

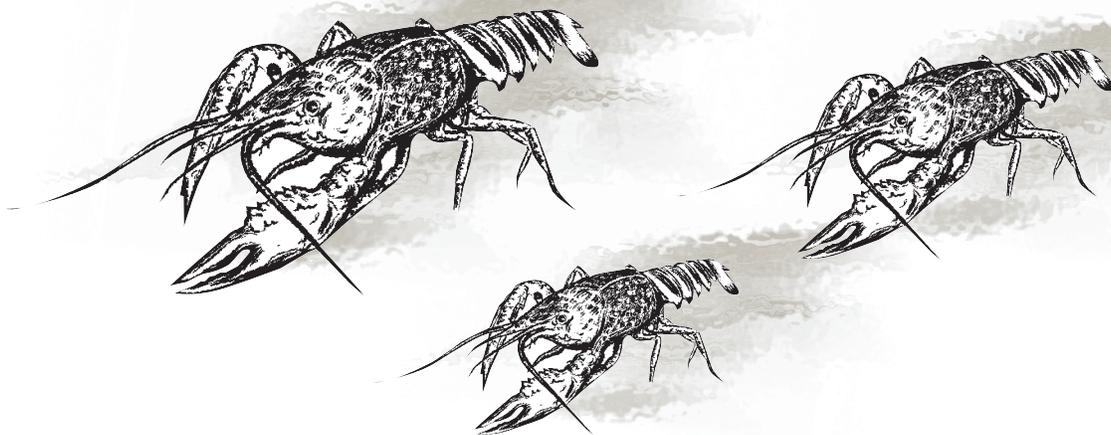
# **Aquaculture**

in *North Carolina*

## **Crawfish**

---

*Inputs, Outputs and Economics*



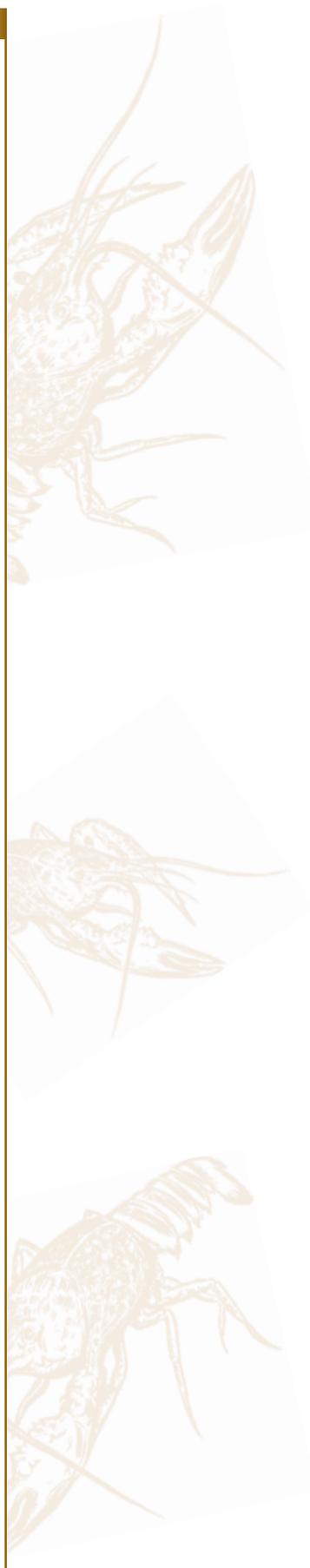
*North Carolina Department  
of Agriculture and Consumer Services*

*Aquaculture and Natural Resources*

# Contents



<b>About This Publication</b> .....	2
<b>U.S. Aquaculture and Crawfish Production</b> .....	2
<b>Production Cycle</b> .....	3
<b>Inputs</b> .....	3
water .....	3
land .....	3
breeding stock .....	4
feed .....	4
oxygen .....	4
medication & chemicals .....	5
electricity & fuel .....	5
harvest bait .....	6
labor .....	6
equipment use .....	6
<b>Outputs</b> .....	6
crawfish .....	6
effluent .....	7
<b>Economics</b> .....	7
initial investment .....	7
operating costs & returns .....	8
<b>Other Topics</b> .....	9
financing .....	9
farm size .....	9
insurance .....	9
permits & licences .....	10
markets .....	10
<b>Crawfish Budgets</b> .....	11
<b>Sources of More Information</b> .....	15



### About this publication

~ ~ ~

The North Carolina Department of Agriculture and Consumer Services, Division of Aquaculture and Natural Resources, created this publication to assist individuals interested in the business of crawfish farming. The publication was also designed for bank lenders who may need more information on the industry to evaluate loan proposals. A description of the inputs and outputs of North Carolina crawfish farms, as well as an estimate of costs, returns, and resource requirements for an example farm are provided. For technical recommendations on building and operating a fish farm, individuals are encouraged to contact agents with the North Carolina Cooperative Extension Service. For information on state regulations governing aquaculture, or for help in preparing an aquaculture business plan, contact the North Carolina Department of Agriculture and Consumer Services (NCDA&CS). See *Sources of More Information* for individuals to contact.

Crawfish farmers simulate the natural habitat of crawfish by constructing shallow ponds which are drained, flooded, and planted with a forage crop at appropriate times during the year.

