in use. A sufficient number of garbage cans must be available to · store all the garbage. On a regular schedule, each garbage container must be cleaned inside and outside with hot water and detergent, taking caution that it does not contaminate food, utensils, or equipment.
- Garbage and refuse must be disposed of in a manner

consistent with state and local laws.

- All sewage (primarily wastewater) must be disposed of in public sewers; if public sewers are not available, a private system (e.g., septic tank) can be used, provided the design, construction and operation of private sewers follow the requirements of the Cabinet for Health Services (contact telephone: (502) 564-7181). If available later, connections to private sewers must be terminated in favor of public sewer systems.

Plumbing

- Temporary food vending units typically have minimal plumbing; plumbing is more extensive in statewide mobile units. All potable water hookups requiring hoses must use food grade hoses.

A statewide mobile unit will need its plumbing plan submitted through the local health department and approved by the state.

- Potable water must be under pressure in statewide mobile unit; water pressure due to gravity is allowed for temporary units. All potable water systems, particularly faucets, must be equipped with backflow protection.
- Unless properly trapped, there must be no direct connection between a sewage system and a drain from sinks in which food, utensils, etc., are kept.

Permits and Inspections

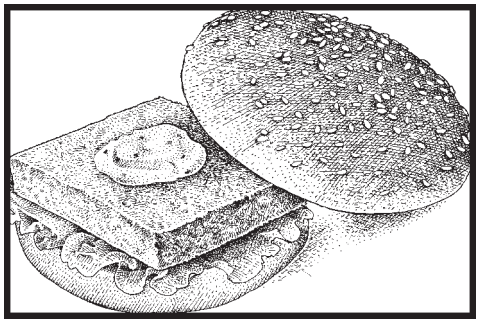
Individuals interested in operating a temporary food unit or a statewide mobile food unit must first contact their local county health department office. Novice food vendors should discuss with a local health department official the location, timing and the individuals who would setup the food booths. This discussion should also extend into the temporary food vending regulations and proposed menus. Temporary food vendors must submit an application to their local health department with a permit fee of $25 (1-3 day events) or $30 (4-14 day events). For a statewide mobile unit operator, an annual permit can be purchased that allows unlimited vending days (unit must move every 14 days from a site and cannot return for a minimum of 30 days), within the permit year, for a fee of $120.

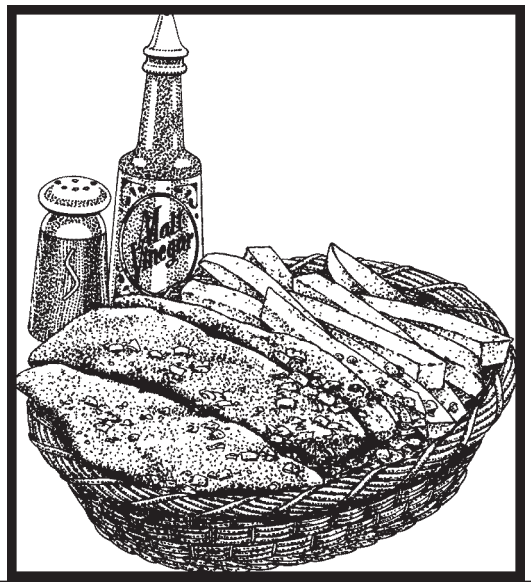
Temporary or statewide mobile food unit operators should expect inspections from the health department of the county of operations. If regulations are not followed, penalties could be exacted, and, in certain cases, the food vending operation might be terminated. The frequency of inspections depends upon the length of the festival.

Economics

This section will outline the estimated costs of holding a prawn festival at a temporary food-vending site. Prawns are harvested only during fall; as such the temporary food-vending site is the chosen model because most prawn farmers in Kentucky, intending on holding a festival, are unlikely to purchase or rent a statewide mobile unit. A few producers with special contacts with restaurants might consider on having a festival at the restaurant.

