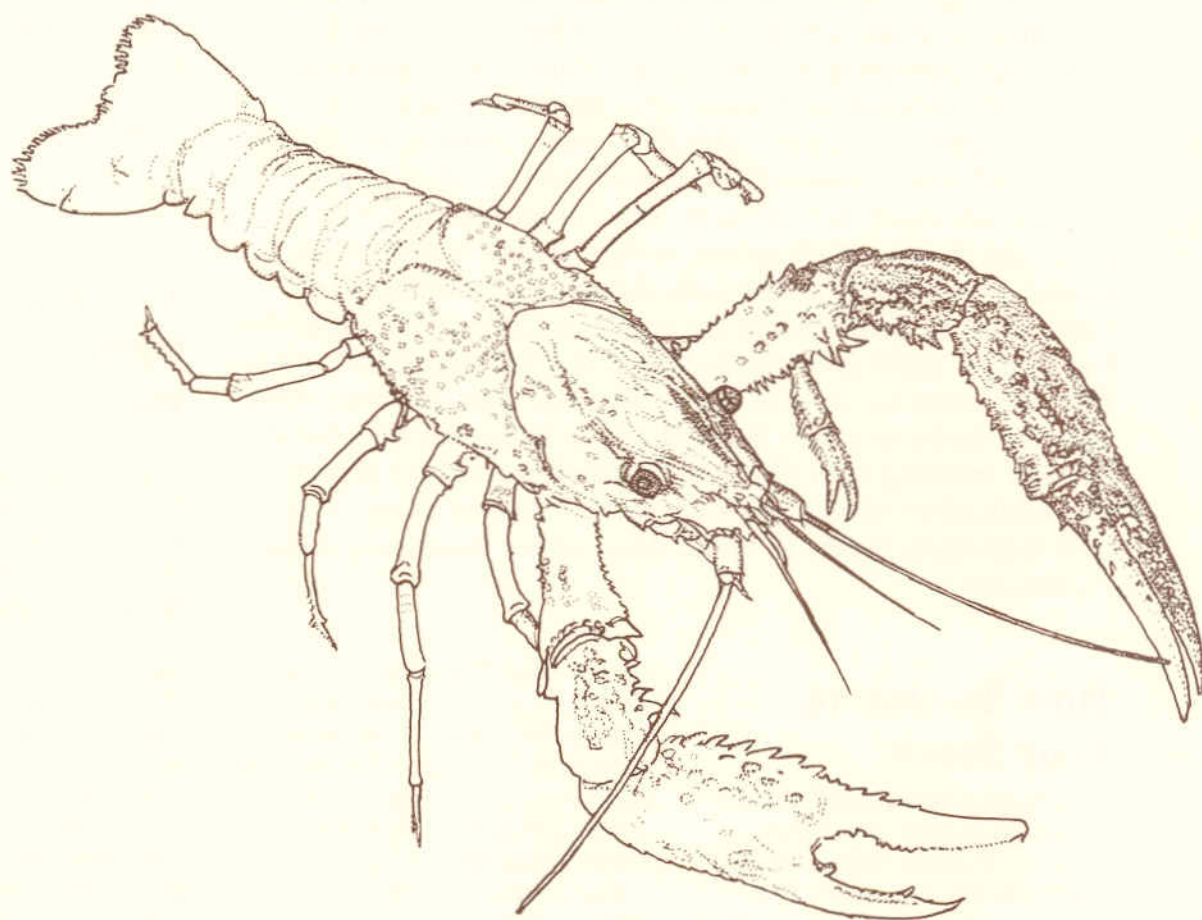


# Producing Soft Crawfish in Mississippi: Is It for You?



# Producing Soft Crawfish in Mississippi: Is It for You?

The production of soft-shell crawfish is a new and potentially profitable industry for the southeast and Gulf Coast. Like the more familiar soft-shelled crab, soft crawfish production provides an opportunity to produce a seasonal high value food product for consumer markets.

Commercial production began in 1986, when the first crop was harvested in Louisiana. Since then, operations have been started in Mississippi, Texas, Florida, and North Carolina. In the 1989-90 season, more than 20,000 dozen soft-shell crawfish were produced in Mississippi.

Crawfish must periodically molt (shed their skin) to grow. As the crawfish grows, it fills its hard shell with tissue. Once filled, a new soft skin forms beneath the hard shell in preparation for molting. During molting, the hard outer shell is discarded, and the emerging soft crawfish can increase in size. The soft skin then hardens with calcium to form a new hard shell. It is during this brief time of molting that the soft crawfish must be harvested. Crawfish shed their shells up to 11 times in their lives and may molt every 15 to 25 days under favorable culture conditions.

