AQUACULTURE AND ECONOMIC DEVELOPMENT: POTENTIALS IN SOUTHEASTERN NORTH CAROLINA

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Economic development has largely bypassed much of the rural coastal plain of southeastern North Carolina. Few industries requiring skilled workers and paying high wages have been attracted to the region. Most new jobs created in the region have been in low skill, low wage industries that do little to foster economic advancement. To increase development in the region, it is imperative that new economic activities be put in place. These activities must be compatible with the natural and cultural resources of the region. One such activity that many believe has significant potential to enhance economic development is aquaculture, especially catfish farming.

Catfish farming may be one of those new activities that are critically needed in economically lagging southeastern North Carolina

This paper examines the feasibility of expanding aquaculture acreage in southeastern North Carolina by evaluating climate, soil and water resources required to support a large aquaculture industry. In this paper, southeastern North Carolina includes the counties of Bladen, Columbus, Cumberland, Hoke, Robeson and Scotland, but the focus is upon Robeson County because Robeson's economy, soils, climate, topography, and water resources are typical of the region. It is assumed that what is aquaculturally feasible in Robeson should apply to the region as a whole.

The Aquaculture Industry in the United States

Aquacultural specialists in many regions of the United States contend that aquaculture is an industry with much potential for expansion in the 1990s. Their optimism is based upon an expanding population, decreasing catches from the world ocean, and aquaculture's ability to provide a clean product grown under closely monitored conditions that limit pollution, unlike the catch from the rivers and oceans where there is no or very little quality control. Medical research showing that seafood is a "health" food also should contribute to increased seafood consumption in a very health conscious population. The health and nutrition concerns of an aging population and dietary preferences of many ethnic groups are also important factors affecting demand for seafood, a demand that most likely will need to be met by aquaculture rather than landings from the world ocean.

American aquaculture includes the production of many species, including catfish, trout, salmon, hybrid striped bass, tilapia, shrimp, oysters and other mollusks as well as alligators. But catfish

production accounts for almost half of the total industry output and represents the vast majority of aquaculture production and expansion during the 1980s. Catfish farmers in 1980 delivered 46 million pounds to processors, in 1989 the figure had risen to more than 343 million pounds (USDA, March 1990). Most of the production was concentrated in a handful of southern states. Mississippi leads in total sales while Arkansas is a distant second (Table 1). Although North Carolina currently ranks tenth in total sales, its rate of expansion of acres of operations (up 89.3 percent in two years) makes it one of the fastest growing states in the country. In a single year, from 1989 to 1990, the aquacultural water surface increased by more than 60 percent while yield expanded by approximately 120 percent (USDA, March 1990:32-33). Total sales increased from 883 thousand dollars in 1988 to almost 1.2 million in 1990 (Table 1).

State	Operations Number		Water Surface Acres		Total Sales—all sizes $1.000	
Mississippi	345	308	88,000	94,000	192,804	227,400
Arkansas	204	206	16,000	20,500	22,752	29,577
Alabama	352	350	13,466	18,600	23,811	24,062
Louisiana	150	200	8,000	11,500	12,531	15,225
Texas	148	145	1,656	3,640	1,136	5,997
Missouri	200	125	2,700	2,700	2,041	2,576
Florida	66	47	845	1,200	1,808	2,474
South Carolina 1/	—	29	—	1,450	244	2,381
Oklahoma	90	85	1,400	1,300	966	2,235
North Carolina	36	50	581	1,100	883	1,172
Other 2/	105	147	2,772	4,680	10,740	10,110

Table 1. Catfish: Number of operations, water surface area, and total sales: 1/1/89 and 1/1/91

1/Included in other states.

2/Includes California, Georgia, Idaho, and Kansas.

Source: *Aquaculture: Situation and Outlook Report.* USDA, Economic Research Service. March 1990, pp. 32-33; March 1991, p. 29.

To predict future expansion, however, it is more realistic to examine recent consumption rates rather than production rates. In 1989, per capita consumption of catfish in the United States was about 12 ounces while per capita seafood consumption was almost 16 pounds, up from 13 pounds in 1980. If catfish were to maintain its current percentage of total seafood consumption, an increase to about one pound per person, or an additional 160 million pounds of harvest annually would have to be realized (USDA,Sept.1990:9). Such an increase would add about 75,000 acres of aquacultural water surface.