### U.S. Aquaculture and Crawfish Production

~ ~ ~

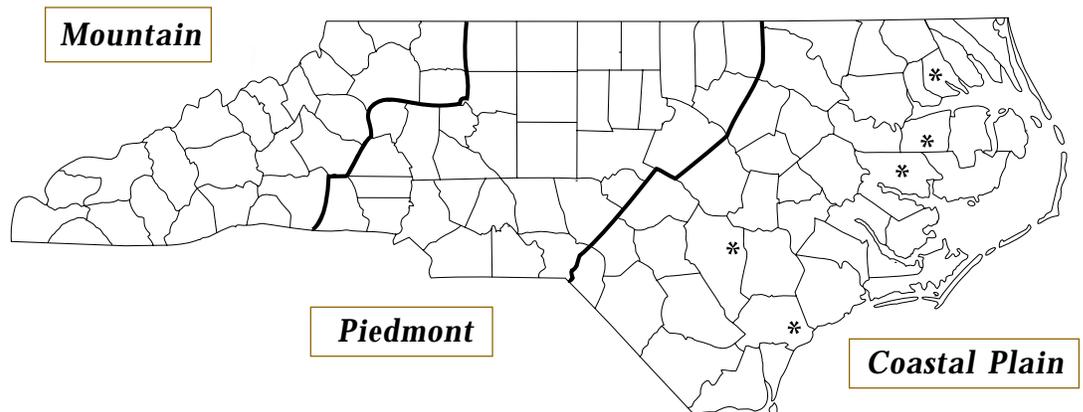
Aquaculture is the fastest growing segment of U.S. agriculture. The farm value of the U.S. aquaculture industry is estimated to be nearly \$1 billion. Crawfish production accounts for about 3% of the total.

Crawfish farmers in the U.S. harvest 40-50 million pounds of crawfish annually. Louisiana consumes 70% and produces 90% of the farmed total. Texas, Florida, and Alabama produce most of the remaining 10%, with North Carolina (NC) contributing less than 1% of the total. In 2000, there were five commercial producers in the state who harvested about 20,000 pounds of

crawfish. All commercial producers are located on the coastal plain.

Wild crawfish grow in wetland areas that may dry in the summer months. Aquaculturists simulate the natural habitat of the crawfish by constructing shallow ponds which are drained, flooded, and planted with a forage crop at appropriate times during the year. Large-scale crawfish aquaculture developed in Louisiana as a means to increase income from rice fields. Today, farmers in Louisiana grow crawfish both in conjunction with rice and as a stand-alone crop. Farmers in NC raise crawfish only as a stand-alone crop, although they can earn extra income by leasing the ponds for duck hunting from fall through the spring.

North Carolina Crawfish Farms, by County, 2000



## Production Cycle

Adult crawfish mate in open water throughout the year, and females burrow into the pond banks to hatch their young. Farmers drain ponds in summer then flood them in spring when the “young-of-the-year” crawfish emerge. Draining allows the farmer to plant a forage crop, usually sorghum. The vegetation, which begins to decay once ponds are filled, serves as the food for crawfish until the cycle begins again with the next summer draw-down. Crawfish in the U.S. are harvested from November through June. Cooler water in NC shortens the harvest season to April through June.

Virtually all crawfish are grown using a forage crop planted during summer draw-down. Crawfish can be grown in ponds that are flooded year-round, as long as feed and a climbing structure are available. However, this production strategy has not proven to be as profitable as the current practice of draw-down and planting of forage. Some farmers do apply raw soybeans or hay to the pond to supplement forage.

## Inputs

Following is a discussion of the production inputs used to raise crawfish. While inputs and target rates for their use have been identified, neither producers nor researchers have been able to precisely quantify the use of an input in terms of pounds of improved yield. For example, some increase in the amount of available forage has not been shown to improve crawfish production by a particular number of pounds per acre. The farmer’s ability to provide a healthy water environment and adequate forage crop are perhaps the most critical factors contributing to successful culture of crawfish.

### Water

Water is the growing environment for aquatic animals, so a source of good quality water is vital to their culture. Well water is often recommended for aquaculture because the quality and quantity of surface water—water from streams or lakes—is often unpredictable. The major disadvantage of well water is that it is usually much more costly to obtain than surface water. Most crawfish ponds in NC utilize rainfall, surface water, or shallow groundwater rather than wells. The example farm in Crawfish Budgets (pages 11-14) assume that shallow groundwater is the water source. The groundwater fills barrow ditches (see *Land*, below) constructed around the periphery of the pond, and water is then pumped into the pond. Water is used to fill the pond, compensate for evaporation and seepage, and to periodically flush the pond if water quality deteriorates. The flow of well water, measured in gallons per minute (gpm), determines the pump size. Recommended practice is to initially fill ponds to a level of 12 inches, then later in the season to fill to 18 inches, each within a two-week period. This requires a pumping capacity of about 15 gallons per minute (gpm) per acre.

**NC crawfish are harvested between April and June.**

**Most NC farms use surface water or shallow ground-water. Recommended pumping capacity is about 15 gallons per minute per water acre.**

### North Carolina Crawfish Production Cycle Established Pond

<b>June</b>	<i>Drain ponds and plant forage crop</i>
<b>Aug-Sept</b>	Forage crop matures
<b>November</b>	<i>Flood ponds to a depth of 8 to 12 inches</i> Crawfish emerge from burrows and feed on available forage
<b>December</b>	<i>Flood ponds to depth of 18 inches</i>
<b>Jan-Feb</b>	Crawfish feed on forage
<b>April-June</b>	<i>Harvest crawfish</i>

Therefore, for the example 10 acre pond, the water pump supplies 150 gpm.