Assuming that a prawn festival is organized at a temporary food-vending location, the organizers will have selected a suitable site with access to municipal sewers and a municipal landfill. A few weeks prior to the festival, flyers, newspaper and radio advertisement have been announcing the festival to the general public. The organizers/operators are going to rent a tent, and purchase equipment such as a freezer, water tanks, utensils, grill, fryer, etc. Operating costs would include processed prawn tails, side items (e.g., hushpuppies, coleslaw, etc.), marinade, tableware, propane, other fuel, advertisement, and fees.





Essential Equipment:

- Tent with screens for food storage, preparation, and utensil/hand cleaning activities (rent: $400). If food is cooked on a grill, outdoor cooking is allowed
- Freezer for keeping perishable items, such as prawn tails, cold ($200).
- Hot and cold potable water tanks ($100). These are assumed to be 50gal Rubbermaid-type tanks, fitted with a faucet.
- Wastewater tank ($50) and solid waste containers (2 × $15)
- Food display tables (2 × $100)
- Plastic containers for utensil and hand washing (4 × $10).
- Food-erving trays ($40)
- Propane Grill ($300) and fryer ($50)
- Thermometers ($20)

Fixed Costs, Fees and Insurance

Equipment ownership cost: $1,030; tent rental: $400; insurance: $500; operating fee: $30. Land or booth space rent is an additional cost. Typical booth rents for small festivals are $50-100/day; however, large festivals, such as the State Fair might require a significantly higher outlay. The advertisement budget of $2,000 includes newspaper and radio advertisement for a 6-week period.

Occasionally, newspapers, radio and TV stations can be persuaded to do a free story on a local prawn harvest and festival.

Item	Cost	Lifespan	Annual Depreciation	Annual Interest
Freezer	$200	5 yrs	$40	$10
Potable water tank, wastewater tanks, and waste containers	$180	5 yrs	$36	$9
Food display tables	$200	10 yrs	$20	$10
Plastic containers, food trays, thermometers	$100	2 yrs	$50	$5
Propane grill & fryer	$350	5 yrs	$70	$18
Total	$1,030		$216	$52

Operating Costs for a Freshwater Prawn Festival

Assume prawn tails are procured at $12.00/lb. Assume that prawn tails are (on average) 18 count (i.e., 18 tails/lb). Assume that each serving contains 5 prawn tails. Hence, 400 lb of prawn tails ≈ 1,440 servings.

Notes:

Operating Costs ($ per day) of a Freshwater Prawn Booth

Item	Quantity (/ day)	Unit Cost	Total Cost
Processed Prawn	400 lb	$12.00	$4,800.00
Side items	1,440 servings	$0.50	$720.00
Marinade	2 bottles	$10.00	$20.00
Spices	2 dispensers	$5.00	$10.00
Plates, forks, etc.	1,450 servings	$0.50	$720.00
Labor	32 hr	$10.00	$320.00
Propane	3 bottles	$50.00	$150.00
Chemicals (soap, bleach, etc.)		$15.00	$15.00
Water	100 gallons	$0.012	$1.20
Fuel	10 gallons	$1.50	$15.00
Fees			$25.00
Total			$6,796.20

We assume that in the course of a 2-day festival 800 lb of tails would be sold. Hence, total cost = Operating cost for 800 lb of prawn tails + Fixed cost (depreciation and interest charged for 2 days)+ Tent rent + Insurance + Advertisement + Fees for a 2-day festival (booth rent and Dept. of Public Health fees) = $13,592.40 + $1.46 + $400+ $500 + $2,000 + $130 = $16,624. Total cost/serving = $5.77. Hence, if each serving is sold at price greater than $5.77, the sellers can receive a profit. Assume that each serving is sold for $8.00, i.e.,