## How To Obtain Your Stock

Production of soft-shell crawfish requires a supply of premolt growing crawfish, held under conditions favorable for rapid growth, and then harvested after they have shed their shells. Only the red swamp crawfish (*Procambarus clarkii*), identified by the dark line running underneath the tail, is used in shedding operations. White swamp crawfish, common in commercial crawfish ponds, are not suitable for molting. When buying crawfish to molt, be sure you're getting only red swamp crawfish.

The best quality premolt crawfish are from commercial ponds, available during the crawfish

season from February to June. In most southern states, some "off season" crawfish are available from late fall in the extreme south to mid-summer in the north, extending the season from about November to July.

Early season crawfish ponds contain large numbers of old, immature crawfish, held over from the previous season, and mature breeders that produced young when the ponds were flooded in October. The holdover immature crawfish make up the bulk of the shedding stock available between November and February. In late February, these old immature crawfish reach maturity and are no longer suitable for shedding. However, young immature crawfish produced in October reach a size suitable for use in shedding

operations in February. Soft crawfish producers should learn to recognize and distinguish these two age groups.

Immature crawfish are grey-green to black-green in color and have small claws. Mature crawfish have much larger claws in relation to body size and are distinctly black on top and red on the sides. Because pond conditions can affect color and size, the presence of certain secondary sex characteristics is the preferred way of determining maturity. (Refer to the reading list in the back of this publication. Both Culley et al. and Culley and Duobinis-Gray give instructions for recognizing immature red swamp crawfish.)

## The Shedding Operation

### The Building

A simple building is all that is needed to house the operation. The building does not have to be elaborate; greenhouses or metal buildings are often used. Most Mississippi producers use existing but unused buildings. The building must be supplied with electricity and running water, and have a waterproof floor with adequate drainage. An oxygen meter and a water quality test kit for fish farming are highly recommended, especially if you plan a recirculating system. Ventilating fans to cool the building in the summer are helpful. If the crawfish are to be cleaned and packed on site, a processing facility, separate from the production area, must be provided.

### Water Systems

Two types of water-use systems are used in Mississippi. In the flow-through or open system, water is continually flushed through the system. Open systems are simpler and less expen-



sive to operate but require large amounts of water. Open systems generally do not heat the incoming water, so the shedding season is limited to spring and early summer months. Closed or recirculating systems filter and reuse the water although small amounts of makeup water are needed daily.

Water quality suitable for fish culture is acceptable. Well water is preferred although surface water can be used. Surface water must be filtered to remove debris and sediment and must not be prone to pollution or low oxygen levels. City water must have the chlorine removed. In open systems, treatment lagoons for discharge water may be required. At full stocking density, water flow rates of 1 to 2 1/2 gallons per minute per tray are recommended, based on the water temperature and feed type used. Recirculating systems should be operated at the higher rate. It is very important that water quality tests be performed before construction of the facility. Poor water quality is one of the major causes of failure in soft crawfish operations.

Young immature crawfish (those available from late February onwards) molt at water temperatures of 70 - 72 degrees Fahrenheit. Old immature crawfish molt best at 80 - 82 degrees Fahrenheit. Temperatures should be kept at 80 degrees Fahrenheit from November through February. Water temperatures should never exceed 90 degrees Fahrenheit.

Recirculating water systems that filter and recycle the water are more expensive to construct and operate than the flow-through systems, but they conserve heat, allowing for more consistent and earlier production.

Shedding operations that can heat their water can operate for the full production season. Heating water with commercial boilers or through a heat exchanger

is more efficient than heating the air within a shedding plant. Use of domestic water heaters, while common, is not recommended because of high operating costs, frequent breakdowns, and limits on flow rates. Where water is in short supply, recirculating systems are also recommended. Some producers limit their production period to February - June and avoid heating costs altogether.

## Culture Trays

Prior to molting, the crawfish are held in light-colored trays mounted on stands. Trays are generally constructed of one-half-inch plywood covered with fiberglass epoxy and are about 8 feet long by 3 feet wide (24 ft<sup>2</sup>). Trays should have sides 6 inches high. Corners should be rounded and have covers to prevent the escape of crawfish. Plastic or fiberglass trays can also be used.

The most efficient way to arrange the trays is in rows placed two wide and running the length of the building. An aisle about 3 feet wide separates the rows of trays. Trays can also be stacked two high, as long as the operator can easily see and reach into each tray. Some producers cover the trays with a closely fitted insulated cover to conserve heat.

