

Producing Soft-Shell Crawfish In Off-Season Catfish Hatcheries

By Jurij Homziak

Soft-shelled crawfish production has the potential to be an important aquaculture industry in the Gulf and southeastern states. It is particularly attractive because it can be a relatively low technology, low investment seasonal activity (December through May); however, this potential has remained largely unrealized because of the low prices paid to soft-shell crawfish producers. At the current market price of \$6.00 to 6.50 per pound for top grade soft-shell crawfish, many producers simply cannot operate profitably.

Low producer prices are the result of a limited market for soft-shell crawfish. A few years ago, when demand outstripped supply, producers asked for and got more than \$11.00 per pound. Word of the profits that could be had at these prices spread quickly. In one or two seasons production of soft-shell crawfish far out-grew the ability of existing markets to absorb the increase. As a result, prices fell to where they are today.

Some industry leaders have suggested that expanding

markets will cause prices to rise and allow profitable operations. While greater demand will help the industry overall, this view may be unrealistic. Even if markets do expand, the price buyers are willing to pay is not likely to rise much above current levels. There are a number of reasons for this.

First, the supply of soft-shell crawfish can easily keep up with any foreseeable expansion in demand, dampening any price increases. There is a lot of unused production capacity in the industry that would come into production in response to any significant increase in producer prices. Low investment cost and low technology requirements will also prompt the industry to again expand and increase production should prices rise significantly.

Second, the market for soft-shell crawfish, a luxury food by definition, may be limited. Even under the best of circumstances, consumer demand for luxury food products is limited. A recent soft-shell crawfish market study (Shirley et al. 1989) found that even small increases in producer prices

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above current levels caused demand for soft-shell crawfish by restaurants, seafood brokers and retail consumers to drop dramatically. Producer prices of \$6.00 to 6.50 per pound translate to over \$11.00 per pound going into white tablecloth restaurants, the main market for soft shells, once all the handling, middle man profits and other costs are added.

Improving Profitability

It may be more realistic to assume that, in the near future at least, producer prices will remain fairly steady and close to current levels. Under these circumstances, turning a profit from soft-shell crawfish will depend on improving efficiency through reduced operating costs, increased returns or, most probably, a combination of both. Research is underway to automate the production process, reducing the amount of labor used and lowering production costs is in this heavily labor intensive industry (Malone and Chen 1991).

Taking advantage of warmer water temperatures and lower stocker crawfish prices, a number of Mississippi producers have limited production to the later part of the season. Expensive heaters and water filters are not needed in open systems, eliminating heating and filter maintenance costs. Less time and skill are needed to manage open as opposed to closed shedding systems, producing significant labor cost savings.

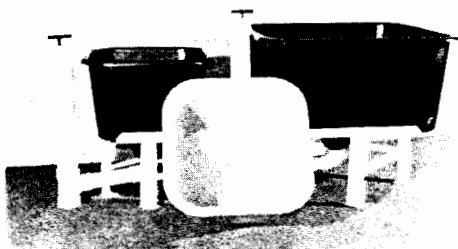
There have also been suggestions that crawfish molting rates can be improved to increase productivity (Huner 1990). While intriguing, this approach remains a long way from practical application.



Dr. Bob Durborow, Mississippi Cooperative Extension Service (left) and Battle Fish Farms hatchery during soft crawfish trials.

Growing other fish or shellfish in the shedding system has also been suggested as a possible way of improving profitability (Bodker 1991). Intriguing, but practical concerns remain to be answered before such an approach can be successful. What are the high value species that can be grown? What will it cost to produce them? Where are the markets? How will space, labor, management and other

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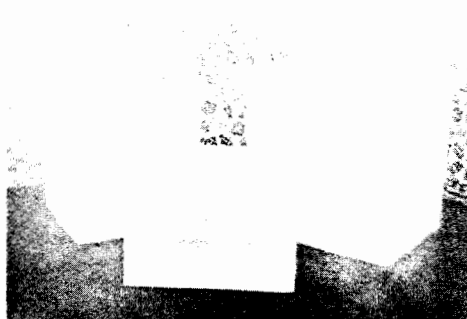
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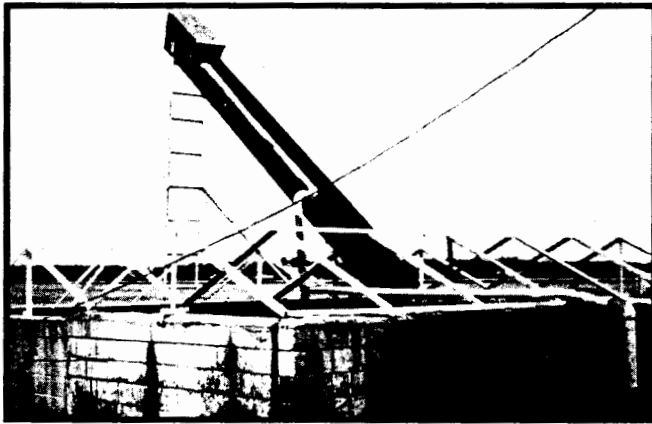
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Aeration tower at the hatchery.

resources be divided? How will soft-shell crawfish production be affected? There are no simple answers.