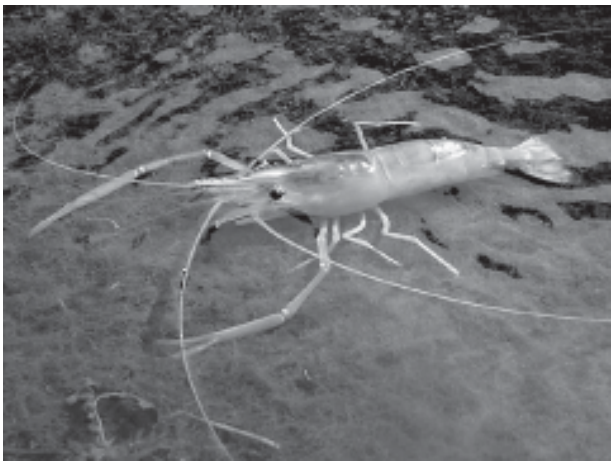
profit/serving = $2.23); 400 lb of prawn tails, sold per day, would amount to a profit of $3,211/day. Current commercial yields have been in the vicinity of 800 lb/ac (whole prawn) or 400 lb/ac (prawn tails), on average. Given that the above budgets take into account of the production costs of prawn (i.e., processed prawn is being purchased at $12/lb), our analysis suggests that even with a modest profit margin of $2.23/serving, producers involved in a small food festival can expect to receive a return in the neighborhood of $3,000/day.

Festival information

Information regarding festivals typically includes 1) festival name, 2) location and date, 3) purpose of festival, and 4) information of a contact person. Several existing sites on the Internet provide valuable and up-to-date information of Kentucky's festivals. Currently, there is a Website dedicated to festivals in Kentucky: www.kyfestivals.com. Additional information also can be obtained by contacting Kentucky's department of tourism at 800-225-8747.

Summary

Temporary food festivals are a unique means of selling locally grown prawns. While locally grown prawns are not price competitive with respect to imports, they can be available fresh, or even live, which is a marketing asset for direct sales to individuals seeking fresh seafood. Food festivals, scheduled around important



Freshwater prawns are gaining acceptance among Kentucky farmers.

social events, have proven in the past to be crowd attractors in which entrees cost in excess of $7.00 per plate. The economic analysis, outlined above, indicates that sellers could make a profit selling prawns at these prices. This allows food festivals to a potentially lucrative market for fresh, locally grown prawns.

NOTES:

Acknowledgements

The authors are grateful to Mr. Mark Reed and Ms. Kathy Fowler, Kentucky Department of Public Health, for reviewing the bulletin and making useful suggestions. Also, the authors wish to thank Dr. Jim Tidwell for his suggestions and support of this effort. The authors are grateful to the staff of the Aquaculture Research Center, Kentucky State University for useful suggestions, and finally, thanks to the prawn producers of Kentucky for their support and interest.

Marketing seafood produced on a small scale: the case of Kentucky

The United States is currently a net importer of seafood. Much of the aquaculture products that Americans consume are grown in foreign countries. This is principally true for shrimp and salmon. However, the domestic catfish and trout industries have seen significant success in U. S. and world markets.

Small-scale aquaculture is becoming increasingly popular in rural United States, where farmers are looking to aquaculture for an alternative revenue source. This is particularly true for states such as Kentucky, where the demand for tobacco, their main crop, has been decreasing over the last few years. Consequently, many farmers with little prior knowledge of aquaculture are investing considerable sums of money into this enterprise. It is important for such individuals to consider marketing their product, with realistic goals, prior to engaging in a serious commitment of resources.

Catfish has been the traditional aquaculture crop in the United States. Catfish is relatively easy (and relatively inexpensive) to grow and well liked by consumers. However, recent years have seen the influx of relatively inexpensive Vietnamese catfish, commonly known as the Basa catfish, which have substantially reduced the price of

catfish at the wholesale level. Consequently, domestic aquaculture producers are looking for other, more profitable, crops. Research has indicated the production feasibility of species such as freshwater prawn, Australian red claw crayfish, and largemouth bass in relatively small ponds (0.25 – 1 ac) in the United States. However, the marketing potential for each species is different, and the amount of financial risk involved is also significantly different from catfish farming.

In recent years, large seafood suppliers, both domestic and foreign, have been able to tailor their products according to the needs of wholesalers, retailers and restaurants. Consequently, marketing attempts made by small-scale aquaculture producers have received considerable resistance because small-scale suppliers are generally not able to package and supply product as effectively as the larger suppliers can. Small-scale seafood suppliers also have limited advertisement budgets, further hampering their ability to market their products.

