LOUISIANA FARM-RAISED CRAWFISH STATUS AND NEEDS ASSESSMENT

Audubon Nature Institute
Gulf United for Lasting Fisheries
March 2017

INTRODUCTION

In evaluating the status and needs of the Louisiana farm-raised Crawfish industry and the potential for development of a certification model specific to crawfish, the Louisiana Crawfish Sustainability Committee chose to utilize the 8 main areas and requirements laid out in the Global Sustainable Seafood Initiative (GSSI) Section C- Essential Components for Aquaculture Standards. The GSSI Aquaculture components are rooted in the principles of the FAO Technical Guidelines for Aquaculture Certification.

These 8 areas are:

1. Aquatic Animal Health Management
2. Chemical & Veterinary Drug use
3. Environmentally Responsible Infrastructure Construction, Waste Disposal and General Storage
4. Feed Use
5. Impacts on Habitat and Biodiversity
6. Seed
7. Species Selection and Escapes
8. Impacts on Water Resources

This initial pre-assessment summarizes characteristics and existing practices of the Louisiana pond-raised crawfish industry for each of these areas and highlights areas that the project should focus additional efforts on.

PRE-ASSESSMENT SUMMARY

1. Aquatic Animal Health Management

- **Antimicrobial Usage**
- **Biosecurity**
- **Off-Farm Disease Transmission**
- **Record Keeping**

Serious disease problems associated with non-intensive crawfish culture are thought to be rare. Individual crawfish are known to be susceptible to various pathogens, such as bacteria, virus, fungi, protozoans, and parasites; however, epidemic outbreaks sufficient to effect commercial production in earthen ponds have not been demonstrated.

Because of the insignificance of known disease in pond culture of crawfish, disease management is not deliberate. Practices that prevent food shortages, overcrowding, and low oxygen are the extent of practices related to disease management in the crawfish industry. (pg. 43 LA Crawfish Production Manual)

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Section C.2. Chemical and Veterinary Drug Use

- **Chemical Usage**
- **Legal Compliance**

Crawfish aquaculture as practiced in Louisiana uses extensive methods of production in earthen ponds, and these methods are little more than limited control of the natural environmental habitats and conditions under which these animals evolved. Temporary dewatering of ponds during the summer promotes aeration of bottom sediments, reduces abundance of aquatic predators and potential disease organisms, and allows for the establishment of vegetation that serves as cover for crawfish and the food resources when ponds are flooded in the fall. The extensive method of crawfish cultivation results in relatively low population densities. For this reason, disease problems that require the application of chemicals or drugs to the animals or water in which they are grown for disease control are not recommended and for all practical purpose, non-existent. Practices that prevent food shortages, overcrowding and low oxygen (common stressors) are the extent of practices related to disease management in the crawfish industry.

Because crawfish are often grown in rotation with other agricultural crops, such as rice, or near agricultural crops where pesticides are used, caution is taken ensure crawfish are not exposed to pesticides, particularly after the pond or field is flooded and crawfish have emerged from their burrows. Crawfish are very sensitive to various classes of pesticides, particularly insecticides, which can be toxic even at low concentrations. Only a few agricultural chemicals (insecticides and herbicides) are labeled by the US Environmental Protection Agency (EPA) for use in crawfish ponds to control insects or weeds in the forage crop cultivated as a food supply for crawfish from summer to early fall. Crawfish are protected from chemical exposure within the sealed burrow from legal pesticide applications on dry or slightly wet ground. Insecticide or herbicides are not used in crawfish ponds after they are flooded in the fall and until they are drained (dewatered) in late spring/early summer.

Crawfish farmers must comply with federal and state law in regards to the use of agricultural chemicals by following chemical label restrictions on any compound used in or adjacent to crawfish ponds or otherwise be subject to potential civil or criminal penalties. Veterinary drugs are not used, or recommended for use in commercial crawfish culture in Louisiana, nor to our knowledge are any drugs approved by the US Food and Drug Administration (FDA) for use in commercial crawfish aquaculture.

References:

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3. Environmentally Responsible Construction, Waste Disposal and General Storage

- **Maintaining Good Culture and Hygienic Conditions**
- **General Environmental Management**

Pond construction. location, and design are the most important physical factors for successful crawfish production. Proper design and construction gives the crawfish farmer better control over flooding, drainage, forage management, water circulation and harvest.

Proper pond construction and water management will enhance the farmer's ability to conserve water and energy while pumping. It also reduces the possibility of soil erosion when draining ponds.

Flooded crawfish ponds have a positive effect on the environment. These ponds greatly benefit and improve the quality of water entering and exiting the field. Crawfish ponds also provide more than 120,000 acres of manmade wildlife habitat.