Aquacultural production is rapidly gaining on expected demand so that new market must be cultivated if water surface is to continue its present rate of exansion

The United States' catfish industry is expanding its capacity faster than this projected demand. For example, approximately 30,000 acres have been added to production during the past two years and more than 14,000 are under construction. If this trend in expansion continues, the major challenge to catfish producers will be to develop new markets rather than to increase acreage (USDA, Sept.1990:9).

The potential agriculturalist should evaluate pond sites, water supply, soils, and market possibilities, and then examine the potential for profitability (Jensen). Most importantly, persons considering aquaculture ventures should be certain that they have a market for their product and realize that aquaculture is an expensive undertaking. Start-up costs, including land purchase, pond construction, well drilling and equipment purchases quickly add to several thousand dollars per acre. According to farmers in the region, the average start-up cost in Robeson and surrounding counties exceeds $6,000 per acre. Annual operating costs can exceed $2,500 per acre. So the investmen is high for the average $1,000 per acre profit.And while risks are comparable to those of other crops, the management requirements are higher.

Resources Affecting Aquaculture in Southeastern North Carolina

The physical environment is at present a major delimiting factor in aquaculture's development. The industry requires a mild climate, level land, abundant supplies of high quality water, and soils suitable for pond construction.

The climate of southeastern North Carolina and Robeson County is humid subtropical, characterized by abundant rainfall during all months, a cool, moist winter and a long, hot summer. So the region's climate falls within the range normally identified as acceptable for catfish and striped bass production.

The Carolina Bays, shallow, eliptical impressions on the land, appear to lend thenselves well to fish farming

The study area's topography is generally level except along the marine terraces and interfluves between stream floodplains where the land slopes up to 12 percent. Shallow, elliptical depressions, known as Carolina Bays, are found throughout the Coastal Plain region. Many of the bays could most likely be more effectively used for fish farming than for field crops. Some of the level land is not well suited to crop production because of poor drainage, especially when precipitation exceeds runoff and the water is ponded for several days. Thousands of acres of level to gently sloping land on the Atlantic Coastal Plain are topographically suitable for aquacultural use.

The development of an extensive aquaculture industry is contingent upon a dependable, high quality water supply. The water

should be of such quality that it would not negatively affect the production operations (saline or high iron levels, or low oxygen levels) or contaminate the fish. In southeastern North Carolina, most of the water used in aquaculture could be extracted from geologic formations consisting of alternating layers of less permeable clay and sand. These Cretaceous aquifers such as the Black Creek, Cape Fear and Pee Dee, provide much water for irrigation and other purposes. Two recent studies (Ross, 1989, 1990) show that, in general, the quantity and quality of groundwater supplies within the region are acceptable for aquaculture and identify no contaminants that would affect either the growing operations or the fish. In fact, much of the region's water is ideal for catfish production. The Black Creek Formation, the largest in volume and areal extent, appears to be the most significant source of water for future aquacultural activities in the region.

Most of the region's soils are acidic and low in natural fertility and organic-matter content. The "A" and "B" horizons are usually up to five feet thick, and are underlain in most soil series by a clay or sandy clay loam "C" horizon and are very suitable for pond construction. These characteristics make it feasible for landowners to consider aquaculture as an alternative to field crop cultivation, especially in some of the less fertile soils.

Soils suitable and available for aquaculture in Robeson County alone total 8-9000 acres

A preliminary identification of the soil series best suited for aquaculture was made by comparing the agricultural productivity and engineering uses of each soil series. Soils with highest yields for important field crops such as corn, tobacco, cotton and soybeans were not considered viable for aquaculture since they were providing a good return to the farmer.