This chapter includes marketing information synthesized from various sources, such as private firm studies, government/university-supported research, and individual experiences. Most of the information is in reference to Kentucky; however, it is relevant to many small-scale aquaculture-marketing scenarios in the United States.

Characteristics of Small-Scale Producers

Small-scale producers usually have a low volume of production, with seasonal product availability, and higher production cost, when compared with larger scale production. Small-scale producers are more flexible than their larger counterparts in addressing special needs of a community, e.g., such as duck eggs for an Oriental market. Due to their ability to address niche markets, small-scale producers are able to supply fresh products and are more capable of raising a product in a pesticide/herbicide/antibiotic free environment than larger producers, who might find this prohibitively costly. Due to the above reasons, small-scale producers often sell their products to a select clientele that are willing to pay a premium price for special products.

Direct Marketing

All small-scale marketing efforts should begin with serious consideration of selling product directly to the final consumer. Experiences of direct marketing in Kentucky have shown that many consumers will buy fresh seafood at premium prices, and, if the product quality was high, such consumers often become regular customers.

Direct marketing is usually the most profitable product outlet with respect to dollars earned per pound of product. However, successful direct marketing is contingent on the seller having a friendly, sociable personality.

Food festivals are also a lucrative means of direct marketing. In a festival, seafood is cooked and sold to the final consumer. Since festivals often feature products that cannot be purchased through retail and restaurant outlets, unique products such as freshwater prawn and Australian red claw crayfish have an advantage, just from their value as a novelty item. State departments of health regulate food vending, and sellers must follow specific regulations for food and environmental safety. Further details are available in the chapter on festivals.

Farmers' markets are another promising direct marketing opportunity. Farmers' markets usually attract a consumer clientele that are often seeking a fresh, locally grown product, and are willing to pay a premium price for quality. Sellers should first obtain the approval of the farmers' market manager, prior to sales. For processed product sales, a county health department representative (from the county that the market is located) must be contacted for inspection of the selling site and equipment. Sellers are usually required to purchase a retail food-marketing permit to operate at a farmers' market, in addition to potential farmers' market membership fees, gate fees, and a meat sales permit.

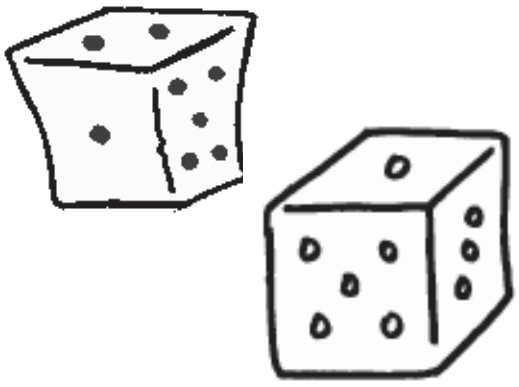
Advertising is vital for the success of direct marketing. Consumers should know about the farmer's product and why it is unique, when compared to products they typically purchase in groceries and restaurants. Radio and newspaper ads and flyers in grocery stores, schools and churches have been very successful in direct marketing efforts. Advertisements should indicate product description, with illustration, price, harvest date, and contact

information.

Processing fish and crustaceans is an important issue in direct marketing. Modern consumers seek food products that are convenient to prepare, and are often unwilling to clean and fillet fish. In fact, direct marketing attempts often fail because of the lack of processing facilities. Most state health departments oversee seafood processing and require processing in a HACCP-approved environment. However, processing regulations for direct marketing is simplified by many states: for example, in Kentucky, farmers do not have to be HACCP trained, as long as products are processed in a HACCP-approved facility. FDA regulations require all seafood processing sites, for wholesale or retail sales, to have a HACCP plan. For further information, refer to the seafood-processing chapter, and contact your local health department.