Many crawfish farmers use the same farm equipment, tractors, and irrigation systems that are used in rice production. Keeping this equipment on a year-round maintenance program keeps this equipment in working order and reduces environmental contamination.

Additionally, crawfish are typically not fed commercial supplemental feed; therefore, the risk of environmental contamination from feed additives and chemicals does not exist.

Louisiana Crawfish Production Manual
https://articles.extension.org/sites/default/files/w/9/9c/Louisiana_Crawfish_Production_Manual.pdf

4. Feed Use

- **Environmental conditions of feed ingredients**
- **Feed Biosecurity**
- **Feeding Efficiency**
- **Legal Compliance**
- **Record Keeping**

Crawfish have been classified as herbivores (vegetation eaters), detritivores (consumers of decomposing organic matter), omnivores (consumers of both plant and animal matter) and, more recently, obligate

carnivores, which means that they “require” some animal matter in the diet for optimal growth and health.

Crawfish are known to ingest living and decomposing plant matter, seeds, algae, epiphytic organisms, microorganisms and an assortment of larger invertebrates such as insects and snails. They also will feed on small fish when possible. These food sources vary considerably in the quantity and quality in which they are found in the aquatic habitat.

Supplemental feeds are typically not provided to crawfish aquaculture ponds. Commercial culture of crawfish relies on a self-sustaining natural food web system for providing nourishment to crawfish.

Crawfish production in Louisiana relies solely on established vegetative forage crops to create a natural food web that will last through the production season. Crawfish receive their sustenance from sources within a complex food web, similar to that which occurs in natural habitats. (La Crawfish Production Manual Ch.9,pg.39).

Various agriculture byproducts, formulated feeds and hay have been tried over the years but have been unsuccessful in increasing the growth rate and harvest yield in crawfish. (La. Crawfish Production Manual, Ch.9, Pg.9).

Feeding prepared feeds or supplementing natural food sources has not been proven to be economically feasible or produce positive results in growing crawfish. (La. Production Manual, Ch. 9,Pg.9).

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https://articles.extension.org/sites/default/files/w/9/9c/Louisiana_Crawfish_Production_Manual.pdf

5. Impacts on Habitat and Biodiversity

- **Benthic Habitats**
- **Predator Control**
- **Preventing Habitat Impacts**
- **Sensitive Habitat and Biodiversity**

Crawfish are polytrophic benthic omnivores that consume a variety of microbial, vegetative and animal matter in constructed managed ponds. Crawfish ingest living and decomposing plant matter, seeds, algae, periphyton, microorganisms and an assortment of larger invertebrates such as insects, aquatic worms, and snails. For crawfish to grow at their maximum rate, they must feed to a greater extent on high-protein, energy rich animal food sources produced within the pond from the decomposition of summer grown vegetative material after fall flood-up.

Many other invertebrate and vertebrate species find crawfish ponds to be food-rich havens, and these ponds offer water and food resources when they are in short supply in natural habitats. The lavish food-rich environment not only supports commercially viable crawfish populations but numerous other wetland species (terrestrial and aquatic). Crawfish pond/wetland habitats in southwest Louisiana have been declared a “Continentally Important Bird Area” (IBA) by the National Audubon Society because it supports 70 species of resident, seasonal, and migratory water birds, many of which are listed as “species of conversation concern”. Whooping cranes actively use crawfish ponds as nesting and food in southwest Louisiana.

Crawfish of all sizes are predated upon by many invertebrate and vertebrate predators that thrive in and about the shallow, vegetated waters of crawfish ponds. Predaceous aquatic insects consume young,

recently molted crawfish. Bullfrogs, amphiumas (a large eel-like salamander) and several species of water snakes flourish in crawfish ponds and consume all sizes of crawfish. Turtles and alligators will prey on crawfish. Small mammals, such as the Norway rat, mink, raccoon, opossum and otter are often abundant and will consume crawfish and sometimes the bait placed in crawfish harvesting traps. Raccoons and otters also will damage traps when getting to the crawfish and/or bait. Although collectively these predators can consume significant quantities of crawfish, crawfish reproduction and growth rates, and predator management are usually sufficient to prevent major economic harvest losses.

Raccoons and otters turn over and sometimes destroy crawfish harvest traps. Nutria and muskrats will damage levees and must be controlled to prevent major water loss. These nuisance mammals are classified as "fur bearers" and are protected or regulated by wildlife laws. During trapping season these animals may be trapped by a licensed trapper, skinned and the hides sold [RS56:259 C. (1)]. Outside of trapping season, a special Nuisance Wildlife Permit can be obtained from the district offices of the Louisiana Department of Wildlife and Fisheries (LDWF) or the USDA Wildlife Services, to trap or shoot these animals when causing problems.

