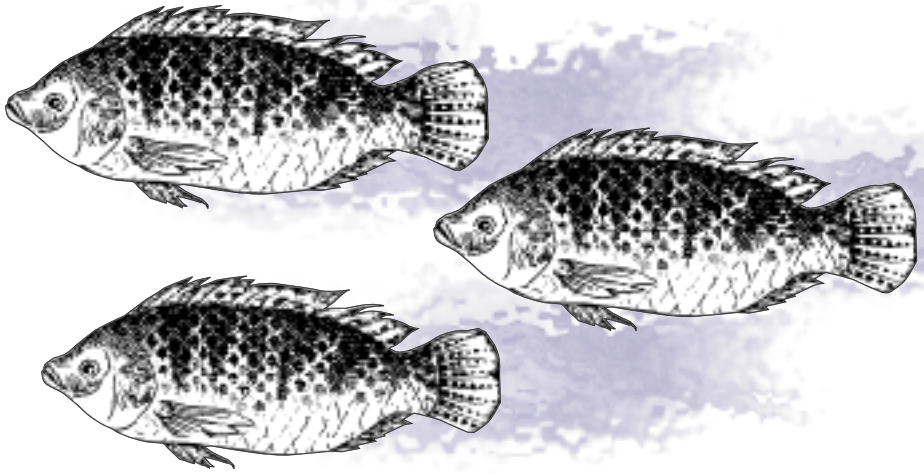
Aquaculture in North Carolina

Tilapia

Inputs, Outputs and Economics



North Carolina Department
of Agriculture and Consumer Services

Aquaculture and Natural Resources

Contents

About this publication

~~~

The North Carolina Department of Agriculture, Division of Aquaculture and Natural Resources, created this publication to assist individuals interested in the business of tilapia 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 the North Carolina State University Fish Barn, as well as an estimate of costs, returns, and resource requirements 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 (see Sources of more Information on page 16).

U.S. Aquaculture and Tilapia Production

~~~

Aquaculture is the fastest growing segment of U.S. agriculture. The farm-gate value of the U.S. aquaculture industry is estimated at nearly $1 billion. Tilapia food fish production accounts for about 4% of the total value.

Tilapia are a group of two dozen species of freshwater, plant-eating fish native to Africa. Tilapia have been cultured for thousands of years, are the second largest aquacultured species in the world (after carp) and are grown in over 80 countries. They are considered an ideal fish for aquaculture; tilapia grow in a variety of environmental conditions, breed easily in captivity, are efficient converters of feed to fish meat, and have a mild flavor which appeals to consumers.

Production of tilapia has been one of the fastest growing aquacultured species in the U.S. In 2001 an estimated 20 million pounds were grown by over 100 producers. Most tilapia is produced in one of six large US facilities, each of which grows over one million pounds annually. In addition, there are about 20 operations producing from 200,000 to one million pounds, and 50 to 100 producing less than 200,000 pounds annually.

Most US producers grow the fast-growing species *Oreochromis niloticus*. While the vast majority of tilapia grown in the world are raised in ponds in tropical climates, pond culture in the U.S. is only feasible in the southernmost parts of Texas and Florida, or where geothermally heated water is available. Tilapia thrive in waters having a temperature of 82..to 86..F. Tilapia grow much more slowly at a lower temperature and lose their resistance to disease when temperatures fall below 70..F. Tilapia cannot survive in water below 55… F, precluding their survival outdoors in North Carolina.

Ninety percent of U.S.-grown tilapia are raised in water-reuse or so-called recirculating systems. These systems raise fish in tanks, usually indoors. Specialized equipment is used to filter waste from the water and add oxygen as needed. Nearly all of the water is reused rather than discarded.