### **Land**

Optimal land for pond aquaculture is cleared and flat or has a slight gradient, with a clay content of greater than 20%. For crawfish farming, high clay content is particularly important because crawfish can burrow five or six feet into levees.

Agents with the Natural Resource Conservation Service (NRCS) can determine the suitability of a land area for fish farming, and test the soil for pesticide residues which may rule out the use of the land for any type of aquaculture.

The North Carolina Department of Agriculture and Consumer Services (NCDA&CS), Agronomic Division, does a comprehensive soil analysis on request. The NCDA&CS or NRCS can also help the farmer contact someone with the U.S. Corps of Engineers to determine if any of the potential site is considered wetlands. In almost all cases, wetlands can not be converted into fish ponds.

Potential crawfish farmers have more latitude than other aquaculturists in their choice of land because pond bottoms do not have to be completely cleared. Rather than deriving levee (dike) material from the center of the pond, some NC crawfish pond levees were built by constructing a “barrow ditch” around the pond periphery; the land surface becomes the pond bottom. This construction method can reduce land clearing and pond construction costs, but a very uneven pond bottom may reduce the effectiveness of paddle wheel aerators. (see *oxygen* below)

The cost of land suitable for fish farming in rural NC typically ranges from \$1,000 to \$1,500 per acre. Crawfish Budgets assume \$1,250 per acre.

Characteristically, crawfish farms use about 80% of the total land area for water.

The remaining 20% is used for levees and barrow ditches.

### **Breeding Stock**

Crawfish are initially stocked in April or May of the first production year at the rate of 50 to 100 pounds per acre. Once stocked, crawfish breed in the ponds, and farmers do not need to purchase crawfish stock again. There is no hatchery or fingerling stage as is typical for other types of aquaculture.

One of the biggest disadvantages of uncontrolled breeding within the pond is the likely appearance of numerous unmarketable “runts,” which often appear in the 3rd or 4th and successive years after stocking. Stunting is likely to occur if the pond was not harvested heavily enough, leaving 10 or more crawfish per square meter.

At its worst, stunting can lead to a production year when almost no crawfish of market size are harvested. To prevent stunting, producers are encouraged to maintain forage and water quality so that these do not become limiting to growth, fully harvest ponds each year, drain the pond rapidly after harvest so that not all crawfish have time to burrow, and remove some young-of-the-year crawfish soon after flood-up in fall if they appear too numerous.

### **Feed**

Crawfish feed on decaying vegetation from pond fill-up to draw-down. Sorghum sudan grass is the most common forage crop used in NC ponds. NC producers do not raise crawfish in conjunction with any other crops (such as rice). Producers typically apply seed and fertilizers at equal to or less than the commercial rate. Costs of forage production constitute about 8% of annual variable operating costs. In comparison, the feed cost for fin fish (such as catfish) production typically represents 50% to 60% of variable costs.

**Crawfish farms can be built on partially cleared land and on high-clay soils unsuitable for other crops.**

**Crawfish feed on forage crops such as sorghum-sudan. Some farmers also supplement planted forage with soybeans.**

Too little or too much rainfall can have an adverse effect on the amount of forage available, and inadequate forage can dramatically lower production. Some crawfish producers in recent years have supplemented natural forage with raw soybeans, applied at a rate of 20 pounds every two to three days. Research studies in Louisiana, and anecdotal evidence from growers in NC, show this to be an effective means to supplement planted forage.

### **Oxygen**

Like all animals, crawfish require oxygen to live. Oxygen in natural waters comes from two sources: oxygen produced by algae, and oxygen transferred from the air into the water by wind action.

In crawfish ponds, a great deal of oxygen is required during the biological breakdown, or decay, of the forage crop from fall through spring. Most production problems are related to depletion of oxygen. Unlike some cultured aquatic animals, such as catfish, which swim to areas of better water quality, crawfish do not readily move to areas of the pond where oxygen levels are higher. However, some crawfish will crawl out of the pond onto levees if oxygen levels are low.

Many crawfish producers add water and circulate and aerate pond water to raise the level of dissolved oxygen. As water enters the pond it can be pumped through an aeration screen, or paddlewheel aerators in the pond can both circulate water and add oxygen to the water.

Recirculation and aeration are achieved by using one or more pumps and some means of passive aeration, such as a series of screens through which water splashes before re-entering the pond. Most Louisiana producers rely on pond flushing and passive aeration to maintain oxygen levels, and pond water is exchanged an average of nine times per season. Research indicates that water and energy are used more efficiently by

replacing high-flow water pumps and screen aeration with mid-pond baffle levees and paddlewheel aerators. The baffle levees create an internal maze-like levee system within the pond. While aerators alone add oxygen to the water, baffle levees used in conjunction with an aerator create a fast flowing stream of oxygenated water throughout the pond. This significantly reduces the amount of water required, since existing water is recirculated. It does increase the initial construction costs, since more dirt is moved to create the mid-pond levees.

Crawfish Budgets assume the use of electrically-powered pumps to fill the pond from a surface water source, baffle levees, and a 5 horsepower electric paddlewheel aerator.

While crawfish can survive in ponds that do not circulate or aerate water, production will likely be less than 300 pounds per acre, compared to 500 to 1,500 pounds expected from ponds in which high oxygen levels are maintained.