Producing Soft-Shells in Catfish Hatcheries

Rather than try to grow other species in soft-shell shedding systems, it may be more profitable and straightforward to grow soft-shell crawfish in existing commercial aquaculture facilities. Specifically, in catfish hatcheries. The design and inputs needed to operate a catfish hatchery are very similar to soft-shell crawfish shedding systems. Both use warm, flowing good quality water, insulated buildings, troughs for holding the stock, commercial catfish feed and skilled labor familiar with handling aquatic animals.

Catfish hatcheries are widespread and fairly common, found on most larger fish farms throughout the catfish farming region. With the heart of catfish country in the Delta region of the lower Mississippi, most hatcheries are also close to stocks of crawfish in Louisiana. Most important of all, catfish hatcheries operate for only about ten weeks of the year, starting up in late April or early May in the Mississippi-Louisiana-Arkansas area. Because the soft-shell crawfish season can start as early as November, this leaves a window of opportunity early in the year for soft-shell crawfish production in catfish hatcheries.

Financial Benefits

Using off-season catfish hatcheries for soft-shell crawfish can significantly lower crawfish production costs. Sharing hatchery facilities and equipment would eliminate most initial investment costs, estimated to be over \$22,100 and \$16,700 for 1,440 ft² closed and open shedding systems, respectively (Posadas and Homziak 1991). Annual fixed costs for the crawfish enterprise (estimated at \$3,265 for 1,440 ft² open systems) would also be reduced through sharing depreciation with the hatchery and, because there are no construction costs, by eliminating interest payments.

Using estimated annual costs and returns (Posadas and Homziak 1991), an open 1,440 ft² system can produce about \$13,252 worth of crawfish in four months (at a \$6/lb base price). With no initial construction loan to service and depreciation shared equally between catfish and crawfish, total annual costs for soft-shell crawfish production in a

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catfish hatchery would be about \$9,699, returning \$3,553 to land, labor, management and risk. This is nearly 2 1/2 times the \$1,444 return projected for a standard open shedding system over the same period.

Soft-Shell Crawfish Production Techniques

Soft-shell crawfish shedders can refer to a number of excellent references to learn more about the catfish hatchery business. Contact your state Extension Service for information on these publications. On the other hand, most catfish farmers and hatchery managers are not familiar with soft-shell crawfish production; however, because the success of this approach depends on the interest of this group, it may be useful to review how shedding systems operate. The **References** and **Additional Information** sections below identify some useful publications on soft-shell crawfish production.

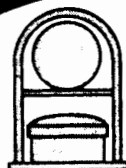
Crawfish must periodically shed their hard outer shell to grow. When crawfish mature and stop growing they no longer molt. Growing crawfish may shed their shells up to 11 times in their lives, and may molt every 15 to 25 days when temperature is favorable, water quality is good and feed is abundant. As the crawfish sheds its hard outer shell the emerging soft-shell expands in size and then hardens in a few hours. It is during this brief time period between shedding and hardening that softshells may be harvested. Understanding and controlling this cycle of growth and molting is the key to shedding soft-shell crawfish.

Not all crawfish are suitable for shedding. Only the red swamp crawfish, distinguished by the dark line running

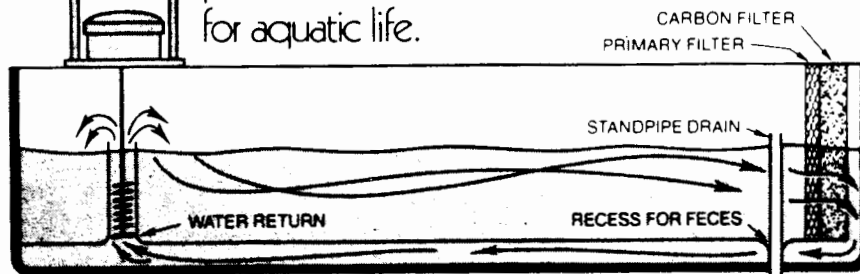
under the tail, is used. The other common crawfish, the white river crawfish, does not do well in shedding systems. Mature crawfish are also unsuitable for shedding operations because they generally have stopped molting. Only young, immature actively growing crawfish are used. Culley and Duobinis-Gray (1990) provide a good illustrated guide that shows how to identify red swamp crawfish and how to sort mature from immature crawfish. It takes a little practice (and a few mistakes) to sort mature from immature crawfish.