North Carolina Tilapia Production

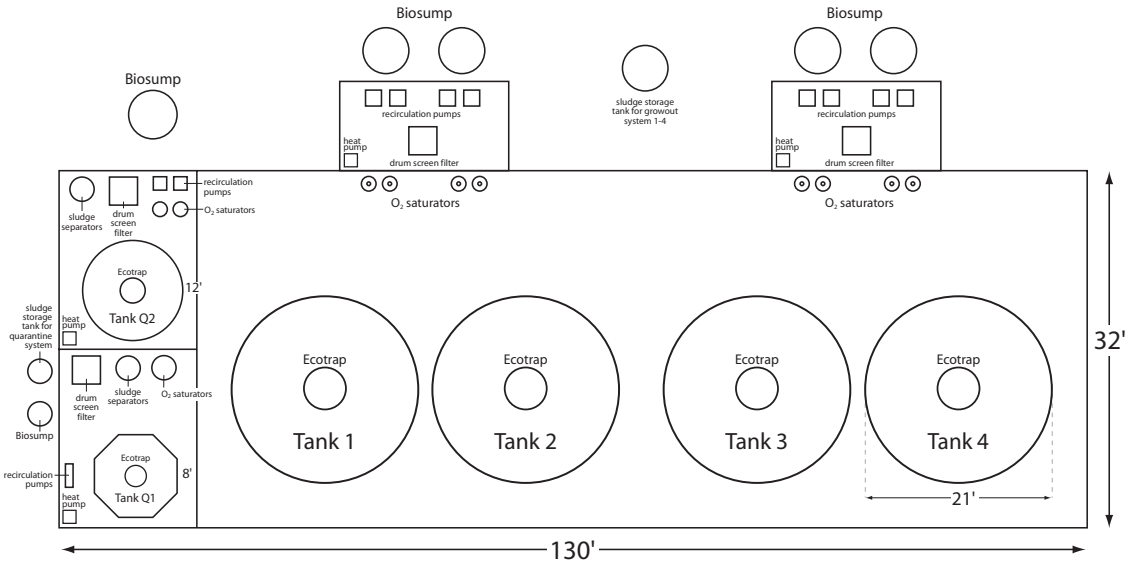
~~~

North Carolina has grown rapidly in the past few years as a source of U.S.-grown tilapia. The state has one integrated
~~~

hatchery, grow-out, and processing operation with a capacity to produce over 500,000 pounds of tilapia per year, and 10 operations with a stated design capacity of 200,000 to 400,000 pounds each in existence or under construction. There is also a commercial-size research and demonstration facility, the NC State Fish Barn, located at North Carolina State University in Raleigh. Tours and classes are held in conjunction with the facility. All North Carolina tilapia production facilities are indoor water-reuse systems.

An Example System: The NC State Fish Barn

~~~

To make tilapia production economically feasible in an enclosed (indoor tank) system, fish are grown at much higher densities than they would grow in a natural setting. For example, pond-raised catfish are raised at a rate of 0.005 to 0.007 pounds of fish per gallon of pond water. In contrast, the example system presented in this publication allows a density 100 times as great: tilapia are grown at a maximum density of 0.66 pounds of tilapia per gallon of water. The sophisticated water treatment components in tank systems allow for this density of production.

There are dozens of different types of tilapia tank systems in use around the world. While there is no single recommended or standard tank system, there are some basic components that the system must have. Each system is composed of a combination of tanks, pumps and filters of varying size, shape, and efficacy. The costs of building and operating each system and the returns to each differ markedly. The costs and returns given in Tilapia Budgets (pages 11-15) and explained below are valid only for facilities based upon the model at the NC State University Fish Barn. Potential producers are advised to contact researchers at the Fish Barn (see Sources of More Information) for assistance in setting up their own tilapia production system or in evaluating a specific design.

The example Fish Barn is a 32 x 130 insulated building with six fiberglass tanks, varying in size from 1,800 to 15,000 gallons, plus associated monitoring, harvesting, and water treatment equipment. Up to 10% of the water volume of the system is exchanged each day (that is, 10% new water enters, while 90% is filtered and reused). The discharged water goes through a treatment system to a 1/2-acre effluent pond.

Incoming fingerlings are initially stocked into an 1,800 gallon quarantine (Q1) tank, where they are held and screened for diseases for 6 weeks. They are then harvested and restocked into the 4,000 gallon nursery (Q2) tank. After another 6 weeks of growth the fish are transferred to one of the four 15,000 gallon grow-out tanks (G tanks). After another 6 weeks, half of the fish are stocked into another of the G tanks. There the fish remain for another 50-60 days, and then they are harvested. Thus, the total cycle time between first stocking and first harvest is about 180 days. One tank is harvested per month, in four equal weekly batches, with 2,389 pounds harvested each week.

Fish are moved from tank to tank to make optimum use of the production capacity of the system. As the tilapia grow and require a larger water volume, they are transferred into larger tanks. When the preceding tank is unoccupied, another group of fish called a cohort is introduced into the system. As a result, once the system is fully stocked, one G


~~~

General design of a Tilapia fish barn
with water treatment components



tank will be harvested every 180 to 210 days, resulting in a constant, year-round supply of tilapia.