### **Medication & Chemicals**

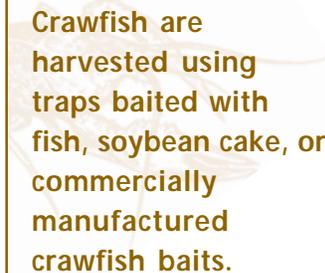
Crawfish culture using current methods is virtually free of significant disease problems. While lime may be used to alter the pH of pond water, no other medications or chemicals, other than herbicides used in conjunction with the forage crop, are commonly used.

### **Electricity & Fuel**

Electricity and diesel fuel are used for the water pump, aeration, and mowing of levees. The cost of installing electrical lines is site specific, ranging from zero to tens of thousands of dollars depending on the distance to existing electrical lines. Farmers should contact their local electrical utility office for help in determining the cost. Tractor-powered pumps and paddlewheels can be used in areas where these costs are prohibitive. Crawfish Budgets assume that



**Most crawfish mortality is related to low levels of dissolved oxygen. Farmers maintain a high oxygen content by circulating and aerating pond water.**



**Crawfish are harvested using traps baited with fish, soybean cake, or commercially manufactured crawfish baits.**

the farm uses electricity and is located close to an electrical line.

Electrical and fuel costs make up about 10% of the total variable costs per year.

### ***Harvest Bait***

Crawfish are harvested using traps which are normally baited one day and emptied and re-baited the next. Ten to twenty wire mesh traps per acre are set with either fish or commercially manufactured baits. Some NC producers use trash fish for bait, at a cost about one-quarter that of available manufactured baits, but fish is much more difficult to source and handle. Crawfish Budgets assume use of manufactured soybean cake or cottonseed, at a cost of \$15 per 50-pound bag. Bait is used at a rate of 1/3 pound per trap, four times per week over a 16-week harvest season.

### ***Labor***

Most labor is confined to summer planting of the forage crop and the March-June harvest season. Managers also need to oversee the farm during the months when it is flooded to ensure that oxygen levels remain high.

Labor costs on large farms are 20-40% of annual variable operating costs and they depend largely on the harvest method employed. Harvest and re-baiting of traps in smaller operations is done by “walking the pond,” manually emptying traps onto a motorless harvest platform. Large farms often use some type of motorized apparatus, such as a “crawfish combine” which allows the operator to harvest four to five times as many traps per hour. Smaller farms use more labor than larger farms, but avoid the \$6,000 to \$8,000 investment in a harvest combine.

The 10-acre farm in Crawfish Budgets assumes no use of hired labor, and they do not include a cost for owner’s labor.

Owner’s labor is estimated at 15 to 20 hours per week during the harvest season to actually harvest the crawfish, plus additional time for marketing and delivery. Less than five hours per week during the rest of the year is typically required.

### ***Equipment Use***

Mesh traps for harvest, one or more pumps to source water, harvest equipment (consisting of a john boat and metal tubs), and some means of aeration are the principle equipment required for crawfish production. A shed and some means of holding crawfish until sale are also commonly used. The Holding Equipment in the Investment Costs table includes a cost for PVC pipe and cement blocks which combined provide a holding pen and water spray to keep crawfish damp until they are sold.

### ***Outputs***

#### ***Crawfish***

Newly hatched crawfish generally reach market size—25 to 30 grams, or about 15 to the pound—in two to three months. Harvested crawfish may be recently matured young-of-the-year, or older crawfish from the previous year.

In NC, most product is sold to NC restaurants and seafood markets, or pond-bank to individual consumers. Crawfish are sold live within two to three days of harvest, and can live for one to two weeks if properly refrigerated.

The pounds of crawfish that a farmer produces and traps can vary from year to year. The quality of water and the forage crop, the severity of predation by fish and birds, and the degree of stunting caused by overpopulation are three factors that affect annual production.

**Harvest varies widely from day to day, and producers can expect to trap from 15 to 90 pounds per acre per week during the season.**

**Crawfish Production Summary Budget, Years 1-2 \***

	<b>Year 1 (April - December)</b>		<b>Year 2 &amp; thereafter</b>	
Pounds Harvested	lbs.	-	lbs.	6,500
Income	\$	-	\$	14,625
Expenses				
forage crop	\$	525	\$	525
electricity & fuel	\$	284	\$	479
repair & maintenance	\$	240	\$	360
interest on operating funds	\$	52	\$	123
debt payment	\$	3,747	\$	3,747
property taxes & insurance	\$	625	\$	625
harvest & marketing	\$		\$	1,087
<b>Total Expenses</b>	<b>\$</b>	<b>5,474</b>	<b>\$</b>	<b>6,945</b>
Returns to Owner's Labor, Land, & Capital	\$	(5,474)	\$	7,680

\* Excludes annual depreciation, estimated at \$1,209

**Crawfish Budgets assume that the farmer borrows one-half of the total initial investment.**

The pounds of crawfish trapped on any given day or week during the harvest season is unpredictable. Producers expect harvests of about 40 pounds per acre per week during the season. For the 10-acre operation in Crawfish Budgets, this results in a weekly harvest of 400 pounds during the 16 week season. The average annual harvest for managed NC crawfish farms is estimated at 650 pounds per acre, per year.

**Effluent**

Crawfish ponds may release water in periods of heavy rainfall, when ponds are drained, and when water is exchanged in an attempt to improve water quality. Crawfish production methods mimic conditions in the wild, and thus water released from these artificial wetlands is not expected to be of significantly different quality than other wetland areas.

In NC, effluent from aquaculture operations is monitored if the farm discharges greater than 30 days per year and produces more than 100,000 pounds per year. Currently, no crawfish operations meet both these criteria.