In direct marketing, producers are burdened with considerable amounts of sales risk stemming from factors such as weather, prices, general economy (affecting household income), equipment failures affecting product availability and quality, etc. If products were sold to wholesale, retail and restaurant markets, the

Evaluate Your RISK



corresponding marketing agents bear some of the risk. The remainder of this chapter would be devoted to marketing to wholesalers, retailers and restaurants.

Wholesalers, distributors, retailers and restaurants are particular about consumer acceptance, price, quality, and availability of a product. Restaurants and retail outlets prefer frozen, convenient packed (e.g., individually quick frozen, or IQF, and vacuum packed) seafood products at a competitive price. These are some of the reasons behind a general lack of willingness that many wholesale/ retail/ restaurant buyers have towards purchasing product from individual farmers. Although a few upscale restaurants want to feature unique products on temporary menus, and seek small quantities of high quality products (which is the forte of small-scale producers), the persisting question is: how can small-scale producers market their products to wholesale, retail or restaurant markets?

This question was addressed in a two-step process: step 1 involved a survey of upscale restaurants, wholesalers and specialty fish stores in Kentucky regarding their purchasing behavior and interest in local products. Step 2 was a Buyer-meet-Seller meeting organized at Kentucky State University on April 17th 2003. The purpose of this meeting was for fish farmers and processors to learn about the strengths and weaknesses of their products from representatives of wholesale, retail and restaurant markets that have had experience in purchasing seafood. The panel of seafood buyers included representatives of two local wholesalers, owner of two seafood

retail outlets, a commercial smokery, and an upscale caterer.

2003 Survey Results of Seafood Wholesale/ Retail Buyers in Kentucky

- 14 restaurants, 2 fish retailers and 1 fish broker in Lexington; 1 restaurant in Frankfort; and 3 restaurants and 1 fish retailer in Louisville gave information on their fish purchasing habits.
- The most popular seafood items were salmon, shrimp, sea bass, and cod. Of all live seafood purchased, lobsters and mussels were the most common. No restaurant purchased live finfish. Only one restaurant purchased live shrimp and crayfish.
- Interest in purchasing Kentucky-grown catfish: 3 respondents indicated that catfish is used often, 4 discontinued use due to soft meat and supply problems, and 11 indicated that they don't use catfish.
- Interest in purchasing Kentucky-grown freshwater prawn: 7 respondents continue to use prawn, 7 discontinued use due to small size, soft meat and lack of flavor, and 5 indicated that they don't use prawn.
- Interest in purchasing Kentucky-grown hybrid striped bass: only 1 restaurant occasionally uses hybrid striped bass, remaining respondents did not use the product. • Interest in purchasing Kentucky-grown largemouth bass: only 1 restaurant attempted to sell the product, but discontinued use due to lack of interest. The remaining respondents did not use largemouth bass.
- Interest in purchasing Kentucky-grown paddlefish: 3 restaurants used

smoked paddlefish. They all discontinued use because of product quality problems. The remaining restaurants do not use paddlefish.

- Almost all respondents were interested in purchasing fresh fish.
- Only 3 restaurants were interested in purchasing fresh shrimp. The remaining restaurants wanted frozen (or IQF) shrimp.
- Price paid by restaurants and retailers for fish: $2.50-$12.00/lb.
- Price paid by restaurants and retailers for shrimp (tails): $3.50-$11.00/lb.
- Average demand for Kentucky-grown fish: 15 lb/week (2 restaurants), 20lb/week (2 restaurants), 30 lb / week (2 restaurants), and 40 lb/week (1 restaurant). Four restaurants indicated that they would not purchase Kentucky grown fish.
- Average demand for freshwater prawn: 10 lb/week (4 restaurants), and more than 10 lb/week (2 restaurants). Three restaurants indicated that they would not purchase Kentucky-grown prawn.

NOTES:

- High demand season for seafood in restaurants and retailers: spring (April-May). Low demand season for seafood: winter months (December-February).
- Some of Kentucky's aquaculture products have seasonal availability. Four respondents indicated that they would have a problem with featuring a seasonal product, while 13 respondents indicated no such difficulty.
- In 7 restaurants, the chef makes seafood-purchasing decision, while in 8 restaurants, the manager or owner makes the decision.
- Local seafood wholesalers supplied almost all businesses.