Inputs

~~~

Water

A major advantage of water-reuse systems is that water is not usually a limiting factor when siting the facility. The example facility has a well with a pumping capacity of 35 gallons per minute (gpm), but generally runs at a constant rate of just 5 gpm. Water must be derived from a well (as opposed to a surface water source such as a stream) to bar introduction of sediments, other organisms, and pathogens. The facility exchanges about 10% of the total tank volume per day, requiring 6,600 gallons per day. At each harvest, tanks are partially drained, but nearly all of the new water volume is saved in the biosumps (biofilter) and another tank. A flow meter for each system measures the amount of new water added to each separate water reuse system.

Land and buildings

Land is also not usually a limiting factor for siting a water reuse system, as so little is needed and virtually any soil type may be used. Tilapia Budgets assume a 5-acre tract used for the building and 1/2-acre effluent pond which holds water discharged from the system. A ß hp aerator runs nightly in the late spring, summer and early fall to insure that the pond contains enough oxygen.

The building is a 32 by 130 insulated metal-clad pole barn. Tilapia Budgets separate the costs of the actual building from plumbing and electrical systems and the labor to install these systems, because owner/operators often supply their own labor.

Equipment

There are four separate recirculating systems: one for the Q1 tank, one for the Q2 tank, and one for each of the two pairs of grow-out tanks. Systems are separated to prevent pathogen transfer between the systems. It is particularly important that
~~~

Water Treatment System Components

Recirculation pumps create a constant flow of water from the tanks, through the filtering and oxygenation systems, and back to the tanks

Sludge collector	waste solids removal
Particle Trap (Ecotrap)	waste solids removal
Drum screen filter	filters out waste solids from the tanks (fecal matter, food particles) for further treatment
Biosump(biofilter)	ammonia control, carbon dioxide stripping, re-aeration of system water
Oxygen saturator	transfers oxygen into the water
Heater (electrical and gas heaters)	maintains water temperature at a constant 84…

disease problems be detected and treated early in the cycle, and that they not spread to the entire facility. For this reason the Q1 and Q2 tanks are isolated in their own rooms with separate recirculating systems, even though this increases the costs of the facility. Grow-out tanks are paired because the probability of disease is less later in the grow-out cycle than it is at the quarantine and nursery stages.

Each of the four systems has its own recirculation pumps, drum screen filter, biosump (biofilter), particle trap (Ecotrap), sludge collector, and oxygen saturator. The table above gives a brief description of the function of each component, and the costs per component are given in Tilapia Budgets (pages 11-15).

For each system, the water flow is from the tank through the particle trap s main discharge line. The sludge output from the Ecotrap is routed to the sludge collector, where the sludge particles are removed before passing the clarified water through the drum screen filter to the biosump. Return from the biosump is through the main pump suction line, main pump, oxygen saturator, and water heater, and back into the tank.

Oxygen System

The oxygenation system is comprised of a bulk liquid oxygen storage tank, oxygen saturators and in-tank emergency oxygen supply diffusers. Oxygen is continuously supplied to the tank, even during a power outage. The liquid oxygen storage tank is provided by a local supplier and is re-filled from a tanker truck when the oxygen supply reaches a predetermined level.

Waste removal

The waste removal system consists of in-ground sludge storage tanks, sludge pumps, a compost facility for disposal and treatment of solid materials, a settling tank, and a pond for discharged water.

Feeding

Automatic feeders distribute feed each ß hour for fish less than one pound, and each hour for fish greater than one pound. The uniform, timed application of feed throughout the day results in a more stable daily water quality pattern, requiring little

or no manager maintenance control of the oxygen supply. The operator monitors the sludge collectors for excess feed content and, combined with visual observation of feeding, adjusts feed rate and amount in the automatic feeder.

Floating feed is preferred as it allows the fish time to eat the feed, then sinks to the bottom where it can be removed automatically from the system. Feed varies in size and protein content, and each cohort is fed four different types of feed during its growth cycle. Feed is the largest single operating cost, at 20% of the total.

Harvesting and Grading

The equipment used in harvesting and grading the fish consists of nets, baskets, an electric hoist with electronic scales, a custom-built crowder/grader, and an overhead rail for the hoist which runs along the ceiling and down the length of the grow-out tanks.