Fish, if not controlled, are the most significant predator in crawfish ponds that cause significant economic loss. Predatory fish are controlled by thoroughly drying pond bottoms during the interval between seasons and by treating standing pools of water with an EPA-approved fish toxicant, followed by proper screening of incoming water. If not controlled, fish will consume large quantities of crawfish and/or compete with crawfish for the natural food resources (benthic aquatic invertebrates).

Avian predators are not as easy to control as fish. Many bird species consume crawfish, and, except for allowable hunting seasons for certain waterfowl, nearly all piscivorous (fish-eating) birds are federally protected, but limited kill permits may be obtained from the U.S. Fish and Wildlife Service on a case by case basis.

Birds are sometimes a problem when they feed on crawfish or turn over traps. In ponds with high numbers of crawfish, egrets and herons may not hurt the crop at all. In ponds with few crawfish, every crawfish is valuable. Egrets and herons along with ibis and seagulls are protected by federal laws and can only be harassed to leave the field.

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6. Seed

- **Legal Compliance**
- **Record Keeping**

Crawfish aquaculture relies on natural reproduction of resident or stocked adults to populate the ponds. Yields of harvestable animals within a season depend on broodstock survival, successful reproduction and survival of offspring. In established ponds, however, where production occurs in the same location each year, *crawfish populations are usually self-sustaining with no need for supplemental stockings*. Once a pond is established, subsequent crawfish crops rely on holdover broodstock from a previous cycle. This reliance is possible because harvesting operations are inefficient, allowing significant "carry over" of unharvested individuals from year to year, even under the most intensive harvesting efforts.

Since crawfish populations tend to be self-sustaining, stocking is usually only needed in new ponds, when a pond has been idle for a season or longer or after extensive levee renovation or other events that disrupt the reproductive process in permanent ponds. Suitable broodstock can be obtained from any type of pond or natural habitat as long as the crawfish are in good health and not under undue stress.

It is recommended, and common practice, that producers in Louisiana stock only red swamp crawfish because of their high fecundity and reference in the marketplace.

Crawfish broodstock are obtained from a variety of habitats (monoculture ponds, rotational ponds and the wild crawfish fishery) and from a wide array of conditions within each of those habitats. (all above from: La. Crawfish Production Manual Ch.6, Pg.22).

Broodstock or juveniles are not raised in commercial hatcheries as is common for shrimp or fish aquaculture.

Louisiana Crawfish Production Manual
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7. Species Selection and Escapes

- **Escapes**
- **Genetically Modified Organisms**
- **Exotic Species**

Whether from managed ponds or wild habitats, Louisiana's crawfish harvests are composed of two species – the red swamp crawfish (scientific name: *Procambarus clarkii*) and to a lesser extent the white river crawfish (scientific name: *Procambarus zonangulus*). Of the 39 species of crawfish that naturally occur in Louisiana, these are the only two species that make up the commercial harvest. The Red Swamp crawfish in the preferred species for culture in aquaculture systems. Both are harvested from the wild in the Atchafalaya River Basin, although the most prominent is the red swamp.

The natural range of the red swamp crawfish is from southeastern New Mexico, across Texas, Louisiana, Mississippi and southwest Alabama. The range extends north along the Red, Arkansas and Mississippi Rivers to southeastern Missouri and southwestern Kentucky. This species has been introduced into many other states through the aquarium trade and limited commercial production for human consumption has been attempted in Mississippi, Georgia, North Carolina and California. It has also been exported to Europe, Central America and Asia for commercial use.

White river crawfish have a much smaller range than the red swamp crawfish. It occurs mostly in riverine habitats in Louisiana. This species is not intentionally cultured and measures are taken to prevent white river crawfish from invading aquaculture systems that focus on red swamp crawfish.

Producers stock their ponds with red swamp crawfish obtained from other farms or from the Atchafalaya River Basin. There are no genetic selection or breeding efforts in the selection of stock. All red swamp crawfish grown in aquaculture systems should be considered "wild." Since red swamp crawfish occur naturally throughout Louisiana, escapes from aquaculture production systems is not an issue.

Range map for Red Swamp Crawfish https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=217
Range map for White River Crawfish https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=2897
Number of species in LA and USA
http://www.wlf.louisiana.gov/sites/default/files/pdf/document/37780-fisheries-brochures/crawfish_front.pdf

8. Impacts on Water Resources

- **Legal Compliance**
- **Salinization**
- **Water Use**
- **Water Quality**

Crawfish farmers do not require permits from either county (parish), state or federal authorities to pump surface or subsurface (well) water to use in crawfish ponds, nor are permits currently required by crawfish farmers to discharge water from crawfish ponds into the State's receiving waters. Permits are, however, required for drilling of wells to supply subsurface water for agriculture, including crawfish aquaculture. Both surface and subsurface water is acceptable for crawfish aquaculture. Wells provide predator-free water, but have limited discharge capacity and higher investment and pumping costs. Surface water is satisfactory if it is pollution-free and if nuisance predatory fish are screened out. Although cheaper to pump, surface water is usually not as reliable in quantity and quality.