**Economics**

~ ~ ~

The tables below estimate initial investment, operating costs, and annual returns for a 10-acre crawfish enterprise. The enterprise consists of one, 10-acre pond. The pond is built in April of Year One and stocked with 750 pounds of crawfish, drained in the summer and planted with a forage crop, and flooded in the fall. The owner harvests 650 pounds of crawfish per acre in Year Two and thereafter (years are calendar years, from January to December).

The crawfish enterprise is an addition to an existing farm. The budgets assume that land and some equipment (a mower and repair equipment) are already owned. Summaries of the investment and operating costs and returns for years one and two are given above. (A detailed investment budget and costs and returns appear on pages 11-14).

**Initial Investment**

The 10-acre pond requires an initial investment of \$31,725 for pond construction, the well, and new equipment. In addition, the owner supplies the land (valued at \$15,625 or \$1,250 an acre) and

**From the first harvest, March to June of the second year, the 10-acre farm earns \$6,945 in profit to the farmer's labor, land, and capital.**

some equipment that is already owned (valued at \$2,500). The budget assumes that the farmer purchases \$7,675 in new equipment. The farmer borrows the remaining \$24,050 for pond construction and water supply. Thus, the farmer invests about half of the total initial investment by investing owned land, owned equipment, and cash to buy new equipment. The borrowed amount is financed by a bank at 10% over 10 years.

**Initial Investment**

(Including owned land & equipment)

	Value(\$)	% of total
land (owned)	15,625	31
equipment (owned)	2,500	5
new equipment	7,675	16
pond construction	19,750	40
water supply	4,300	8
<b>Total</b>	<b>49,850</b>	<b>100</b>

**Operating Costs and Returns**

Sales are based on a price of \$2.25 per pound. Pond-bank prices have ranged from \$2.00 to \$2.50 per pound over the last few years. NC crawfish are sold directly to the public, or to local retailers or restaurants. Net returns are calculated before income tax and do not include the costs of owner labor or use of owner funds.

Costs are split into the categories of variable costs and fixed costs. Variable costs vary directly with the volume of output; if nothing is produced, variable costs are zero. Variable costs include the inputs described in *Inputs* (forage, electricity & fuel, bait, etc.), repair and maintenance, and an interest cost on operating capital. Crawfish Budgets assume that the farm finances variable costs with a bank credit line. Interest cost is about \$100 per year for the crawfish farm. A marketing expense of \$325 per year is added to account for telephone calls and fuel used to deliver crawfish.

Fixed costs must be paid whether or not the farm produces, and tend to remain constant regardless of the volume of output. Fixed costs include property taxes, insurance, economic depreciation (replacement of worn-out equipment) and the debt payment. Note that the debt payment includes both principal and interest.

In Year One (April to December), the farmer makes the initial stocking of the pond, drains the pond, plants a forage crop, and floods the pond in November. No crawfish are harvested in Year One. Expenses for this year are \$1,101 in operating costs plus \$4,372 in fixed costs to pay for property taxes, insurance, and the debt payment, for a total of \$5,474. Note that the Summary Budget, above, does not make an allowance for carrying over the cost of the first year; if the owner is not able to pay operating costs and the debt payment from some other source of funds, additional interest costs will be incurred on any amount carried over into Year Two.

In Year Two, the farm harvests 650 pounds of crawfish per acre, for a net income of \$14,625. Variable Costs are \$2,573 (\$0.40 per pound harvested) and Fixed Costs are \$4,372 (\$0.67 per pound harvested). The Net Return to the farmer's land, labor, and capital is \$7,680 (\$1.18 per pound harvested).

The breakeven price for Year Two and subsequent years is \$1.07. This means that the farmer must receive a price of \$1.07 or higher per pound to pay all of the costs associated with raising the crawfish.

The breakeven price is very sensitive to changes in yield and sale price. For every 10% rise (fall) in the yield per acre or in the sale price, net returns rise (fall) by about \$140 per acre. For example, if the price is \$2.50 per pound, or 10% greater than the expected \$2.25 per pound, net returns to the farm for that year increase by \$1,670, to a total of \$9,350.

**Other Topics****Financing**

Fish farming is capital intensive. An initial investment of \$3,000 to \$10,000 per water acre, plus annual operating expenses of nearly the same amount, are required for many types of farms raising fish. Crawfish farming is less capital intensive, and land, construction, and operating costs are lower. For the example farm, the initial investment is \$3,172 per water acre (excluding the lost of land), and operating expenses average \$695 per acre per year.

While the climate for aquaculture loans is improving in NC, lenders still consider fish farming to be riskier than other farm ventures. Although aquaculture is considered a form of agriculture, it differs in that fish are sold through seafood marketing channels, with which agricultural lenders are usually unfamiliar. Lenders are unsure where crawfish will be sold, and wonder how the bank would be able to sell the crawfish (and manage the farm) if the farm were to fail. Another concern is that, in comparison to livestock and other crops, lenders can not see the crawfish to exactly determine the amount in the pond, or gauge the management success of the farmer until harvest. Also, unlike the production of some other types of livestock—hogs, turkeys, chickens—the aquaculture industry does not have integrator companies which contract with growers for quantity and price.

Also, unlike farm land which can be used for many different types of crops, most fish farms are specialized (and capital-intensive) facilities which cannot readily be converted to other uses. In contrast to ponds used for culture of fin fish, however, the artificial wetlands built for raising crawfish can also be leased for duck hunting, either to private individuals or hunting clubs. NC crawfish farmers report offers of from \$500 to \$1500 per season to lease their crawfish ponds for duck hunting.