Instrumentation and Control System (ICS)

The ICS allows for automation of some operations at the Fish Barn, thus reducing the need for labor. The ICS is comprised of various sensors, controls, and alarms. The system utilizes programmable logic controllers to monitor specified parameters (water flow, temperature, oxygen level alarm status, power status, water level) and initialize action (automatic or alarm) based on the specified setpoints. Personnel are called by telephone after hours if there is an emergency, and they can dial in and check the alarm status of the system. In Tilapia Budgets, the cost of the control and alarm system is included in the building electrical costs and telephone dialer.

Medication and Chemicals

Aquaculturists maintain that the key to successful fish management is stress management. Fish can be stressed by changes in temperature and water quality, by handling, and by nutritional deficiencies. Stress increases the susceptibility of fish to disease, which can lead to catastrophic fish losses if not detected and treated quickly.

Disease-causing organisms are likely to enter the system from hauling water, on fingerling fish introduced into the system, or on nets, baskets, gloves, etc., that are moved from tank to tank. Tank facilities guard against the introduction of disease from the outside by screening incoming fish in a quarantine tank, proper cleaning and disinfection of baskets, gloves, etc. used during transfer and harvest of fish, and requiring foot baths and other biosecurity measures for workers and visitors entering the facility. These measures, and the maintenance of a healthy growing environment through proper feed, temperature, and water quality management can keep a Fish Barn virtually disease free.

Three chemicals are added to maintain optimum water quality in the facility.

Rock salt is added to the water on a weekly basis or as needed to maintain chloride levels at 200-300 ppm. Calcium carbonate is added as needed to maintain calcium hardness at a level of 80-100 ppm. Sodium bicarbonate is added twice daily to maintain alkalinity and buffer against pH variations. The total cost of chemicals comprises less than 5% of total variable operating costs.

Additional salt, ozone, or the application of ultraviolet light may be added to the water to reduce a high bacterial count (which may result from over-feeding).

Unchecked, a bacterial or disease problem can quickly result in the loss of an entire tank. It is of the utmost importance that the operator take the measures necessary to keep the facility disease-free.

Electricity

Water reuse systems require significant amounts of energy to operate. For the example system, about 15% of the total electricity is required for the building heating, ventilation, and air conditioning (HVAC) and the remainder for operation of pumps, filtration, and water heating equipment. The total cost of electricity comprises approximately 12% of variable operating cost.

Fingerlings

The quality and health of the incoming stock of fingerlings is of utmost importance. One of the most important factors in procuring quality fish stock is to buy from reputable, established hatcheries. If disease organisms are accidentally introduced into the system, they can be extremely difficult to eradicate or control, requiring the breakdown of the system components for disinfecting and drying. This disrupts the production cycle and can easily result in a net economic loss for the system.

Tilapia fingerlings are readily available from one hatchery in North Carolina and a number of hatcheries across the U.S. The quality of the tilapia, both in terms of genetics and health of the fish, can vary widely between source hatcheries. Operators are advised to deal with reputable hatcheries and refuse to accept questionable loads. Tilapia Budgets includes stocking of 15,000 fish per cohort, one cohort (one tank) stocked each month, for a total of 180,000 fish per year. The cost of fingerlings is about 13% of total variable cost.

Labor

Daily maintenance of the system requires water quality testing as needed, filling of the feeders, addition of sodium bicarbonate and rock salt, cleaning of the piping and equipment (such as the drum screens), visual verification that all systems are acting normally, and recordkeeping. Stocking, sampling, and harvest of the tanks is also required periodically. This requires a relatively high degree of competence. The person in charge must be able to recognize problems in the system that might not be obvious to an inexperienced person.

The example Fish Barn is designed to minimize operator labor. Eight hours per day are typically required, with less time on weekends. About 2,400 pounds of fish are harvested one day each week, and this requires another part-time laborer. Fish can also be transferred on this day. Tilapia Budgets do not include the cost of the owner s labor. They do include $7,680 annually for transfer and harvest labor.

Outputs

~~~

Tilapia

The example system has an overall survival of 91%, for an annual harvest of 114,660 pounds of 1.40 pound tilapia. Tilapia Budgets assume that 100% of the fish are sold to a live market. (See Marketing, below).

Effluent

The tilapia operation discharges about 6,600 gallons of water per day, to the effluent pond. Solid wastes flow automatically to storage tanks, which are emptied and pumped to the compost


~~~

facility weekly. The facility generates about 800 cubic feet per year of compost, which could serve as an additional source of income.