Areas subject to saltwater intrusion are not recommended for crawfish aquaculture. Tolerance to salinity is directly proportional to crawfish size. Ideally, crawfish ponds should not be located where salinities higher than 3 ppt are likely to occur through most of the crawfish production season. Coastal areas with low salinity water usually have highly organic soils that are marginal areas to farm crawfish. Crawfish farmers in coastal regions should monitor tidal influenced surface waters for salt content particularly during a drought. Water discharged from crawfish aquaculture practices do not contribute to the salinization of receiving waters.

Consumptive water utilization in crawfish farming is typically higher than for terrestrial agricultural crops. Water is required to fill crawfish ponds and replace losses from evaporation and seepage during the fall, winter and spring production season. The total quantity of water required to maintain a typical rice-field crawfish pond at capacity from October flood-up through mid-June drawdown, is about 91 inches per surface acre, of which 40% will be supplied by precipitation and the balance (60%) from pumping surface or ground water. Of the 91 inches of water used, 73 inches (81%) will be lost to evaporation and transpiration. Effluent discharged during an average crawfish production cycle is 23 inches per surface acre with end of season pond drawdown (37%), non-intentional discharge from precipitation overflow,

excess pumping and levee breaks (29%), normal levee seepage (22%) and oxygen management (12%) accounting for the water releases. Whether surface or sub-surface water is used, a water input (pumping) capacity of 75 to 100 gallons per minute per surface acre is ideal for intensive management strategies for crawfish ponds that average 12 to 18 inches deep when fully flooded.

Water quality depends on management and on properly designed and constructed ponds that have a dependable water supply. Important water quality variables are dissolved oxygen, pH, total hardness, total alkalinity, iron, hydrogen sulfide content, ammonia, nitrite and salinity (salt content). Ideally, dissolved oxygen should be maintained above 2 parts per million (ppm). The source water pH after being aerated should range from 6.5 to 8.5, and both total hardness and total alkalinity should range from 50 ppm to 250 ppm as calcium carbonate. As a general rule, most waters and soils used for crawfish production in Louisiana are sufficiently high in hardness and alkalinity and do not require additions of agricultural limestone or other amendments than required for the vegetative forage crop being cultivated as a food supply for the crawfish. Dissolved iron and hydrogen sulfide are toxic to crawfish at concentrations often found in well water, but the two compounds are lowered to non-harmful concentrations when the water is oxygenated upon entering the pond. Where iron and hydrogen sulfide concentrations are high, it may be necessary to place a flume ditch or pond between the well and the crawfish pond to allow the iron to settle out before entering the pond. Non-ionized ammonia and nitrite are toxic to crawfish at concentrations exceeding 2 ppm and 5 ppm (as nitrogen), respectively. Concentrations this high are not likely to occur in crawfish ponds because the crawfish production intensity is low and ammonia is rapidly taken up by aquatic plants present in the pond.

The LSU Ag Center, with partners from government and industry organizations, has developed voluntary Environmental Best Management Practices (BMPs) for the crawfish aquaculture industry. The BMPs result in reduced water consumption and lower levels of nutrients, sediments, and organic matter being discharged into the State's waters. These recommended practices are outlined in the publication "Crawfish Environmental Best Management Practices" (Pub 3186). This manual provides guidance for the selection, implementation and management of practices that help crawfish farmers conserve soil and protect water and air resources.

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SUMMARY:

Most crawfish farmers follow the recommendations provided by 1) the Crawfish Environmental Best Management Practices (BMPs) established by the LSU Ag Center and endorsed by the Louisiana Department of Agriculture and Forestry, the Natural Resources Conservation Service (NRCS), and the Louisiana Farm Bureau, and 2) the Louisiana Crawfish Production Manual developed by the LSU Ag Center and the Louisiana Crawfish Promotion and Marketing Board. An Annual workshop is conducted by LSU Ag Center to update farmers on relevant issues related to crawfish production and encourage responsible practices. While these BMPs are generally utilized throughout the Louisiana crawfish farming industry, most are not formal regulatory requirements and documentation confirming implementation of these BMPs is not easily available. The largest gap for the industry at this time is on record keeping and reporting on actual practices implemented at pond facilities.