To catch molting crawfish during the brief period when they are soft requires collecting suitable crawfish and holding them until they molt. Providing feed and good quality water of the correct temperature greatly improves molting success. The crawfish are held in plastic or fiberglass covered plywood trays, usually about 8 feet long, 3 feet wide and at least 6 inches deep. Most operations have the trays arranged in pairs, side by side, to form rows with walkways about 3 feet wide between them. This allows access for feeding, collecting molts, cleaning and other activities. Most producers operate 48 to 60 trays. Considering the time and effort involved in transportation, sorting, acclimation, feeding, handling and processing, 60 fully stocked trays can occupy two people pretty much full time over the production season.

Shedding operations usually maintain 1/2 to 1 inch of water in the bottom of the trays. This allows the crawfish to be partially out of the water and to survive in the event of a dissolved oxygen problem. Often a fine spray of water over



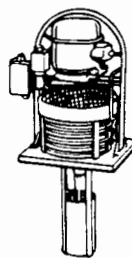
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the tray surfaces is used to aerate the water and keep up water quality. Depending on density and the aeration design, water flows of 1 to 3 gpm are usually enough to keep dissolved oxygen levels above 5 mg/l and total ammonia below 0.5 ppm. The trays are slightly tilted to allow water to drain through a screened outlet. Water temperatures for molting range from 72° F for young of the year crawfish (those available from about February onwards) to 80-82°F for crawfish wintering over from the previous season.

Good quality crawfish are generally available in the Gulf coast states from December to May. Both farm-raised and wild crawfish can be used but poorly handled crawfish will not survive in the shedding facility. Once at the operation, the crawfish are acclimated with no feed for 12-24 hours, usually in unused holding trays. They are then stocked at about one pound (about 24 to 30 crawfish) per square foot of tray surface. The crawfish are fed standard floating catfish feed a rate of 1-2 % of body weight daily in one or two feedings. Mortality usually runs 1-5 per day.

Assuming all goes well, the newly arrived crawfish will molt in about two to four weeks. As crawfish approach molting, they become dark in color and stop feeding. To protect molting crawfish from being cannibalized by their neighbors, crawfish getting ready to molt are removed from the holding trays each day and put into separate molting trays. Grouped together, the non-feeding pre-molt crawfish will not attack newly molted soft-shell crawfish.

Molting rates usually range, on average, from 1.5 to 2.5

percent of the stock held per day. On some days very few crawfish will be molting, on others the rate may reach 5 to 10 percent. One molting tray for every 10 holding trays is usually enough. More than 90% of crawfish molt in daylight hours. This relieves the operator of night duties. Because crawfish harden beyond the acceptable soft stage in less than three hours the molting trays must be inspected at regular intervals during the day to harvest molted crawfish.

Harvested crawfish are usually kept in ice water to slow down hardening. Soft-shell crawfish are usually frozen, either whole or after processing (to remove the two hard stones all soft-shell crawfish have in their heads). Buyers preferences determine the product form, packaging and the degree of processing. Product labels must meet legal requirements as will on-site processing facilities.

Pilot Scale Feasibility Trial

A vertically integrated catfish farm in northern Mississippi demonstrated that a catfish hatchery can be successfully used in the off-season for soft-shell crawfish. Operations began in December using 20 hatching troughs, 18 for holding trays, 2 for molting. Additional troughs were used, as needed, as acclimation trays. Stocker crawfish were purchased once a week, already sorted, from an established supplier in south Louisiana and the crawfish were transported in a fish live haul truck about 450 miles to north Mississippi.

Many catfish hatcheries in the Mississippi Delta rely on deep wells to provide warm, high quality water. The trial shedding operation adapted standard industry operating prac-

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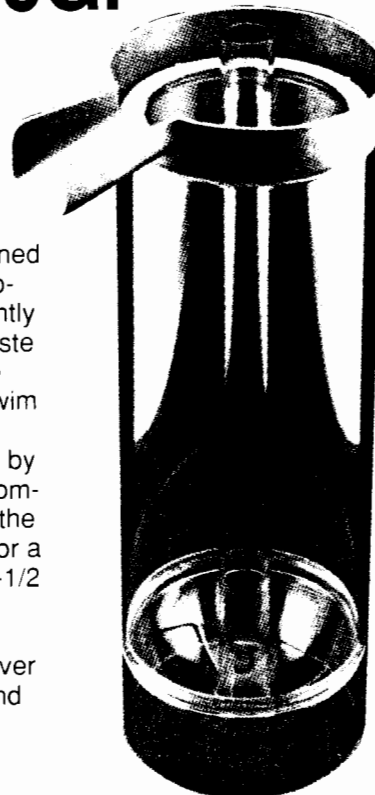
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tices to take full advantage of the abundant geothermal (78-80°F) well water. After some trial and error, the operators decided that deeper, more frequently exchanged water produced better molting and survival rates than did recommended approaches. Depths of 6-8 inches and flow rates of between 3 to 5 gpm maintained excellent dissolved oxygen, water quality and temperature.