Economics

~~~

Tilapia Budgets estimate initial investment, operating costs, and annual returns for a 6-tank facility. Production, costs and sale price are based on the experiences over the past 3 years at the North Carolina Fish Barn Project at NC State University.

Initial Investment

The farm requires an initial investment of $301,575. In this example the owner supplies 25% of the total investment, and the remainder is borrowed over a 10 year loan term.

Summary of Initial Investment

Land	$8,000
Waste removal	$15,000
Building	$61,858
Plumbing and electrical equipment for the building	$19,795
Labor for plumbing, electrical, and equipment setup	$40,000
Equipment	$152,922
Well	$4,000
Total	**$301,575**

Operating Costs and Returns

Sales are based on a price of $1.40 per pound of fish sold. Sale prices for tilapia vary widely by year, season, and source of product, and are in a constant state of flux and uncertainty (discussed below, in Marketing). The $1.40 is based on the experience at the NC Fish Barn, and is based on sales of live fish.

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 above (fingerlings, feed, electricity & fuel, etc.), repair and maintenance, and an interest cost on operating capital. Tilapia Budgets assume that the farm finances variable costs with credit lines from the feed mill and bank at an annual interest rate of 10%.

The facility harvests 6 tanks in Year 1, for a total of 57,330 pounds. Because the business has 6 harvests, but must pay for the production cost of 12 tanks, the facility loses $45,130 in year 1. In year 2, there are 12 harvests, for a total of 114,660 pounds. Assuming a sale price of $1.40, the farm earns $25,919. This is the return to the cost of the owner s labor and use of the owner s $70,000 in initial capital.

For the facility to be more profitable, tilapia must be sold at a higher price or they must be raised for a lower cost. Some tilapia producers are able to sell live tilapia at prices of higher than $1.40 per pound to niche markets. In fact, these niche markets are what sustain most of the tilapia facilities in the U.S.. For planning purposes, however, a price higher than $1.40 per pound should not be used unless the proposed facility has identified and established a market at a higher price.

The second means to profitability is to lower the price of production. One way is to increase the number of pounds produced in the facility, or to use larger components (tanks, filters, etc.) to gain an economy of scale. This could lower the fixed cost per pound of production, thus reducing the overall cost, and increasing profits. For this example, if the farm increased production
~~~

by 15% (18,000 lbs annually), cost per pound would fall to $1.05, and the owner would earn $45,928 annually.

Other Topics

~~~

Financing

Tilapia aquaculture in an enclosed system is attractive to both potential farmers and investors (including bank lenders), because, unlike pond aquaculture, the fish can be seen and their growing conditions seem to be much more under the control of the operator than culture out-of-doors. The disadvantage for existing row crop or livestock farmers is that they can not use to their advantage large tracts of land and farm equipment that they already own. For example, catfish aquaculture requires large tracts of flat farm land, as well as tractors and other farm equipment. This can give an existing farmer a significant edge in getting into pond aquaculture. Existing buildings on a farm (such as those used for livestock) can not be readily converted into a Fish Barn; in virtually all cases, it is less costly to build from scratch.

While the climate for aquaculture loans has improved as the industry has grown over the past 10 years, lenders still consider fish farming to be riskier than other farm ventures. A fish barn is a specialized and highly capital-intensive facility that is not easily converted to other uses. While fish farming 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 tilapia will be sold, and wonder how the bank would be able to sell the fish (and manage the farm) if the fish farm were to fail.

Until just recently, the aquaculture industry did not have any integrators that is, there were not any companies which contracted with producers as is done in the production of hogs, turkeys, and chickens. Over the past several years, one integrator company has emerged, and is contracting for growers in the southeast. The company provides financing and some inputs and purchases the tilapia when they reach market size.

Farm Size & Productive Capacity

As noted above in the discussion of operating costs and returns, larger farms with greater production can lower the cost per pound, resulting in a higher net profit. For example, if the tank size (and size of pumps, filters, and other water treatment components) were doubled for the example system, the cost of these components would be more, but they would not be double the cost of the smaller sized components. Larger farms would not generally result in a savings in variable costs, however, as feed, fingerlings, electricity, etc. increase in proportion to the number of fish being produced. There could be some savings in management labor, however.

Insurance

Private insurance is more readily available for tank farming than for production of fish in ponds. Farmers can obtain insurance for equipment failure, lost production, and losses sustained due to interruption of production.

Permits and Licenses

The North Carolina Department of Agriculture and Consumer Services grants an aquaculture license for a period of five years. The license is free. Because tilapia is not a native species, written permission


~~~

from the North Carolina Wildlife Resources Commission is also required of new growers. A capacity use permit is required for well-water withdrawals in some areas. If the proposed aquaculture 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.