Most producers operate small systems of 20 to 48 trays, but larger systems are becoming more common. A labor intensive operation, a 48-tray system can easily employ two full-time people over the production season, not including time and labor needed to collect and transport crawfish to the facility.

One end and corner of each tray is slightly elevated (one-fourth inch) to allow rapid flushing and draining of each tray. The lowest corner in the tray floor is provided with a drain. Water level is controlled by a stand pipe covered by a screen

to prevent the escape of crawfish and the loss of food. The stand pipe should be removable so the trays can be drained and cleaned completely. Depending on temperature and loading density of the trays, water levels are maintained between three quarters and one inch high by the stand pipe. A water pipe enters the top of each tray along one of the sides and water sprays into the tray from emitters to provide oxygen for the water. The spray is aimed towards the tray wall to create a slow current across the tray. Oxygen should ideally be about 5 ppm and should exceed 3 ppm at all times. Adjust flow rates to keep total ammonia below 0.5 ppm. Measure oxygen levels frequently, especially at the start of the operation. Measure total ammonia and nitrite frequently (sometimes daily), particularly after restocking with new crawfish.

## Production

### Collection and Transport

The production operation begins with collecting premolt crawfish trapped from farm ponds. Arrangements are made in advance with crawfish farmers for purchase of sorted (only immatures) or unsorted stock. Be sure you're not getting stunted or white river crawfish! Prior arrangements with the farmer can insure healthy crawfish. The capture, transport, and acclimation of premolt crawfish from ponds to the molting operation is a critical step. In general, the crawfish should be packed loosely (20 - 22 pounds per sack), kept cool, damp, and ventilated, and not subjected to temperature or oxygen shocks.

It is good to have multiple sources of crawfish. Use only crawfish that have been in traps for a short time, preferably from stand-up traps. Avoid crawfish



from ditches or those exposed to low oxygen (less than 3 ppm) or high water temperatures (above 90 degrees Fahrenheit). Crawfish that have been roughly handled, overheated, packed too tightly, or allowed to dry for even a brief period will begin to die after several days. Because premolt crawfish are costly and hauling times can be three hours or more, it is prudent to buy good quality stock and handle premolt animals carefully. Be sure to account for hauling losses (5 to 20 percent) when planning purchases of stock.

### Acclimation

Once at the facility, place crawfish into unused culture trays for a period of acclimation, usually 12 to 24 hours. The most common method of acclimation is to drip water into the acclimation trays to a depth of one-fourth inch after the crawfish have been unloaded. Turn off the water and leave the crawfish undisturbed for 6 - 10 hours. Begin to add water again, very slowly at first, gradually reaching full flow rates in 4 - 6 hours. Do not feed during acclimation.

In the winter, acclimate crawfish in covered trays to reduce the temperature shock of introducing cold crawfish into a warm-water system. Some producers have started using holding trays to keep stocks of crawfish on hand, allowing the culture system to continue producing at full capacity.

Place the acclimated crawfish in the culture trays at a density of about a pound per square foot (about 24 - 30 crawfish) of tray bottom. In average size trays, this comes out to be about 24 pounds of premolt crawfish per tray.

### Feeding

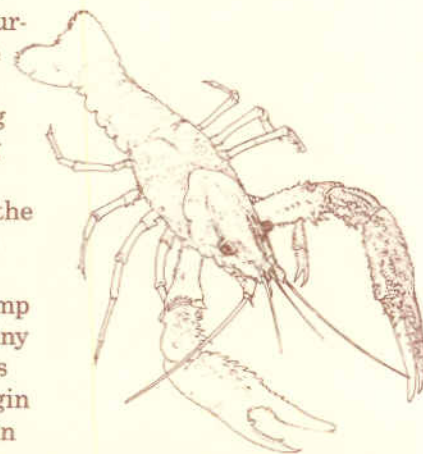
Following acclimation, feed the crawfish daily with commercial feeds. Either a water stable float-

ing catfish pellet (30 to 35 percent protein), shrimp feed, or commercially available crawfish feeds are suitable. Some commonly used feeds are produced by E.I. DuPont, Orange, TX 76731; Zeigler Bros., Gardners, PA 17324; Burris Feeds, Franklinton, LA 70438. Raw fish or other organic materials are not recommended as feed because they may reduce the oxygen content of the water and affect the flavor of the crawfish. Provide feed once or twice per day at a rate of one to two percent of the weight of crawfish in a tray. It may be necessary to feed two to three times this amount for the first few days after acclimation. Stop feeding and increase water flow when dissolved oxygen drops below 3 ppm. If waste feed builds up, reduce the feeding rate.