Buyer-Meets-Seller Discussion on the Market Potential of Local Seafood

The following list summarizes the different issues of discussion from the meeting.

- Long term marketing success of any product hinges on quality and packaging.
- Accurate labeling is also vital for marketing a product. Labeling and advertisement must focus on what makes local products unique, with respect to comparable imported products. Sometimes having a harvest date on the label increases buyer confidence in the product.

Product volume is vital for developing a contract with wholesalers or distributors. Producers or producer groups should have storage facilities for inventory build up that can supply wholesalers with the product volume they require at the appropriate times during a year. Product availability to satisfy demand is vital for market

success. Seasonal products could be processed and stored for year- round availability.

- Criticizing imported products can be counterproductive. For example, if U. S. catfish producers decry imported Vietnamese catfish as being dirty and unsafe for consumption, many consumers are likely to turn away from catfish, both domestic and imported.
- For local products to be accepted in wholesale and retail markets, buyers need to know about both the products and their handling. Information on processing, packaging and storage are important to instill confidence in buyers.
- Local products are very likely not price competitive with respect to imported seafood. However, markets interested in local products would be looking for uniqueness, food safety and quality, and value added products that are difficult for many third world nations to replicate. For example, large mouth bass and paddlefish are uniquely American. Therefore, local producers should focus on providing good value to their customers, and not necessarily be obsessed with price and volume competition in international markets.
- Since the terrorist attacks of September 11th, 2001, the Kentucky seafood wholesalers have noticed a significant increase in interest for locally grown products.
- Kentucky is known worldwide for its bourbon products. International markets might be accessible to

Kentucky aquaculture products if there were a connection with existing Kentucky products (e.g., bourbon-smoked fish).

Based on the above results and other information, the following exposition summarizes marketing information for some of the more popular aquaculture products in Kentucky and neighboring states.

Catfish

Catfish can be a difficult commodity to market in the small scale owing to the intense competition from large catfish suppliers from the U. S. south. However, niche markets for catfish continue in the retail and restaurant level. A recent survey conducted by Kentucky State University researchers have found several ethnic grocers (primarily Asian) are interested in live and fresh whole dressed catfish. Typical prices paid by these grocers range between $1.00-$1.50/lb; the demand volume is usually between 50-100lb every two weeks. The average breakeven price for catfish is usually between $0.75-$0.85/lb. This implies that a small-scale catfish producer with a simple live hauling system can make some profit in this market provided they live in proximity to the grocery stores.

Freshly-grilled catfish from a Kentucky pond

While a few restaurants demand fresh fillet or whole catfish, which is usually unavailable from wholesalers and distributors, most restaurants prefer frozen fillets. However, even in the frozen fillet market, small-scale producers can make inroads. Recently,

several catfish farmers in Kentucky formed a cooperative (the Purchase Area Aquaculture Cooperative) and constructed a mechanized processing facility. This processing plant produces "deep-skinned" catfish fillets, which are deemed superior to the mass-produced catfish fillets from large-scale processors in the U. S. south. As a result of the high quality product, several restaurants and a major grocery chain are currently purchasing Kentucky catfish. For this product, quality, and not only price, is the selling point.

Although a mechanized processing facility can be very useful, there is an important condition limiting their efficiency: highly mechanized processing plants require (and produce) large volumes of fish everyday. Such processing plants operate profitably only if there is sufficiently high market demand to match their production capacity. If small-scale producers only want to supply a local or regional retail and restaurant demand, a small hand processing facility might be more suitable. In Kentucky, this is embodied in a HACCP-certified processing trailer known as the Mobile Processing Unit (MPU). The MPU is a self-contained unit that can be transported to a producer's farm and temporarily installed on a gravel or concrete bed with potable water and electricity connections. The MPU will allow hand processing of fish at a very low cash cost (usually labor is supplied free by the farm family). While the MPU is currently not certified for catfish processing, it is expected to happen in the near future. The MPU costs up to $250 to rent (including a refundable deposit) for a two-day fish processing operation.