Alternative Uses

The Fish Barn system has been used to grow hybrid striped bass and yellow perch in addition to tilapia. With modifications, the system could also be used to raise flounder, ornamentals, and other fish. The species raised would have to provide a sufficiently high price and/or low operating costs to sustain the relatively high capital costs associated with the building and equipment.

Marketing

The American Tilapia Association is the main provider of information on tilapia markets in the U.S. Its August 2001 report notes that U.S. domestic production increased about 2 million pounds during 2000 to a total of 20 million pounds. Annual sales were estimated at $34 million. An additional 152 million pounds were imported (reported on a live-weight basis, though the fish enters the US market as frozen whole fish or fresh or frozen fillets). Since 1993, domestic production has increased 60 percent, while imports have increased 500 percent.

The marketing of tilapia is extremely competitive. In warmer climates (Costa Rica, southern China and Taiwan, South America), tilapia can be grown cheaply in outdoor ponds, and imported cheaply to the U.S. This has placed significant and growing price pressure on US producers. While the bulk of imports has been frozen whole fish sold at prices of less than $0.60 per pound, in recent years the largest percentage increase has been in fresh and frozen fillets.

Because of the price pressure on whole fish and fillets, most U.S. producers sell their fish live to ethnic markets. Fish are sold in large shipments to seafood wholesalers, as well as to local restaurants and seafood markets. Producers earn a 20-40% premium on live compared to iced fish. New producers are encouraged to develop local niche markets to obtain the highest price with the lowest transport cost.

Research

Researchers in North Carolina, other states, and other countries are performing research on both tilapia culture and recirculating systems in general. Improving water quality, reducing energy use, more efficiently dealing with waste management, and producing faster-growing strains of tilapia with a higher fillet yield are all high-priority topics. Because tilapia can be produced cheaply in ponds in a number of countries, growers in the U.S. must find methods to grow tilapia more efficiently and at a lower cost in recirculating systems. Of equal importance is creating value-added tilapia products that will appeal to consumers.

Tilapia Budgets

~~~

NOTE: 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.

number of tanks	6.0
total water volume	65,500.0
building size, sq feet	4,160.0
fish stocked per cohort	15,000.0
cohorts stocked/harvested per yr in full production	12.0
survival	91.00%
fish harvested per cohort	13,650.0
average size at harvest	1.40
FCR	1.4
avg. length of production cycle in days	195.0
pounds harvested per tank	9,555.0
lbs harvested, year 1 (6 tanks)	57,330.0
lbs harvested, year 2 (12 tanks)	114,660.0
fingerling cost	0.10
kwh per pound of production	2.54
bank credit line interest rate for yearly op. expenses	6%
percent of construction financed by owner	0%
percent of equipment contributed by owner	37%
bank interest rate for construction (10 year loan)	6%
bank interest rate for equipment (5 year loan)	6%
sale price per lb	$1.40

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 40-50 hours per week. Harvest and transfer labor is estimated at 64 hours per cohort.

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

3. The owner funds 25% of the total initial investment, or $70,094, in labor & equipment.
~~~