Another potential advantage of using deep well water for shedding crawfish in the Delta is that it is very soft. Experiments with soft-shelled crabs have shown that shell hardening can be significantly delayed if the newly molted crabs are held in very soft water. While there was no documented evidence that this had happened, observations by the facility operators suggest that soft-shell crawfish produced in soft water may stay in the marketable soft condition longer.

The hatchery was in a fully insulated building. The warm water flowing through the trays kept the interior of the building comfortable, even when it was quite cold outside. The operation reported an average molting rate near 2.5 %, above average for established Mississippi soft-shell crawfish producers and well above rates expected for a start-up operation. Mortality rates were extremely low, less than 1 %. Production was marketed in nearby metropolitan areas, in local restaurants and involved some of the buyers of the fish farms catfish.

The operation shut down at the end of March to allow several weeks for clean up and preparation for the catfish breeding season. Production operations fit smoothly into the

catfish hatchery production cycle. While most of the product was eventually sold, the majority of sales were small lots. The modified hatchery-shedding facility could profitably produce soft-shell crawfish at current farm gate prices (about \$6.00 per pound), but markets for soft shell crawfish in catfish country remain small, scattered and difficult to access. Marketing consumed too much time and effort for Battle Fish Farms to resume shedding operations the following season.

There appear to be several reasons the exceptional performance during the trial. Abundant supplies of warm, good quality water eliminated water quality problems. Without water heaters and filters, the operation was freed from the disastrous malfunctions often encountered in recirculating systems. The operation also started pretty high up on the learning curve. First there was no need to develop the technical skills to operate a recirculating system (avoiding a significant number of system problems and failures along the way). Second, as experienced catfish hatchery operators, they already possessed the technical and management skills essential for success.

Conclusions

Soft-shell crawfish can be produced in off-season catfish hatcheries at costs below farm gate prices. Catfish hatcheries can be used for soft-shell crawfish production essentially without modification, providing hatchery operators with an opportunity to realize greater returns from their hatchery facilities. While marketing problems still remain, the soft-

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crawfish industry need not be limited by high production costs. Innovative approaches to reducing production costs will be the key to the success of the soft-shell crawfish industry. With better access to national and international markets, producing soft-shell crawfish in off-season catfish hatcheries may be the key to profitability in the future.

Additional Information

Mississippi State University Cooperative Extension Service has a limited number of copies of publications essential to anyone considering soft-shell crawfish production in catfish hatcheries. *Enterprise Budgets for Mississippi Soft-Shell Crawfish Production* (Publication No. 1812, Posadas and Homziak 1991) and *Producing Soft Crawfish in Mississippi: is It For You?* (Publication No. 1780, Homziak and Posadas 1991) are available from the Mississippi Cooperative Extension Service, Coastal Research and Extension Center, 2710 Beach Blvd., Suite 1E, Biloxi, MS 39531. An earlier version of Homziak and Posadas' (1991) manual appeared in this magazine (Homziak 1989). Alabama, Louisiana and Mississippi Cooperative Extension Services also have published information on the design, operation and financial aspects of catfish hatcheries and fish farms. Contact your County Agent, the state Cooperative Extension Service or Sea Grant for information on how to obtain copies of these publications.

There are a number of other good soft-shell crawfish production manuals available (e.g. Culley and Duobinis-Gray 1990), along with financial information and enterprise

budgets (e.g. Posadas and Homziak 1993), that describe the commercial softshell crawfish industry in detail. New developments in the industry are often described in the annual *Proceedings of the Louisiana Aquaculture Conference* (available from the Louisiana State University Agricultural Center, Baton Rouge, LA). The newsletters of the Louisiana Soft-Shell Crawfish Association and the Crawfish Center, both located in Lafayette, Louisiana, may also be useful.

Acknowledgements

Bob Durborow, now an Aquaculture Specialist at Kentucky State, first saw the potential connection between catfish hatcheries and soft-shell crawfish while working in the Mississippi Delta. Previous work with Ben Posadas also figured in the development of this article. This work was sponsored in part by the NOAA/National Sea Grant College Program, U.S. Department of Commerce, under Grant No. NA89AA-D-SG016, through the Mississippi-Alabama Sea Grant Consortium. The U.S. Government and the Consortium are authorized to produce and distribute reprints for governmental purposes, not withstanding any copyright notation that may appear within. This is Mississippi-Alabama Sea Grant program Publication No. MASGP-92-014.

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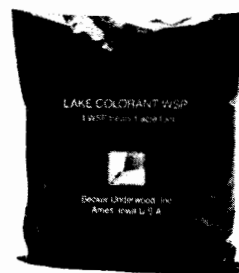
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