LOUISIANA COOPERATIVE EXTENSION SERVICE
LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER

Southern Regional Aquaculture Center

SRAC

Crawfish Culture

Site Selection, Pond Construction and Water Quality

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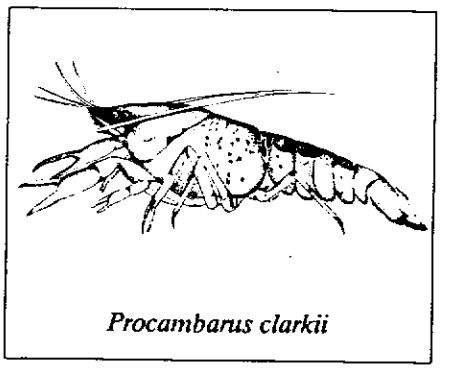
There are over 500 species of crawfishes worldwide in various sizes, colors, life cycles and habitats. Species of crawfish that are commercially important in the Southeast United States are the red swamp crawfish, *Procambarus clarkii,* and the white river crawfish, *Procambarus acutus acutus.*

The development of crawfish culture was stimulated by the year-round demand for crawfish and the seasonality of crawfish catch from natural production areas. The industry is relatively young – 20 years – in comparison to other agricultural industries.

Development of crawfish culture has made a significant impact on crawfish availability. Ponds have made crawfish available almost year-round compared to a 3-month availability from natural production areas. Crawfish production in Louisiana ranges from 70 to 100 million pounds with ponds producing an average of 60 percent of the catch.

Present pond area is as follows: Louisiana, 125,000 acres; Texas, 5,000; Florida, 2,500; South Carolina, 1,000; Arkansas, 500; Mississippi, 250; and 100 acres or less in Alabama, Georgia, Maryland and North Carolina. Crawfish culture is now the largest crustacean aquaculture food industry in the United States.

Culture methods used to grow crawfish are simple when compared to other cultured aquatic animals. Crawfish culture fits into farm management plans by using marginal agricultural lands, permanent farm labor and farm equipment during off-peak farming periods. The average pond is 40 to 60 acres in size. No hatcheries are used to produce young crawfish for stocking ponds nor are formulated rations used to feed crawfish. Rather, young are produced by brood stock contained within the pond, and vegetation is utilized as a forage for the crawfish. Intensity of culture is low and risk from diseases is low.



Procambarus clarkii

Disadvantages of crawfish culture are the high volume of water (70 to 100 gallons per minute per surface acre) required to maintain water quality; high expense of harvesting; the length and frequency of the harvesting season; and the need for market expansion and product development.

Research is presently being conducted on better pond design, oxygenation of pond water with paddlewheel aerators, more efficient traps and better harvesting methods, better baits, determination of nutritional requirements, feed development and feeding, grading, marketing and food processing.

Site location and pond construction

Location and pond design are the most important factors in a successful pond. Crawfish ponds should be located in flat, open areas and the soils should be heavy clay. Some sandy clay soils may hold water and

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are suitable for fish culture but are unsuitable as a soil in crawfish ponds. A heavy clay soil is necessary to maintain the integrity of crawfish burrows. Sandy soils are not recommended for crawfish ponds.

Perimeter levees should have a core trench filled with clay to prevent water seepage. The minimum perimeter levee base should be 9 feet wide to prevent leakage from the burrowing activities of the crawfish. A levee system 3 feet high is adequate to contain the 18 to 22 inches of water necessary to cultivate *Procambarus*. The land should have no more than a 6-inch slope between perimeter levees; otherwise, the area should be leveled or divided into two or more ponds. Ponds with a steep slope channelize water, have poorer water quality, and reduce efficiency of harvesting.

Interior baffle levees are built on the same specifications as perimeter levees and are spaced 150 to 300 feet apart to facilitate water circulation (Figure 1). A recirculation canal, external to the perimeter levee, and a re-lift pump or paddlewheel aerator is recommended to aid in water circulation, and to minimize water usage and pond water discharge. Ponds designed to recirculate water are important in areas where water is scarce or where expensive subsurface water must be pumped from great depths.

Drains should be matched with the pond size, pumping capacity and projected rainfall. A three-tier 1/2-inch mesh aeration screen should be used to oxygenate water pumped into the pond. Crawfish ponds should be isolated from crops that require frequent use of pesticides and fertilizers.

Consult your local Soil Conservation Service technician for assistance in planning your crawfish pond, mapping out land elevations, and determining the volume of dirt that must be moved during construction.

Types of crawfish ponds

Crawfish ponds are generally categorized as wooded, semi-wooded and open ponds. Open ponds are further subdivided into permanent, ricefield and marsh ponds.