TILAPIA BUDGETS
INVESTMENT COSTS
New Construction & Equipment

	UNIT	PRICE ($)/UNIT	# OF UNITS	TOTAL($)
Land	acre	4,000.00	2	8,000
Waste Removal				
settling pond	acre	10,000.00	0.5	5,000
aerator (1/2 hp)	unit	2,500.00	1	2,500
composter	unit	7500.00	1	7,500
Subtotal				15,000
Building				
building, 32'x130' pole barn	sq ft	14.64	4224	61,858
electrical	unit	7,395.00	1	7,395
plumbing	unit	7,200.00	1	7,200
HVAC (heating & cooling)	unit	5,200.00	1	5,200
Subtotal				81,653
Well & 3/4 hp pump (35 gpm)	unit	4,000.00	1	4,000
Per-tank system equipment (detailed equip. list on next page)				
grow-out systems	unit	89,660.00	1	89,660
quarantine 1	unit	11,897.00	1	11,897
quarantine 2	unit	18,771.00	1	18,771
Subtotal				120,328
System-wide equipment				
feed bins	unit	3,000.00	2	6,000
feeders	unit	300.00	6	1,800
feeder controller	unit	510.00	1	510
gas generators	unit	4,200.00	1	4,200
oxygen monitor	unit	5,234.00	1	5,234
hoist, trolley & track	unit	2,000.00	1	2,000
crowder (for harvest)	unit	2,500.00		2,500
misc. harvest equipment (nets, baskets, etc)	unit	1,000.00	1	1,000
2-ton water heat pumps	unit	2,000.00	2	4,000
telephone dialer	unit	350.00	1	350
lab equipment	unit	4,000.00	1	4,000
misc. equipment		1,000		1,000
Subtotal				32,594
Labor				
For building electrical and plumbing				20,000
For equipment set-up				20,000
Subtotal				40,000
TOTAL				301,575

	PRICE ($)/UNIT	# OF UNITS	TOTAL($)
Detail of equipment by tank system:			
For grow-out tanks (two pairs)			
tanks (15,000 gallon fiberglass)	5,000.00	4	20,000
pumps (2 hp)	565.00	8	4,520
particle trap (Ecotrap)	3,674.00	4	14,696
oxygen saturator (90-130 gpm)	786.00	8	6,288
foam fractionator (30 gpm min.)	675.00	4	2,700
bio sump	2,000.00	4	8,000
bio sump media	1,280.00	6	7,680
media blower	213.00	4	852
regenerative blower	562.00	2	1,124
biosump level control	200.00	4	800
drum screen filter	11,000.00	2	22,000
drum filter rinse pump	500.00	2	1,000
Subtotal			89,660
For the Q1 tank			
tanks (1,500 gallon fiberglass)	1,000.00	1	1,000
pumps (1 hp)	565.00	1	565
particle trap (Ecotrap)	1,627.00	1	1,627
oxygen saturator (35-85 gpm)	332.00	1	332
foam fractionator (30 gpm min.)	675.00	1	675
bio sump	400.00	1	400
bio sump media	39.00	6	234
media blower	213.00	1	213
regenerative blower	351.00	1	351
biosump level control	200.00	1	200
drum screen filter	5,800.00	1	5,800
drum filter rinse pump	500.00	1	500
Subtotal			11,897
For the Q2 tank			
tanks (4,000 gallon fiberglass)	4,000.00	1	4,000
pumps (1 hp)	565.00	2	1,130
particle trap (Ecotrap)	2,729.00	1	2,729
oxygen saturator (35-85 gpm)	759.00	2	1,518
foam fractionator (30 gpm min.)	675.00	1	675
bio sump	700.00	1	700
bio sump media	149.00	6	894
media blower	213.00	1	213
regenerative blower	412.00	1	412
biosump level control	200.00	1	200
drum screen filter	5,800.00	1	5,800
drum filter rinse pump	500.00	1	500
Subtotal			18,771

TILAPIA BUDGETS
OPERATING COSTS AND RETURNS
Year 1

	UNIT	PRICE/ UNIT($)	# UNIT	TOTAL($)	% OF TOTAL	$ PER LB
Gross Receipts						
tilapia	0	1.40	57,330	80,262		
Variable Costs						
fingerlings	per	0.10	180,000	18,000	14.42%	$0.31
feed	lb	0.18	120,393	21,175	16.97%	$0.37
bicarbonate	lbs	0.16	21,069	3,371	2.70%	$0.06
rock salt	mo	50.00	12	600	0.48%	$0.01
chloride	mo	50.00	12	600	0.48%	$0.01
electrical usage						
pumps and filters	mo	1150.00	12	13,800	11.06%	$0.24
building heat and AC	mo	200.00	12	2,400	1.92%	$0.04
propane	mo	300.00	4	1,200	0.96%	$0.02
oxygen	100 cu ft	0.30	8,719	2,616	2.10%	$0.05
repair & maint. of equip.	mo	300.00	12	3,600	2.88%	$0.06
labor, transfer & harvest	$/cohort	640.00	12	7,680	6.15%	$0.13
office overhead	mo	100.00	12	1,200	0.96%	$0.02
interest on above operating funds	dol.			1,649	1.32%	$0.03
marketing cost	dol.			1,000	0.80%	$0.02
SUBTOTAL, VARIABLE COSTS				78,891	63.21%	$1.38
Fixed Costs*						
payment on land and const. debt	dol.			18,838	15.10%	$0.33
payment on equipment debt	dol.			19,663	15.28%	$0.33
property taxes and insurance	dol.			5,000	4.01%	$0.09
oxygen tank rental	mo	250.00	12	3,000	2.40%	$0.05
SUBTOTAL, FIXED COSTS				46,501	36.79%	$0.81
TOTAL COSTS				125,392		$2.19