Most NC crawfish farms are small and have been financed by the owners themselves. Those who have been able to gain financing to raise fin fish (catfish or hybrid striped bass) have had a combination of the following: owned assets such as land, equipment, or cash, which typically makes up 50% or more of the total investment amount; a good credit history and a good relationship with a banker; and experience on a fish farm.

**Farm Size**

Like farming of traditional agricultural crops or livestock, aquaculture operations must be of a certain size to create returns to justify the large initial investment in facilities. Investment on a per acre basis varies greatly depending on the size of the farm. Larger farms allow savings in per acre pond construction and equipment costs, just as larger cotton or peanut farms are less costly to develop on a per acre basis the larger the total size of the farm.

The average Louisiana crawfish pond is 40 to 60 acres, and farms are typically several hundred acres in size. All NC crawfish farms are less than 15 acres. At this size, farmers can not easily achieve the economy of scale which lowers investment costs per acre and fixed costs per pound produced. Small farms can still be profitable, however, because of the relatively high sale price of NC crawfish.

**Insurance**

Government programs now include aquaculture for protection against weather-related crop disaster. Contact your local USDA Farm Service Agency Office for information.

General liability policies are available for crawfish farms as are policies covering equipment damage due to weather. The difficulty of determining the number of crawfish in a pond at any one time has

**Farmers spend about 2 hours per acre, per week harvesting crawfish during the 16 week season, plus added time for marketing and delivery.**

impeded the development of more inclusive policies to cover crawfish kills.

### **Permits & Licenses**

The North Carolina Department of Agriculture grants an aquaculture license for a period of five years. The license is free. A free capacity use permit is required for well-water withdrawals in some areas. If the proposed operation is not in a wetland and does not meet the criteria of both (1) discharging water more than 30 days per year and (2) producing more than 100,000 pounds per year, it is likely that no other permits will be needed. Potential producers are encouraged to contact the NC Department of Agriculture (see *Sources of More Information*) to learn about situations when other permits may be required.

### **Markets**

Greater than 40% of U.S. crawfish are processed for tail-meat. A mature crawfish yields about 15% tail-meat for total body weight. Tail-meat processors have been hurt in recent years by an influx of cheaper product from Asia.

About 5% of crawfish production is exported to European markets as whole, cooked and frozen product. This market requires the largest crawfish, sized at 10 to 15 to the pound.

The remaining crawfish are sold whole, and either live or cooked. Product is sold directly to the public, or to wholesalers, retailers, or restaurants. In NC, all product is sold whole and live to one of these markets.

Louisiana pond-bank prices (price that the farmer receives) vary widely from month to month during harvest season. Prices are highest in winter and early spring, then fall by late spring when the harvest of crawfish from the wild is greatest. Prices can vary from a low of about \$0.25 to a high of \$1.50 per pound depending on the time of

year. Based on reports of total number of pounds and farm-gate value, price per pound to the farmer averages \$0.75.

The differences in farm-gate price for Louisiana and NC producers can be largely explained by three factors. First, Louisiana investment (land and construction costs) and operating costs (electricity and bait) are lower per acre and per pound of harvested crawfish. Secondly, there are many more producers as well as wild harvesters, and keen competition keeps prices low. A third reason is the way in which crawfish are sold. Crawfish growers in NC have a much more direct route to the consumer, selling pond-bank to individual consumers or directly to seafood markets and restaurants, thus avoiding charges by brokers or wholesalers that could cut into their profit margin.

With annual NC production of less than 20,000 pounds, prices have remained high and steady (\$2.25 per pound) compared to the Louisiana market. Some out-of-state crawfish are reportedly sold in NC, but only anecdotal information on quantities and prices is available. Mortality during shipment is variable and reported to be as high as 50%. Considering the Louisiana farm price plus margin to the wholesaler, transport cost to Raleigh (NC), and mortality of 15%, the cost of small shipments (< 1,000 pounds) of Louisiana crawfish during the March-June season is roughly estimated at \$1.70 per pound. This does not include any margin for the local distributor.

It is difficult to predict the change in sale price that would result from an increase in NC production or increased shipments of out of state crawfish. Current NC growers have had no difficulty in selling all of their crawfish within the state between Raleigh and the coast. Markets from Raleigh inland and to other states have not been explored.

**Crawfish farmers can also earn extra income by leasing their ponds to hunting clubs in the fall and winter.**

**Virtually all NC crawfish are sold live at pond bank to the public, or to local retailers or restaurants.**

**Crawfish Budgets**

~ ~ ~

These worksheets provide only general costs and returns estimates to fish farming.

Investment costs in particular can vary greatly and are extremely site specific. Prospective fish farmers should use these worksheets as a guide to obtaining costs specific to their site.

The crawfish Budgets, below, assume that the owner already owns 12.5 acres in land and \$2,500 in existing equipment.

