CAGE CULTURE AS AN EXTENSIONIST'S TOOL FOR THE DEVELOPMENT OF A REGIONAL AQUACULTURE INDUSTRY

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Cage Culture as an Entrance into Aquaculture
Cage culture is frequently the most rapid and economical means of entering into aquaculture practice. In many areas, multi-purpose farm ponds which commonly serve for irrigation, livestock watering, and/or recreational fishing are readily available and, in general, are underutilized in terms of fish production potential per unit of surface area. The relative investment required to begin cage production is a small fraction of the costs entailed by the creation of specialized pond systems which may cost in excess of $2000.000/surface acre for construction costs alone. Many state extension services and universities have sponsored assistance programs in past years to introduce landowners to cage culture in areas where farm ponds are common. Growing crops of fish within existing farm ponds, allows farmers to gain first-hand fish culture experience while risking very little and help make the decision as to whether or not this endeavor is the right one before putting great amounts of capital into fish farming. In this manner, cage culture can be used as a "stepping stone" to increased levels of involvement in aquaculture. To illustrate this point, and to help identify the advantages and disadvantages to this approach, a description of a state-sponsored cage culture program, The Tilapia Extension Cage Culture Project presently being implemented by the University of South Carolina is provided below.

One Example of Cage Culture Extension: Current Status and Progress Summary of the University of South Carolina Tilapia Extension Project
The Tilapia Extension Cage Culture Project was designed to find appropriate methods for producing seasonal food fish crops of blue tilapia in farm ponds in the coastal region of South Carolina as well as to examine the economic feasibility of various means of marketing farm-raised tilapia both within and outside of the targeted area. Landowners from Georgetown and Horry Counties were selected to participate in the project with the help of Clemson Extension Service personnel based in each county. The landowners participating in the project had little or no fish culture experience prior to the onset of this study. Although all of the farm ponds contain other warmwater fish species, management is on an extensive level with harvests made only as a product of recreational fishing activity.

Both counties have an active involvement in agriculture but presently very few operating aquaculture operations. The large number of farm ponds within this area provides an important resource for aquaculture development. The majority of these are groundwater ponds, built by removing earth (often taken for use as fill in highway or building construction) from a site to a depth below the natural water table (in the South Carolina Low Country, water table level is often less than 10 feet below the natural ground level). Watershed ponds, created by damming a natural stream bed are also common. Growing fish in cages enables the farmer to use a pond or other body of water that would otherwise be difficult or impossible to manage. This includes extremely large ponds, ponds that can not be drained, and ponds which can not be easily seine due to
irregular shape, depth or the presence of obstructions such as stumps and logs. At the present time, the abundance of these ponds constitutes the greatest readily available resource for freshwater aquaculture in the two county region.

Rural landowners in Georgetown and Horry counties of South Carolina raised young-of-year and overwintered blue tilapia fingerlings during 1988 and 1989 respectively in floating cages. Young-of-year tilapia which were spawned in freshwater earthen ponds in May 1988 grew to an average size of 136g before harvest in late October with no significant difference in size between male and female fish. Overwintered fingerlings stocked in May 1989 attained an average weight of 232g by harvest in early October however, males outgrew females by an average ratio of 1.63 to 1. Males and females were not observed on any of the sample dates during the 1988 or 1989 growing season, although swollen female genital papillae were observed during the 1989 season indicating the possibility of spawning activity.

A marketing study conducted in the course of the two-year study indicated that a minimum average weight of 350g was required for tilapia to be sold to high-paying specialty markets. Smaller tilapia are not acceptable to these markets but can be sold elsewhere at a much lower price per pound. Farmers participating in this project were able to sell tilapia of 350g average weight to a specialty market in New York through a livehauler for $1.00/pound on a live weight cash-and-carry basis. Some blue tilapia of the same size range were sold locally in small amounts for prices up to $1.25/pound. Area wholesale markets paid a maximum price of $0.60/pound.

Study results demonstrated that blue tilapia of three-quarter pound average size and above are the most marketable. Overwintered male fingerlings grew significantly better than overwintered females in mixed-sex cage culture, suggesting that all-male populations might yield higher productions and more uniform size fish at harvest. Outside specialty markets currently offer the most attractive price when minimum size requirements are met or exceeded and appear to be the most profitable outlet for farm-raised blue tilapia at this time.

Farmers are presently raising all-male tilapia crops obtained by hand-sexing mixed-sex fingerlings and will harvest and market these fish in fall 1990. The project will provide workshops for project participants during the remainder of 1990 and 1991 addressing the topics of hormone sex-reversal procedures for the production of all-male fingerlings and the design, building and operation of appropriate overwintering facilities.