**Excludes annual depreciation, estimated at $21,246*

RETURNS SUMMARY
Returns to owner s management, labor, and capital

	PER LB	TOTAL
Returns above variable costs	$0.02	$1,371
Returns above total costs	($0.79)	($45,130)
Breakeven price/lb above variable costs	$1.38	
Breakeven price/lb above all costs	$2.19	

TILAPIA BUDGETS
OPERATING COSTS AND RETURNS
Year 2 and Thereafter

	UNIT	PRICE/ UNIT($)	# UNIT	TOTAL($)	% OF TOTAL	$ PER LB
Gross Receipts						
tilapia	lb	1.40	114,660	160,524		
Variable Costs						
fingerlings	per	0.10	180,000	18,000	13.43%	0.16
feed	lb	0.18	160,524	28,233	21.07%	0.25
bicarbonate	lbs	0.16	28,092	4,495	3.35%	0.04
rock salt	mo	50.00	12	600	0.45%	0.01
chloride	mo	50.00	12	600	0.45%	0.01
electrical usage						-
pumps and filters	mo	1150.00	12	13,800	10.30%	0.12
building heat and AC	mo	200.00	12	2,400	1.79%	0.02
propane	mo	300.00	4	1,200	0.90%	0.01
oxygen	100 cu ft	0.30	11,625	3,488	2.60%	0.03
repair & maint. of equip.	mo	300.00	12	3,600	2.69%	0.03
labor, transfer & harvest	$/cohort	640.00	12	7,680	5.73%	0.07
office overhead	mo	100.00	12	1,200	0.90%	0.01
interest on above operating funds	dol.			1,808	1.35%	0.02
marketing cost	dol.			1,000	0.75%	0.01
SUBTOTAL, VARIABLE COSTS				88,103	65.74%	0.77
Fixed Costs*						
payment on land and const. debt	dol.			18,838	14.06%	0.16
payment on equipment debt	dol.			19,663	14.23%	0.17
property taxes and insurance	dol.			5,000	3.73%	0.04
oxygen tank rental	mo	250.00	12	3,000	2.24%	0.03
SUBTOTAL, FIXED COSTS				46,501	34.26%	0.40
TOTAL COSTS				134,605		1.17

**Excludes annual depreciation, estimated at $21,246*

RETURNS SUMMARY
Returns to owner s management, labor, and capital

	LB	FARM
Returns above variable costs	$0.63	$72,421
Returns above total costs	$0.23	$25,919
Breakeven price/lb above variable costs	$0.77	
Breakeven price/lb above all costs	$1.17	

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
3903 Inwood Road
Raleigh, NC 27603
(919) 513-0452
rebecca.dunning@ncmail.net

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 tilapia culture methods. As part of the **North Carolina Cooperative Extension Service**, the following aquaculture extension agents can be contacted to work one-on-one with prospective 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
NC State University
Campus Box 7646
Raleigh, NC 27695
(919) 515-4589
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
Recirculating Systems Specialist
NC State University
3903 Inwood Road
Raleigh, NC 27603
(919) 513-2106
dennis_delong@ncsu.edu

Prepared by

Rebecca Dunning
North Carolina Department of Agriculture
Division of Aquaculture and Natural Resources
and **Dennis DeLong**
Recirculating Systems Specialist
NC State University

Graphic design and typesetting by:
Joey Fountain

Acknowledgments

The authors wishes to express thanks to Dr. Tom Losordo of North Carolina State University for many helpful comments on this publication.

1,350 copies of this public document were printed at a cost of $594.00 or $0.44 each.

February 2002
~~~