.....

acres water	10.0
acres land	12.5
number of ponds	1.0
crawfish harvest:	
lbs. harvested/acres/year	650.0
Bank credit line rate for yearly operating expenses	10%
Percent of construction financed by owner	10%
Percent of equipment contributed by owner	100%
Bank interest rate for construction	10%
Sale price per lb.	\$2.25

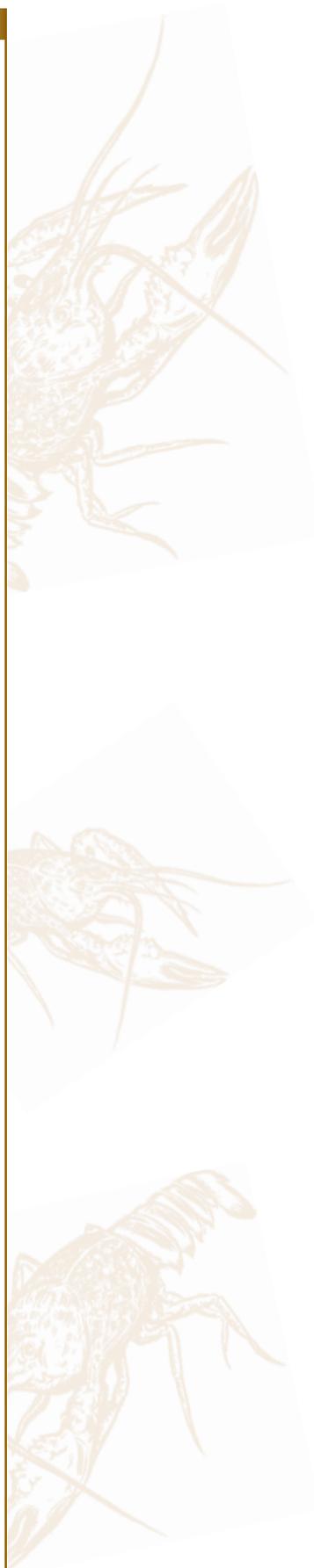
.....

**For this set of worksheets:**

(1) No cost is assumed for owner’s labor or for the interest cost of using the owner’s personal funds. Labor is estimated at 15-20 hours per week to harvest the crawfish during the 16 week season, plus time for delivery and marketing, and a total of 100 hours of labor during the remainder of the year.

(2) Budgets assume that all construction and equipment purchases take place at the beginning of year 1. Loan payments begin in year 1, but sales do not take place until year 2. If the owner does not have another source of income to make the payment until sales begin, then additional interest cost will be incurred.

(3) The owner funds 1/2 of the total initial investment in land, equipment & facilities. For this example, the owner contributes 12.5 acres of land, \$2,500 in existing equipment, and \$7,675 in cash for the purchase of new equipment. A total of \$24,050 is borrowed.



**CRAWFISH BUDGETS**  
**INVESTMENT COSTS**

*Addition to existing farm  
Land is owned and some  
equipment shared*

**New Construction & Equipment**

	UNIT	PRICE/UNIT(\$)	# OF UNITS	TOTAL(\$)
<b>Pond Construction</b>				
pond construction (varies widely by site).....	acre	1,800.00	10	18,000
vegetative cover .....	pond	500.00	1	500
drainage structure & piping .....	pond	750.00	1	750
electrical equipment and installation .....	pond	500.00	1	500
<b>SUBTOTAL</b> .....	-	-	-	<b>19,750</b>
<b>Water Supply</b>				
delivery pump (10 hp) .....	unit	3,800.00	1	3,800
piping .....	pond	500.00	1	500
<b>SUBTOTAL</b> .....	-	-	-	<b>4,300</b>
<b>Equipment</b>				
paddlewheel (5 hp) .....	unit	2,800.00	1	2,800
traps .....	unit	4.50	300	1,300
water test equipment .....	unit	500.00	1	500
holding equipment .....	unit	450.00	1	450
initial breeding stock .....	lb	2.50	750	1,875
harvest platform .....	unit	250.00	1	250
miscellaneous .....	unit	500.00	1	500
<b>SUBTOTAL</b> .....	-	-	-	<b>7,675</b>
<b>TOTAL INITIAL INVESTMENT</b> .....	-	-	-	<b>31,725</b>
Investment cost per water acre .....	-	-	-	3,172

<b>Shared Farm Equipment, Owned shared with other farm activities</b>				
shop equipment	unit	2,000.00	1	2,000
mower	unit	500.00	1	500
<b>TOTAL</b>				<b>2,500</b>

**CRAWFISH BUDGETS  
OPERATING COSTS  
YEAR 1, APRIL-DECEMBER**

*Addition to existing farm  
Land is owned and some  
equipment shared*

	UNIT	PRICE/UNIT(\$)	# UNIT	TOTAL(\$)	% OF TOTAL
<b>Gross Receipts</b>					
crawfish .....	-	-	-	-	-
<b>TOTAL GROSS RECEIPTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Variable Costs</b>					
sorghum/Sudangrass seed.....	lb	0.80	500	400	7%
fertilizer/herbicide .....	acre	12.50	10	125	2%
electrical usage					
paddlewheel.....	hr	0.30	510	153	3%
delivery pump .....	hr	0.30	271	81	2%
fuel & oil.....	acres	5.00	10	50	1%
repair & maint. of equip. ....	mo	30.00	8	240	4%
interest on above operating funds .....	dol.	-	-	52	1%
<b>SUBTOTAL, VARIABLE COSTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1,101</b>	<b>20%</b>
<b>Fixed Costs*</b>					
payment on construction debt .....	dol.	-	-	3,747	68%
property taxes and insurance .....	acre	50	13	625	12%
<b>SUBTOTAL, FIXED COSTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4,372</b>	<b>80%</b>
<b>TOTAL COSTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>5,474</b>	<b>100%</b>

