WESTERN MARYLAND RESEARCH & EDUCATION CENTER
MARYLAND COOPERATIVE EXTENSION ✦ AGRICULTURAL EXPERIMENT STATION

RURAL ENTERPRISE SERIES

RES-01

Aquaculture Enterprise

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In deciding whether to develop a pond for aquaculture and in determining which species of fish to produce, it is important to consider the financial impact of the various alternatives. This is a long-run decision that will affect you for many years, so it is useful to evaluate different scenarios and estimate the value of the pond in economic terms. Salmon and trout are the most common farm-raised fish in our region.

Water source and quality are big concerns for aquaculturists. Springs and wells often produce high quality water. Springs have the added advantage that they require no pumping cost. However, either you've got a spring or you haven't.

Production Methods

Aquaculture can entail growing cage-cultured or loose fish in ponds or springs. Fish can also be grown in tanks or raceways using water that flows through once or is cleaned and recirculated. Aquaculture may entail a fee-fishing enterprise in which people pay for the privilege of fishing and pay for each fish kept. Successful fee fishing operations usually have a sizable pond with high-quality water, preferably on a property with a scenic location, within 50 miles of a large population area. The type of operation you set up will determine your costs and profitability.

Pond-based culture is the most common form of aquaculture in the U.S. The minimum pond size for a commercial aquaculture operation ranges from one to five acres. At least one-third of the pond should be at least six feet deep. About 2,000 pounds of fish can typically be produced per acre of lake surface.

Most smaller operations purchase fingerlings to grow out because this avoids the more difficult to manage fry to fingerling stage. The price varies depending on species, quantity, and availability.

Skills and Time Needed

You'll need specific knowledge of the kinds of fish that thrive in the type of setup and the water chemistry you will have. A member of your team will have to be vigilant in making sure that the fish eat regularly. Some species won't eat if the water temperature does not suit them, for instance. Aquaculture is an intricate game of trying to maximize gains (fish flesh) while minimizing inputs (feed). If you can maintain fish in an optimal setting, they will gain optimal weight for the food they eat. The more you know about fish to start with, the better. Because fish can be difficult to observe, it's important that you have a patient and diligent fish tender on your team, especially if your fish are not in cages. It would also be valuable to have a person on the team who can identify fish diseases and parasites. Once a week, it is recommended to remove debris and algae from the cage mesh because this can clog water flow.

Legal, Equipment, and Resource Concerns

Of course, aquaculture is most profitable if you already have a suitable pond or spring on your property. It will probably take a long time to earn back the money spent to dig a pond.

You will probably need a license from the state agricultural or fish and game agency for your enterprise. Depending on the size of your operation, you may need a permit from the state environmental agency to discharge water from the operation. If you want to dig a pond, you'll probably have to talk with the county soil conservation district.

Water testing equipment, treatment chemicals, aeration devices, nets, a scale, feeding equipment, and processing equipment are all necessary in a typical aquaculture enterprise. You'll need electricity for pumps and, if you're using a pond, a floating pier. Feed accounts for about 1/3 of production costs. Treatments for parasites and pathogens may be necessary. Predation by birds and raccoons can be significant and should be considered when designing the facility.

Marketing Concerns

It's wise to research the market possibilities before deciding what kind of operation to open and which species to raise. Possibilities include retail sales at the farm or a farmers market, sales to supermarkets, restaurants, or food brokers, and mail or Internet-based sales. Fish can be sold whole or processed. Value-added products, such as smoked trout, can bring a premium price. You might be able to sell your cage-raised fish to a fee-fishing operation or use them in your own. Don't forget to include in your cost estimates the labor cost of setting up markets for your fish and for bookkeeping.

Financial Picture

The sample aquaculture enterprise budget on page 4 provides the framework to allow you to develop your own aquaculture budget specific to your needs and resources. The numbers used in this example do not necessarily represent a typical aquaculture operation. Each operation is different, and it is up to you to estimate your income and expenses based on your conditions and resources. This budget is meant only to serve as a starting point. It assumes that the landowner is having a pond dug specifically for the aquaculture operation.

The first section of the work sheet contains the income calculations. The number of fish stocked is multiplied by the estimated survival rate to get the total fish produced. This is multiplied by the average sale weight per fish to get the total selling weight in pounds. The total pounds produced is multiplied by the price per pound to get the total income for the pond per year.

The next section estimates the variable costs, which are costs that depend on the number of fish produced. The number of fingerlings is multiplied by the price per fingerling to get the total costs for fingerlings. The total weight gained is estimated by subtracting the initial weight of the fingerlings from the total selling weight. The total weight gain is multiplied by an estimated feed conversion ratio to get the total feed consumption in pounds. This is multiplied by the feed price per pound to get the total feed cost.

The labor hours are estimated and multiplied by the wage rate to calculate labor costs. If you are providing the labor yourself then this could be considered as the opportunity cost for your labor (the financial and social price you pay for using your time in the enterprise versus in some other way). Some people choose not to value their labor and consider the net income as the return to their labor.