Wooded ponds – The earliest type of pond used for crawfish cultivation in Louisiana was the wooded pond. These ponds are built in forested areas on heavy clay soils near drainage canals filled with precipitation from surface runoff. Wooded ponds produce 200 to 800 pounds of crawfish per acre. Production is limited by the inability to manage water effectively. These ponds have internal borrow ditches that channel water directly to the drains, impeding water circulation throughout the

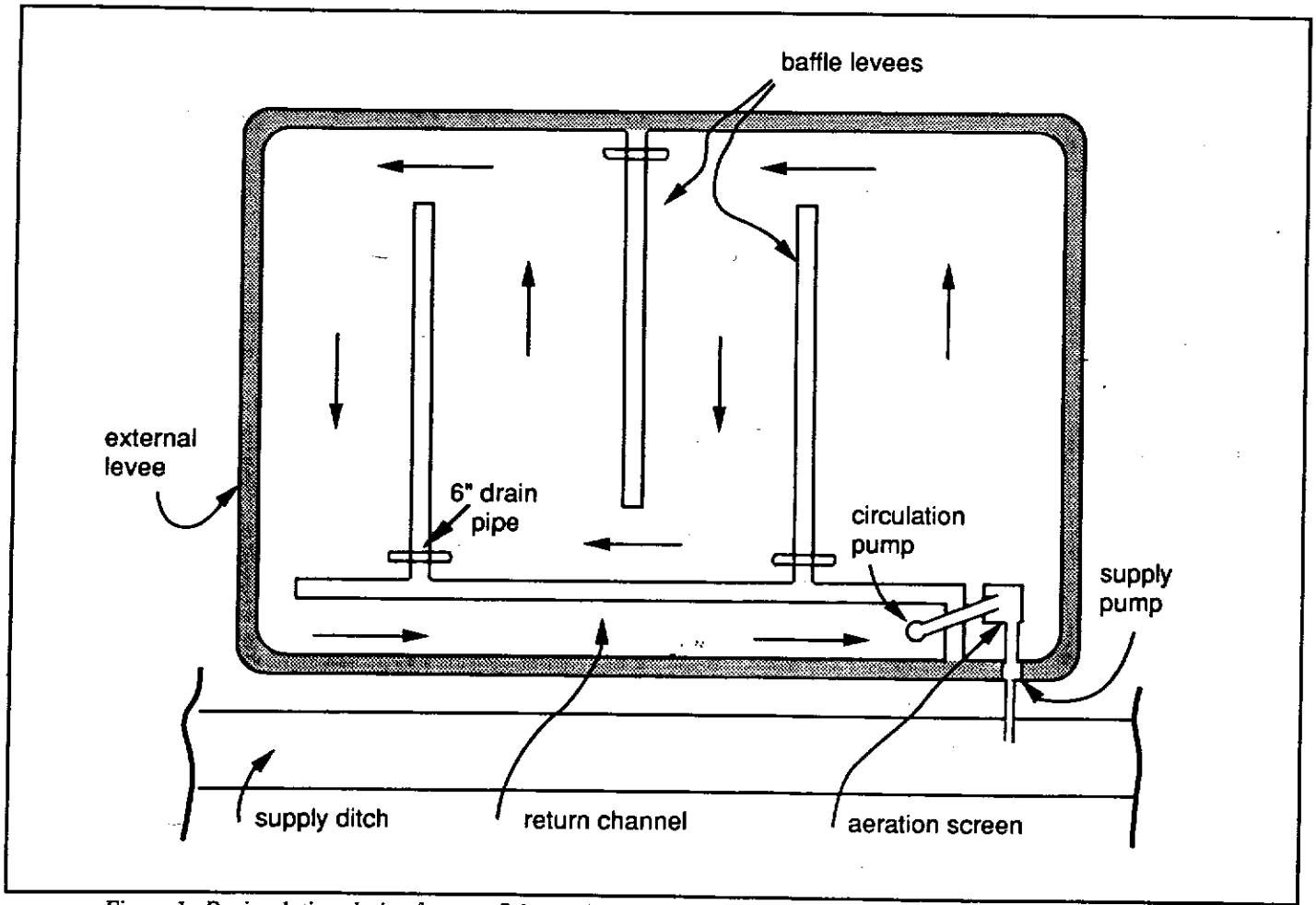

Figure 1. Recirculation design for crawfish pond.

pond. Wooded ponds have poor stands of vegetative forage because of shading, but leaf litter provides a significant amount of forage for the crawfish. Water flow and crawfish harvest are difficult because the trees hinder movement of water and obstruct harvesting boats. Tree-free lanes are cut to provide trapping areas in wooded ponds.

Semi-wooded ponds – After several years of alternate flooding and drying, wooded ponds have high hardwood mortality, thus reducing tree density and generally improving crawfish habitat. A vegetative forage base of terrestrial grasses and aquatic plants is developed which requires better water circulation and more intense water management. Properly managed semi-wooded ponds produce 15 to 30 percent more crawfish than wooded ponds, but poorly managed semi-wooded ponds produce fewer crawfish than wooded ponds because water quality is often poorer.