**Cage Culture as a Means of Developing Aquaculture Industry Infrastructure**

It is important to realize that aquaculture is not simply a form of farming, it is an industry. The development of an industry is largely dependent on the creation of many affiliated manufacturers, distributors, and other types of businesses. In regions in which aquaculture is still at an early stage of development there are usually few management inputs available to the fish farmer. Cage culture requires many of the same materials, supplies, equipment and services that are needed on large-scale fish farms and which must be readily available before larger enterprises can be successfully established. In itself, cage culture can not bring in all of the support that will ever be needed by full-time aquaculture enterprises but it can be helpful by laying the essential groundwork.
Aspects of Aquaculture Initially Impacted by Cage Culture

One of the foremost management inputs required for aquaculture on any scale is feed. Although most feed and seed stores in an agricultural county will carry catfish feed, the majority of this may be sold to landowners which feed their farm ponds on an occasional or supplemental basis and generally buy no more than a few bags at a time. This is presently the case in the coastal counties of South Carolina where food prices can be as high as $14.00/50-pound bag for 32% protein floating catfish feed when purchased in small quantities. This is the equivalent of $560.00/ton at a time when bagged feed can be purchased for $300.00/ton or less on orders of one ton or more. In areas with large fish farming industries small quantities can often be purchased at near bulk bagged prices. For the average farm pond owner the actual price may not be an important consideration if the pond(s) are primarily used only for recreational fishing and the fish used for family consumption. However, in commercial fish farming, feed cost is the greatest single line item among operating costs and can make the difference between making a profit and taking a loss. The first stage of development of commercial aquaculture in many areas involves introducing farmers to the basic idea that fish, like poultry and hogs, can be raised as a profitable, mainstay crop, instead of a merely a novelty or a sideline.

When commercial cage culture or other small-scale commercial aquaculture begins to develop in a region of low previous aquaculture activity, an increased demand for feed at discount prices also develops. Wholesale feed distributors and feed and seed retail stores can move greater volumes of feed and subsequently purchase larger quantities from their suppliers at increased savings. With greater market demand for feed (or any other required product or service), the end result is, eventually, an increased availability at a lower price. In coastal South Carolina, at this time, farmers practicing cage culture on small farms may collectively in order to attain discount prices on feed, since prices are high for quantities less than one ton. However, an increasing level of fish farming has brought down per bag prices at some of the larger farms cooperative supply companies in the region. Since transport cost from outside feed mills are considerable, the most substantial reductions in feed cost come only once local feed mills begin producing aquaculture feeds in large quantities.

Creation of a Local Market for Fingerlings

In areas where aquaculture is just beginning, fingerling supplies are not available locally on a regular basis. Farm pond owners often acquire pond stocks of fish from outside area fish farm which are brought in by livehauling and sold on prescheduled dates and locations within the farming community. In South Carolina the cost per fingerling from these suppliers is often many times the price charged by large-scale fingerling producers. The increased fingerling market created by regional cage culture and small pond aquaculture can provide a niche for small-scale fingerling producers. As an example of this, in Orangecrumb, SC, where cage culture of catfish has seen widespread activity in recent years, there are now a handful of local fish hatcheries which provide fingerlings of the commonly stocked farm pond species. Fingerling production, unlike food fish production, generally necessitates the use of ponds on commercial scale operations. Fingerling production farms have traditionally been the first "permanent" aquaculture installations to enter a specific area. In addition to gaining a more local supply of fingerlings the area gains a resident core of full-time fish farmers which can help support each other and help newcomers to the industry. Aquaculture development has demonstrated over the years that all of the extension efforts and outside support systems in the world can not replace the impact created by the local group of
entrepreneurs. Further development of the regional aquaculture industry from that point on can be largely dependent on the success of these first "full-time" fish farmers.

This illustration of the effect a growing aquaculture industry can have on local feed and fingerling supplies and prices is applicable to other essential needs as well. Often, retailers that are in business at the advent of fish farming in a given local will cater to its specific needs in order to better serve their time-honored customers. A current day review of the development history of the aquaculture industries in Arkansas, Mississippi, Alabama, and Louisiana would reveal that many materials, equipment and consulting services which were unavailable ten years ago are now easily attainable from many sources.

Cage Culture as a Marketing Tool

Although marketing is the last chore a fish producer performs, it is far from the least. Marketing can make the difference between making an attractive profit and barely breaking even. One time, at a fish farmer meeting, when an experienced fish farmer was asked what advice he could give to someone just starting out, he replied, "Start selling fish before you ever raising them." While this may not always be possible for everyone, the farmer's statement certainly emphasized the importance of an area too often neglected. Cage culture can be used as a method for diversifying fish production in order to locate and test markets for various fish species before entering into production on a large-scale. Cages provide the flexibility to devote more or less production space and effort to any given fish species within a single pond. For example, farmers can experiment with a new species of fish without devoting an entire pond to its production. In addition, many small production units can be used to advantage when seeking high-paying "niche" markets, or, in other words, small, retail level, fish outlets, which can sometimes pay many times the price paid by wholesale distributors or processors for relatively small quantities of fish. Some of these include: restaurants, live-fish markets, farmers markets and other retail fresh fish markets. It is only common sense to try to market your fish where it is well-known and appreciated in order to get the highest return on your investment. In some instances this may mean dealing with distant markets via livehaulers or by the farmers providing their own means of transport. Many successful fish farming operations have been built by persons like the experienced fish farmer at the meeting who entered the industry as livehaulers and gradually moved into production. By selling fish grown by other producers in small lots they can locate the highest paying market outlets before going into production on their own.