### Molting

Crawfish within one to three days of shedding (late premolt) become dark in color and cease feeding. Premolt crawfish are removed to separate molting trays to protect them from being cannibalized. Do not feed premolt crawfish in molting trays.

About one molting tray is needed for every ten culture trays. Culture trays are generally inspected in the morning to identify premolt crawfish and to remove them to the molting trays. Remove all dead crawfish. Because most immature crawfish (more than 90 percent) molt during daylight hours, inspect the molting trays at regular intervals three or four times during the standard workday. Molting occurs within 72 hours. When removing soft crawfish, count the number of molts to make sure all soft crawfish are collected. Newly molted crawfish look limp and soft, and are dark and shiny in color. If a molted crawfish is missed, it may harden and begin to eat the other soft crawfish in the molting tray.





Maintain all culture trays near full density by replacing all dead and late premolt crawfish with new stock. Mortality should generally be 3 - 5 percent per day, ideally 1 - 3 percent. Mishandled crawfish or poor water quality will significantly increase losses. Molting rates in Mississippi have averaged around 1.5 - 2.0 percent per day over a six month production period. Normally, 15 to 25 days are required after feeding starts for significant numbers of crawfish to enter the premolt stage. However, once started, the percentage of crawfish molting can reach 10 percent per day or higher, rapidly depleting the culture trays. Keeping all trays fully stocked is critical to keeping overall molt rates at optimum levels.

### Harvesting and Processing

Place soft crawfish harvested from the molting trays in a pan without water. Do not stack them over three or four deep; otherwise, the crawfish on the bottom may be damaged or deformed. Immediately chill harvested soft crawfish in an ice water solution to keep them alive until delivered to the buyer. The ice water bath prevents the hardening of the shell for up to 12 hours or more. Clean and freeze soft crawfish as soon as possible after collection if you plan to process and sell your product yourself. At optimum molting temperatures, crawfish can harden to paper shell condition in about three hours. If freezing must be delayed, immerse the collected crawfish in an ice water solution.

Pack the crawfish by size or by count, depending on the buyer's preference. All crawfish in a package must be close to the same size. It is extremely important to follow the buyer's exact instructions on handling soft crawfish. Failing to do so will

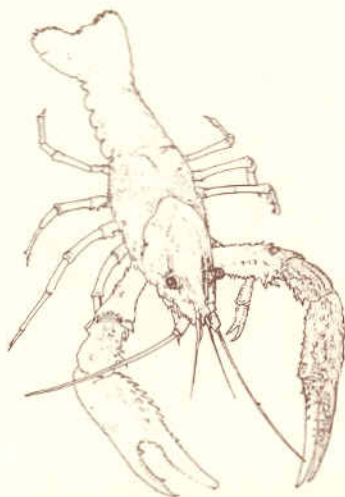
result in loss of sales.

All crawfish must be processed alive and in a fully soft condition. Most Mississippi producers provide live crawfish to buyers, so molted crawfish must be carefully handled.

Independent producers who sell directly must remember that processing, packaging, or freezing areas must be separate from the production area. Regulations require the use of approved and licensed scales. Regulations also prohibit the use of the home kitchen area for any processing or holding of the product offered for sale. Check with your State Department of Agriculture or Extension Service for labeling requirements.

Crawfish sometimes lose one or both claws. It is important to know that buyers will not accept soft crawfish that have lost both claws and will take only a limited number of one-claw crawfish. Excessive numbers of one-claw and no-claw crawfish will erode profits rapidly. Remember, buyers will not accept paper-shelled crawfish, dead crawfish, or crawfish without both claws. Small crawfish (less than about 30 per pound) are very difficult to sell.

All buyers place great emphasis on quality of the product. Past experience shows that an inferior quality or very small product will not sell. As the emphasis on quality has grown, buyer preferences have shifted to a product quick frozen in a commercial freezer and packaged in an attractive form. A home-frozen product packed in plastic bags is no longer acceptable. This has added to the cost of production. As an independent producer, you are responsible for offering for sale a wholesome and sanitary product. If you are doing your own processing, you are required to pack under conditions approved or identified by health agencies in your state. Check with your Extension county agent for assistance.





## Summary

You should give serious thought to planning a crawfish production operation. Supplies of premolt crawfish must be secured and timed to arrive at a rate that will keep the operation at full capacity. Only experience will allow you to estimate mortality and shedding rates. The operation must be designed to use available water supplies and to satisfy water-use and discharge regulations. A recirculating system with filters and a water heater may be cost effective in some situations, but a simple flow-through design will suffice in others.