Soils with low crop yields, but which are suitable for pond construction, were identified as the most likely initial candidates for aquacultural operations (Table 2). Two additional criteria: the limitations for pond reservoirs and the limitations for levees, were then considered. The limitations ranged from slight to severe. Soils

		Limitations		Crop yield		
Series	Acreage	Ponds	Levees	Corn(bu.)	Soybeans(bu.)	Tobacco (lb.)
Byars	3,157	Slight	Moderate	90	—	—
Coxville	31,934	Slight	Moderate	85	40	--
McColl	9,228	Slight	Moderate	85	40	—
Meggett	1,821	Slight	Moderate	—	—	—
Toisnot	2,307	Slight	Moderate	—	—	—

Table 2. Robeson County soil series suitable for pond construction
Source: Derived from Soil Survey of Robeson County.

with slight limitations for ponds and up to moderate limitations for levees, and with low agricultural yields, are deemed most suitable for aquaculture. In Robeson County those soils include Byars, Coxville, McColl, Meggett and Toisnot series. None of these are prime farmland, but they are well suited for pond construction. Almost 50,000 acres of these soils are present in the county. Of those at least 8 or 9 thousand are available for aquaculture. Thus if a substantial market ever materializes, and if farmers are interested in aquaculture, soils suitable for constructing ponds are widespread.

Robeson and surrounding counties should adjust quite well to aquaculture. Robeson is a rural county, with many of its 105,000 inhabitants economically dependent upon extracting a living from the soil. The people have a long tradition of working the land, and in doing it with some efficiency. In 1987, Robeson County led North Carolina in farm cash receipts (Watson 1989). In 1988, almost 30 percent of Robeson County's 606,000 acres were cultivated. Thus, approximately 140,000 of the 320,000 acres of farmland were not in production in 1988 (Ross 1982). About 12,000 acres were planted in tobacco, 53,000 in corn, 91,000 in soybeans, 28,000 in wheat and 11,000 in cotton. Forests cover about 50 percent of the county, within Much of it found in wetlands or poorly drained floodplains.

Other Considerations

What factors other than soil and water should be important to the individual farmer who is considering aquaculture activities? The first consideration is geographic (Davis 1990). For example, the ponds must be readily accessible to the farmer's house because aquaculture is a labor intensive industry and ponds must be placed where they are easily accessible and where trespassing is minimized. Second, the farmer does not want to use land that is more valuable for other crops. The farmer should be satisfied that aquaculture will yield more dollars for those spent than some other crop produced on the same land. And finally, the farmer must want to grow fish and be aware of the risks associated with the industry.

The image of quality can demand that premium price that will make it possible for the small producer in Southeastern North Carolina to successfully compete with producers elsewhere

Aquacultural operations presently operating in the region are small, ranging from four or five acres to about 50. Most future producers in Robeson County and southeastern North Carolina are going to be small, probably tending to operations of fewer than 30 acres and will most likely use family members as the major source of labor. These growers are not capable of competing with the large producers in Mississippi and Alabama, but instead should concentrate their marketing efforts toward local markets. Marketing strategists suggest that local outlets are "willing to pay a premium for fresh, high quality fish.

These (local) firms also may buy smaller quantities than more distant and perhaps larger processors. Local producers... have locational advantages, these advantages include the ability to deliver a very fresh, high quality product" (Easely 1987). Thus small growers should emphasize quality, which may be one of the keys to their success. In some respects, the image of quality can demand a premium price that makes it feasible for small producers in southeastern North Carolina to compete with larger but more distant growers.

Conclusions

Is aquaculture a viable industry in southeastern North Carolina? It appears that the region does have potential for a substantial aquacultural industry, though it will never rival that of the Gulf Coast states. But the proximity to the northeastern United States market and the apparent abundance of high-quality water and land resources provide the basis for a significant industry that could diversify the economic base of the region. The continued growth of the industry will depend upon sales to the northeast, but in the early stages the industry should concentrate on serving local markets such restaurants, seafood markets and supermarkets. As experience is gained in production, processing, and marketing, the region could then begin to move into urban markets in the eastern United States. It is probably not realistic to expect any such expansion within the immediate future. However, if the demand in the United States continues to expand at current rates, southeastern North Carolina should expect to contribute significantly to the expansion.

Aquaculture fits into a secure environmental and economic niche in Sotheastern North Carolina

Aquaculture has an environmental and economic niche in southeastern North Carolina. Interested farmers should consider putting land that is not profitable for field or truck crops in aquaculture. Thousands of acres of such land are found along the numerous interfluves and in Carolina Bays. It is also recommended that the producers should initially concentrate on local markets, taking care not to produce more than local markets can consume. Rational producers, using the existing natural resources of the region, can make aquaculture a profitable industry that could, early in the twenty-first century, become a major asset to the region's economic development.

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