Similarly, cage culture can allow a new producer to enter gradually into production of a certain fish species by adding cages while he builds his market and develops a marketing strategy. Within a single existing pond the novice fish farmer can change his marketing priorities as dictated by current market situation. In addition to permitting the culture of different species of fish within a single pond, cages, enable a farmer to separate fingerlings into different size lots for marketing over a longer period of the year. Staggered size lots of fingerlings can be grown out in separate cages so that some fish can be marketed ahead of the principal harvest season in the fall and help buffer the possible ill-effects of downside market fluctuation. This can be especially advantageous for farmers in South Carolina who raise tilapia in cages and outdoor ponds. Pre-autumn tilapia prices can be substantially higher than in October when the majority of pond-raised tilapia are harvested and brought to market.

While these avenues are open to all producers, they are most needed by small-scale farmers who do not enjoy the lower operating costs created by the economy of size on
large farms. In some areas regional farmers markets may allow live fish to be sold directly to the consumer. Small or large quantities of cage-raised fish can also be sold directly from the farm to the local population. When selling direct to the consumer, the farmer can sell at prices which provide the largest profit margin. Wholesale outlets and processors can provide an avenue for marketing very large volumes of fish, but the price paid to the producer is most always lower. At the risk of oversimplification, successful marketing means selling your product where you take home the highest net profit.

Creation of Fish Farmer Association

Extension agents have many methods of bringing farmers together and establishing cooperative ties between them. These are most successful when the links formed will result in farmers saving money and increasing their profit margin. In a developing cage culture program, in which most farmers are operating on a small scale of production, operating costs can be trimmed right from the onset by organizing feed purchases among local groups of farmers. Farmers buying collectively can purchase feed in lots of one ton or more and cut their individual costs considerably. Often, feed distributors will deliver free within a local area or for a small fee when minimum purchase requirements are met. Feed deliveries to a storage shed can also mean increased convenience for each farmer involved.

Fingerling purchases can also be made more easily and economically when they can be made in quantity. Many large-scale fingerling production farms will transport their own fingerlings to distant markets for the on-farm price plus the cost of transport for a specified minimum quantity. Fingerling prices from the large farms in the major fish farming states can be substantially lower than those of smaller farms elsewhere. Farmer groups can thereby enjoy greater savings and a lower cost of production.

These two examples are only the beginning of the types of cooperative efforts that can be developed between farmers during the implementation of a cage culture program. Farmers can be organized together at a later point in the season to arrange for marketing their fish. Cage harvests can be combined to meet the minimum requirements of various markets, fish brokers, and/or livehaulers. As an alternative, farmers can schedule their final harvests in order to make the most profitable use of small area fish retail markets or to sell direct to the local public from roadside stands on their own farms.

The value created by an association of farmers, however, can be measured in much more than just dollars and cents. Farmer associations also serve as a self-support group for each individual member. Diversifying into a new sector of agriculture can be unsettling to a farmer and initially filled with doubts and worries about the risks involved. Sometimes newcomers to fish farming are met with enormous skepticism and even ridicule as expressed by peers and acquaintances within their communities. The ability to talk over difficulties encountered with others who are sharing the same experiences can provide a lot of moral support and peace of mind. A forum for idea exchange is also established through farmer association and this is probably the most effective form of education. There is no better source of information than that which is acquired through first-hand experience. The benefits mentioned in this paragraph are not always considered prior to the creation of a farmer association, but, in the long run, they are often the best reasons for keeping it together.
The Goal of Cage Culture: From an Extensionist's Viewpoint

In some locations, cage culture may be the only form of aquaculture feasible due to conditions which are poorly suited for the construction of manageable ponds. In these instances, cage culture may be the final solution for producing fish crops. The long-term success of commercial-scale cage culture in any area will likely depend on the regional aquaculture infrastructure which develops. Cage culture will always be dependent on a source of fingerlings which inevitably must come from established fish farms. The success of tilapia cage culture in South Carolina as begun in the USC Tilapia Extension Project will ultimately depend, to a large extent, on the steady availability of fingerlings from a local supplier or through the cooperative efforts of farmer groups. The present goals of the project are to concentrate work efforts with the most progressive farmers in order to increase their progress toward self-sufficiency of production. Normally, new farmers will buy fingerlings until their level of production reaches the point at which it becomes more profitable to invest in the facilities needed to produce their own stocks or when regional demand reaches a level at which fingerling production presents more attractive advantages than food fish production. From an extensionist's point of view, cage culture's real goal is met when it is used effectively to help farmers progress to such a stage at which they become permanently established, full-time fish farmers instead of seasonal cage culture producers.