Open ponds – Open ponds (those containing few or no trees) are recommended for crawfish aquaculture. Open ponds account for 65 to 70 percent of the production area in Louisiana and are the main type of pond found in other states.

- **Permanent ponds.** Permanent crawfish ponds are those constructed solely for the purpose of cultivating crawfish. Crawfish can be harvested in permanent ponds 1 to 2 months longer because there is no conflict with planting, draining and harvesting schedules of other crops. Crawfish yields are 1,000 to 3,000 pounds per acre with an average of 1,500 to 1,800 pounds per acre.
- **Ricefield ponds.** Ricefield crawfish ponds are productive, open ponds because they are located on fertile soil and often have baffle levees, a good water supply and recirculation capability. Crawfish yield is generally 1,000 to 2,500 pounds per acre with an average production of 1,200 pounds per acre. Generally total production is decreased because of the shortened harvest period. These ponds are drained early to replant rice in the spring. Crawfish are commonly double-cropped with rice in Louisiana and Texas.
- **Marsh ponds.** Marsh ponds are constructed in coastal areas and have low crawfish yield (50 to 500 pounds per acre). High concentration of organic matter in soils reduces water quality and decreases crawfish production. Marsh ponds are generally not recommended for crawfish production.

Water supply

Water quantity and water quality are the most common limiting factors in crawfish aquaculture. A pumping capacity of 70 to 100 gallons per minute per surface acre is needed to exchange (turn over) water in a 4- to 5-day period. This exchange rate is necessary to maintain satisfactory water quality in the fall when water is flooded onto vegetation in the pond during warm weather. Crawfish producers can reduce water demand by flooding the pond to an 8- to 10-inch level rather than the full 18- to 22-inch level at the initial flood in fall, and thereafter recirculating/ flushing the pond with fresh, oxygenated water as needed to maintain satisfactory water quality.

An aeration screen is used to oxygenate water as it is pumped into the pond. A properly managed open crawfish pond will generally require nine water exchanges per production season to maintain acceptable water quality. Water quantity is a major constraint to crawfish culture.

Both subsurface and surface water are acceptable for crawfish cultivation. Subsurface water from wells provides predator – and disease-free water but wells have limited discharge capacity and a greater expense in pumping. Subsurface water often contains soluble iron and hydrogen sulfide that must be reduced before water enters the pond. Water recirculation systems are usually recommended for ponds that must rely on subsurface water. Surface water is desirable for large ponds because it is less expensive to pump, but it may not be reliable in quantity and quality. Crawfish ponds are initially flooded in September and October, usually two of the drier months in the year. Surface water contains predacious fishes which are removed through the aeration screen. Smaller fish passing through the 1/2-inch mesh aeration screen need not be removed, because they do not pose a predation problem to young crawfish, and these fishes are killed when the pond is drained in the summer.

Mechanical paddlewheel aerators, 0.25-0.33 horsepower per surface acre, can be used to aerate and circulate crawfish pond water with more cost effectiveness than water replacement by pumping. Pond location and local energy costs dictate the type of pump and power source used for crawfish ponds.

Water quality

Over 99 percent of production problems in crawfish ponds can be directly attributed to improper water management. A good water quality management program requires that crawfish ponds be properly designed and constructed, and that they have a dependable supply of surface or subsurface fresh water. Inadequate concentration of dissolved oxygen (DO) is the most serious water management problem in crawfish aquaculture. Low concentration of DO results in high crawfish mortality; moreover, crawfish do not feed or grow well and can become predisposed to diseases in ponds with chronically low concentrations of DO.

Most serious water quality problems occur 2 to 6 weeks after flooding ponds in September/October, and from April to June because warm water in these months increases the biological oxygen demand (BOD) of inundated vegetation, thus decreasing DO. Dissolved oxygen should be maintained above 3 parts per million for optimal crawfish production.

Significant mortality occurs when DO is less than 1 part per million. Dissolved oxygen should be measured daily. Oxygen deficiency is corrected by replacing pond water with fresh, oxygenated water, or by recirculating the water with pumps or mechanical aerators.

Other water quality variables important in crawfish production are the pH; total hardness and total alkalinity; ammonia, nitrite, iron and hydrogen sulfide content. The water pH should range from 6.5 to 7.5 at dawn, and both total hardness and total alkalinity should range between 50 to 250 parts per million as $CaCO_3$, but 100 parts per million are optimal. If the pH, hardness and alkalinity are low, agricultural limestone should be incorporated into the pond bottom.

Un-ionized ammonia (NH_3-N) and nitrite (NO_2-N) are toxic to crawfish at concentrations exceeding 2 and 4 parts per million, respectively. But concentrations this high are not likely to occur in crawfish ponds because the crawfish production intensity is low, and ammonia is rapidly assimilated by aquatic macrophytes. Iron and hydrogen sulfide are toxic to crawfish at concentrations often found in subsurface well water; however, the two compounds are oxidized to non-harmful concentrations when well water is oxygenated prior to entering the pond.

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