\* Excludes annual depreciation, estimated at \$1,209



**CRAWFISH BUDGETS  
OPERATING COSTS YEAR 2,  
AND THEREAFTER**

*Addition to existing farm  
Land is owned and some  
equipment shared*

	UNIT	PRICE/UNIT(\$)	# UNIT	TOTAL(\$)	% OF TOTAL	\$/LB HARV
<b>Gross Receipts</b>						
crawfish .....	lb	2.25	6,500	14,625	-	-
<b>TOTAL GROSS RECEIPTS .....</b>	<b>LB</b>	<b>2.25</b>	<b>6,500</b>	<b>14,625</b>	<b>-</b>	<b>-</b>
<b>Variable Costs</b>						
sorghum/sudan grass seed .....	lb	0.80	500	400	6%	0.06
fertilizer/herbicide .....	acre	12.50	10	125	2%	0.02
electrical usage .....	-	-	-	-	-	-
paddlewheel .....	hr	0.30	1,020	306	4%	0.05
delivery pump .....	hr	0.30	443	133	2%	0.02
fuel & oil .....	dol.	-	-	40	2%	0.01
repair & maint. of equip. ....	mo	30.00	12	360	5%	0.06
harvest costs: .....	-	-	-	-	-	-
bait .....	lbs	0.30	2,322	697	10%	0.11
sacks .....	unit	0.35	186	65	1%	0.01
marketing ( telephone, gas) .....	lb.	0.05	6,500	325	2%	0.04
interest on above operating funds .....	dol.	-	-	123	5%	0.05
<b>SUBTOTAL, VARIABLE COSTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2,573</b>	<b>37%</b>	<b>0.40</b>
<b>Fixed Costs *</b> .....	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
payment on construction debt .....	dol.	-	-	3,747	53%	0.58
property taxes and insurance .....	acre	50	13	625	10%	0.10
<b>SUBTOTAL, FIXED COSTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4,372</b>	<b>63%</b>	<b>0.67</b>
<b>TOTAL COSTS .....</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>6,945</b>	<b>100.00%</b>	<b>1.07</b>

\* Excludes annual depreciation, estimated at \$1,209

<b>RETURNS SUMMARY</b>			
Returns to owner's management, labor, and capital			
	LB	FARM	WATER ACRE
Returns above variable costs	\$1.85	\$12,052	\$1,205
Returns above total costs	\$1.18	\$7,680	\$768
Breakeven price/lb above variable costs	\$0.40		
Breakeven price/lb above all costs	\$1.07		

## SOURCES OF MORE INFORMATION

~~~~~  
The **North Carolina Department of Agriculture and Consumer Services** provides assistance with permitting and helps individuals analyze the economics of proposed or existing aquaculture operations:

### **Permitting**

#### **Tom Ellis, Director**

North Carolina Department of Agriculture  
Division of Aquaculture & Natural Resources  
P.O. Box 27647  
Raleigh, NC 27611  
(919) 733-7125  
tom.ellis@ncmail.net

### **Business Planning**

#### **Rebecca Dunning**

Agricultural Economist  
North Carolina Department of Agriculture  
P.O. Box 27647  
Raleigh, NC 27611  
(919) 733-7125

### **Marketing**

North Carolina Department of Agriculture  
Division of Marketing  
P.O. Box 27647  
Raleigh, NC 27611  
(919) 733-7125

Many technical publications are available on crawfish culture methods. The best publication for North Carolina growers is the *North Carolina Crawfish Production Manual*, available from Steve Gabel of the NC Cooperative Extension Service (see below).

Also, as part of the **North Carolina Cooperative Extension Service**, the following aquaculture extension agents can be contacted to work one-on-one with prospective crawfish farmers in eastern and central North Carolina:

### **In the Northeast**

#### **Steve Gabel**

Aquaculture Area Agent  
NC Cooperative Extension Center  
730 N. Granville St., Suite A  
Edenton, NC 27932  
(252) 482-6585  
steve\_gabel@ncsu.edu

#### **Dr. Harry Daniels**

Extension Aquaculture Specialist  
Vernon G. James Research & Extension Center  
Plymouth, NC 27962  
(252) 793-4428 ext. 150  
harry\_daniels@ncsu.edu

### **In the Southeast**

#### **Mike Frinsko**

Assistant Aquaculture Area Agent  
NC Cooperative Extension Service  
403 Government Circle  
Greenville, NC 27834  
(252) 757-2803  
mike\_frinsko@ncsu.edu

#### **Marc Turano**

NC Cooperative Extension Service  
PO Box 109  
Bolivia, NC 28422  
(910) 253-2610  
marc\_turano@ncsu.edu

### **In the Piedmont (central NC)**

#### **Dr. Tom Losordo**

Extension Aquaculture Specialist  
North Carolina State University  
Campus Box 7646  
Raleigh, NC 27695-7646  
(919) 515-7587  
tlosordo@unity.ncsu.edu

#### **Dennis DeLong**

Recruiting Systems Specialist  
NC State University  
Campus Box 7646  
Raleigh, NC 27695-7646  
(919) 515-7587  
dennis\_delong@unc.edu

### **Prepared by**

#### **Rebecca Dunning**

North Carolina Department of Agriculture  
Division of Aquaculture and Natural Resources  
P.O. Box 27647  
Raleigh, NC 27611  
(919) 733-7125

Graphic design and typesetting by:  
Joey Fountain

### **Acknowledgments**

The author wishes to express thanks to Steve Gabel of the North Cooperative Extension Service and Dr. Harry Daniels of North Carolina State University for many helpful comments on this publication.

The Crawfish Growers Association holds an annual meeting each March and a fund-raising crawfish boil at state farmers markets in May and June. Contact Steve Gabel, (252) 482-6585, for more information.