Another important catfish marketing opportunity is supplying live

fish to pay lakes. Pay lakes in Kentucky and other regions of the U. S. south typically stock large catfish (2-5 lb) at densities ranging from 114-1,000 lb/ac/week. The typical pay lake season is approximately 30 weeks long, between March and October. Some pay lake operators use their own live hauling equipment, while others depend on live haulers to supply them with fish. Pay lakes pay suppliers (on average) $0.88/lb (without live haul) or $1.27/lb (with live haul) - 2002 prices. The main issue for pay lake operators is a regular, dependable supply of fish. Small-scale catfish producers can make a profitable business of contracting with local pay lakes for a steady fish supply every year.

Harvesting catfish in McLean County, Kentucky, is a family affair.

Freshwater Prawn

Marketing freshwater prawn, beyond direct sales to consumers, has proven to present a significant challenge. This is primarily because small-scale prawn producers have high production cost, unpredictable supply/ low volumes of production, mix of sizes of the final product, among other factors. Freshwater prawn is imported by U. S. wholesalers, with average price of $2.50/lb (heads on), from Asian countries such as India, Bangladesh and Thailand. These prawns are fairly large (10 count, heads on), well packaged, and are available year round. Domestic freshwater prawn production, which mostly limited to small-scale aquaculture, results in breakeven prices in the neighborhood of $5.00/lb. Clearly, U. S. buyers prefer imported prawns to domestic prawns.

Of all attributes of domestic prawn, freshness is perhaps the most unique. While some Asian consumers prefer live prawn, research has identified moderately sized live markets only in Toronto, Canada. Since Toronto is at least a 12-hour road trip from Kentucky, survival of prawns during transport is vital for this market. Initial trials have resulted in very high mortalities during transport; further research is required to make this market feasible for U. S. growers.

While restaurants have access to cheaper imported prawn, fine dining restaurants sometimes prefer domestic prawn because of a variety of reasons that include freshness and advertisement value. Many fine dining restaurants purchase products to support local farmers, which is often a strong advertising point.

Past research has, in general, painted an optimistic picture of selling local prawn to restaurants. However, the above restaurant survey, conducted very recently, shows an alarming trend: several restaurants that used to purchase local prawn have discontinued its use due to high price, small size, and some Kentucky prawns were delivered too soft (or mushy). Clearly, greater quality control and size grading need to be implemented to prevent future loss of markets.

The future of prawn marketing is unclear. The promise of live sales to Toronto is alluring, provided the transport survival rates can be increased. A current research topic is looking into the development of value-added prawn products that have market promise. Other research is trying to increase commercial yields in an attempt to reduce the breakeven price to a level at which domestic prawn is price-competitive with respect to imported prawn. A major grocery chain in Kentucky is attempting to feature Kentucky prawn at higher-than-average prices. It is hoped that consumers will pay a premium price to patronize a local product. If successful, local farmers might be able to sell their prawns in a wholesale environment (large grocery chains often behave like wholesale buyers), at prices higher than the average U. S. wholesale price of prawn.

Largemouth Bass

Largemouth bass (LMB) is still a relatively new aquaculture crop. While its management is similar to catfish, feed-trained fingerlings and feed are both expensive, when compared to catfish. This results in a breakeven price, for food-sized fish, in the neighborhood of $3.00/lb (catfish: $0.75/lb).

The seafood buyer survey, mentioned above, showed that LMB is not widely accepted, at the present time. One retailer felt that LMB could be a difficult sell because it is a sport fish. While this notion might not be unfounded, initial market trials have shown that LMB is well accepted by the Asian community. The Asian live seafood market in Toronto, Canada, have showed strong interest in buying LMB and Asian live haul trucks from Canada have come to Kentucky to purchase LMB at the pond bank. Further research is necessary to search for similar Asian markets for LMB in the United States.

Small-scale producers of LMB can also profitably sell food-sized fish for pond stocking. While this market can offer high profit per pound of fish sold, it is similar to direct marketing and can involve significant risk.

NOTES:

References:

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