As with any farming venture, it is extremely important to have an established market for the product before starting operations. Be aware of the price at which you can sell your product. The days of crawfish selling at nine to eleven dollars per pound are over.

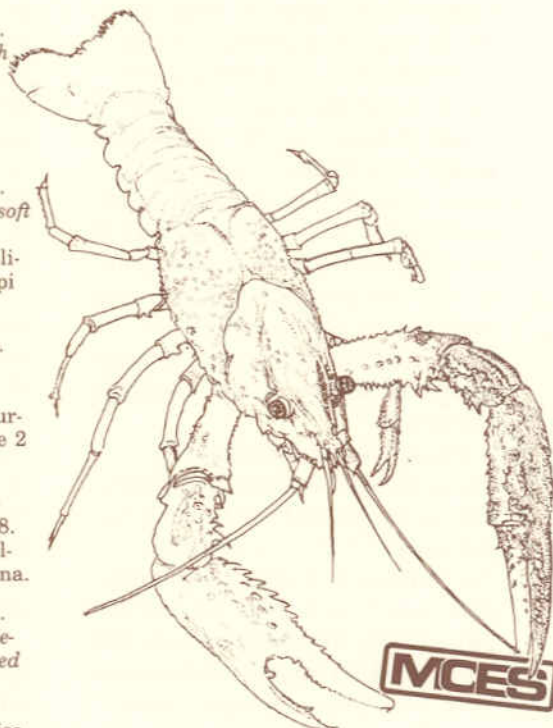
A business plan with an estimate of expenses is essential to any successful venture. We strongly recommend that anyone interested in soft-shell crawfish production make good use of enterprise budgets and cost and return estimates before starting construction. These budgets have been developed from information provided by Mississippi producers and are available through your county agent. While other economic analyses are available, they are based solely on model production systems.

Crawfish production is a relatively new industry, and techniques and methods will differ greatly. Because conditions will vary among sites and with the skill and experience of the individual operators, it is very difficult to predict mortality rates, feeding, shedding rates, and other variables. Building and operating costs can vary widely. All of these can seriously affect the profitability of your

operation. We strongly suggest that you contact your Extension county agent, or the Coastal Research and Extension Center in Biloxi to obtain more information on this venture.

## Additional Reading

- Culley, D. D., and L. F. Duobinis-Gray. 1990. *Culture of the Louisiana soft crawfish*. Louisiana Sea Grant College Program, Louisiana State University, Baton Rouge, Louisiana.
- Culley, D. D., M. Z. Said and E. Rejmankova. 1985. *Producing soft crawfish*. Louisiana Sea Grant College Program, Louisiana State University, Baton Rouge, Louisiana.
- Homziak, J. 1989. *Producing soft crawfish: is it for you?* Aquaculture Magazine 15(1): 26-32.
- Malone, R. F., and D. G. Burden. 1988. *Design of recirculating soft crawfish shedding systems*. Louisiana Sea Grant College Program, Louisiana State University, Baton Rouge, Louisiana.
- Posadas, B. C., and J. Homziak. 1991a. *Enterprise budgets for Mississippi soft crawfish production*. Mississippi Cooperative Extension Service Publication, Mississippi State, Mississippi (in press).
- Posadas, B. C., and J. Homziak. 1991b. *Costs and returns of open versus closed systems for producing soft-shelled crawfish in Mississippi*. Journal of Applied Aquaculture. Volume 2 (in press).
- Reigh, R. C. 1988. Louisiana Aquaculture Conference, April 28 - 30, 1988. Louisiana State University, Agricultural Center, Baton Rouge, Louisiana.
- Shirley, L., J. Homziak and C. D. Veal. 1989. *Factors influencing market development for Mississippi soft-shelled crawfish*. Mississippi-Alabama Sea Grant Program Publication No. 89-035. Mississippi Sea Grant Advisory Service, Biloxi, Mississippi.



This work was sponsored in part by the NOAA/National Sea Grant College Program, U.S. Department of Commerce, under Grant Number NA89AA-D-SG016, through the Mississippi-Alabama Sea Grant Consortium. The U.S. Government and the Mississippi-Alabama Sea Grant Consortium are authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear within. This is Publication No. MASGP-90-022.

By **Jurij Homziak**, Extension Marine Resources Specialist, and  
**Benedict C. Posadas**, Marine Resources Specialist.

Mississippi State University does not discriminate on the basis of race, color, religion, national origin, sex, age, handicap, or veteran status.

### Publication 1780

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914.  
HIRAM D. PALMERTREE, Director

(1M-5-91)