Variable costs are estimated for electricity, marketing, packaging, and miscellaneous. You should also consider any other variable costs that you will have that are not included in this analysis. Interest on operating capital is either the cost of borrowed money used in production or the opportunity cost of using your money, which could be invested in other alternatives. In this example, the total variable costs are multiplied by a 5% interest rate, which is equivalent to 10% interest rate for a half year. The total variable costs are calculated and subtracted from the net income to get the return over variable costs.

The next section of the budget estimates the fixed costs, which are incurred regardless of the number of fish fed. This example includes the cost of developing the pond and the costs of a storage shed and equipment needed to produce the fish. The cost of each item is allocated over its years of useful life to get a cost per year. If you anticipate a salvage value (saleable value after the designated lifespan) for any item, then you would subtract the salvage value from the cost before dividing by the years used. Interest on fixed costs is estimated as the average value (beginning value plus ending divided by 2) multiplied by the interest rate. The total fixed costs are calculated on the last line of this section.

The last two lines of the budget show the total variable and fixed costs and the net income over variable and fixed costs. This example estimates profit of $1,425 per year for the pond or $0.13 per pound of

fish produced. In summarizing this financial analysis, it appears that the pond will turn a profit. For the same operation in which the landowner already has a suitable pond, profits would be considerably higher. However, there is a lot of market and production risk involved. If you are inexperienced in aquaculture, you may have higher costs or lower yields and income than the estimates used in this analysis. Individuals considering aquaculture are advised to do a financial analysis using their own income and expense estimates.

Text adapted from Dale M. Johnson, Farm Management Specialist, Western Maryland Research and Education Center, University of Maryland and from Daniel Terlizzi et al. 1995. Introduction to Aquaculture. Agricultural Alternatives. College of Agricultural Sciences, Cooperative Extension, Penn State University, University Park, PA.

Information Resources

Harrell, R. 1991. What is Aquaculture? Maryland Sea Grant Extension, Finfish Aquaculture factsheet 6. *UM-SG-MAP-91-01.* <http://www.mdsg.umd.edu/Extension/finfish/FF6.html>

Lipton, D. and Harrell, R. Figuring Production Costs in Finfish Aquaculture. Maryland Sea Grant Extension, Finfish Aquaculture factsheet 4. *UM-SG-MAP-90-02.* <http://www.mdsg.umd.edu/Extension/finfish/FF4.html>

Nerrie, B.L. and J. Kiely. Fish and Wildlife Management: Aquaculture and Fishing. Natural Resources Management and Income Opportunity Series. West Virginia University, Extension Service, Morgantown, WV. R.D. No. 751.

Terlizzi, D. et al. 1995. Introduction to Aquaculture. Agricultural Alternatives. College of Agricultural Sciences, Cooperative Extension, Penn State University, University Park, PA. <http://agalternatives.aers.psu.edu/other/aquaculture/>

Aquaculture Enterprise Budget

Pond size:	1 acre
Production time frame:	1 year

INCOME					
Number of fish stocked					8,000
Survival rate					0.9
Total fish produced					7,200
Average sale weight (pound)					1.5
Total sale weight (pound)					10,800
Price per lb					$2.50
Total Income					**$27,000**
VARIABLE COSTS	**Unit**	**Amount**	**Price**	**Total Cost**	**Cost Per lb.**
Fingerlings	each	8,000	$0.90	$7,200	$0.67
Total weight gained	pound	8,800			
Feed conversion ratio	ratio	1.75			
Total feed consumption	pound	15,400	0.3	4,620	0.43
Labor	hour	400	10	4,000	0.37
Electricity	month	12	75	900	0.08
Marketing & packaging	fish	7,200	0.25	1,800	0.17
Miscellaneous	year	1	500	500	0.05
Interest on variable costs		$19,020	5%	$951	$0.09
Total variable costs				$19,971	$1.85
Net income over variable costs				**$7,029**	**$0.65**
FIXED COSTS	**Costs**	**Salvage Value**	**Years Used**	**Cost Per Year**	**Cost Per lb.**
Excavation	$15,000	0	15	$1,000	$0.09
Lining	15,000	0	15	1,000	0.09
Stabilization	1,000	0	15	67	0.01
Plumbing	500	0	15	33	0
Electric hookup	2,000	0	15	133	0.01
Storage shed	2,000	0	15	133	0.01
Aerator	700	0	5	140	0.01
Floating pier	2,000	0	5	400	0.04
15 cages @ $100 each	1,500	0	5	300	0.03
Scale	250	0	5	50	0
Water analysis gear	400	0	5	80	0.01
Miscellaneous	1,500	0	5	200	0.02
Interest on fixed costs	$2,068			2,068	0.19
Total fixed costs				5,604	0.52
Total variable and fixed costs				**$25,575**	**$2.37**
Net income over variable & fixed costs				**$1,425**	**$0.13**

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