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Determining the Profitability of an Aquaculture Business: Using Income Statements and Enterprise Budgets

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The comprehensive financial analysis of aquaculture businesses requires that three key aspects of financial management be evaluated:

- financial position (determined from the balance sheet)
- profitability (determined from enterprise budgets and income statements
- liquidity/cash flow position (determined from the cash flow budget)

Other SRAC fact sheets present an overview of financial management (SRAC Publication No. 4400) and details on financial position (SRAC Publication No. 4401) and liquidity/cash flow (SRAC Publication No. 4403). This publication discusses profitability as measured from income statements and enterprise budgets.

Profitability is the difference between total revenue and total cost. It must be analyzed separately from financial position and liquidity/cash flow. Businesses that are solvent and liquid may not necessarily be profitable. Both enterprise budgets and income statements are useful in analyzing profitability, but income statements are more appropriate for analyzing farm profits and losses. This publication describes income statements and how they can be used, along with enterprise budgets, to improve the profitability of fish farms.

Structure, mechanics, and interpretation of income statements

The income statement is also known as a profit and loss statement. It has a bottom-line measure termed "Net farm income." The income statement begins by itemizing business revenues for a particular year. Then expenses are itemized, both cash expenses and non-cash expenses such as annual depreciation. Depreciation is included in all measures of profit because the business must generate enough cash to be able to replace all equipment when it wears out if the business is to be profitable in the long run. All cash and non-cash expenses are added together to obtain total operating expenses. The cash interest paid for the business for the year is added to total operating expenses to obtain total expenses for the farm. Total expenses are subtracted from total revenue to obtain net farm income from operations.

A positive net farm income indicates a profit for the year, while a negative net farm income indicates that the farm lost money. Net farm income can be viewed as a measure of the return to operator's equity, capital, unpaid labor, and management. Net farm income can be further distributed among what economists call the four principal factors of production: land, labor, capital and management. A series of financial indicators can be calculated from the income statement to calculate the proportion of net farm income earned by each factor of production. For example, returns to labor (how much of net farm income

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can be attributed to the labor in the business) can be separated from returns to management (portion of net farm income attributed to the management of the business). Returns to total assets in the business, and to the equity (the amount of capital contributed by the farmer), also can be calculated, as well as the operating profit margin ratio (the proportion of gross revenues remaining after paying expenses).

Table 1. Income statement for a 256-acre catfish farm, December 31.

Item	Total value
Catfish farm revenue	
Cash catfish sales	$806,400
Accounts receivable	0
Change in market livestock inventory	0
Total catfish farm revenue	**$806,400**
Catfish farm expenses	
Cash operating expenses	
Feed	$278,265
Fingerlings	$72,832
Labor	
Year-round, full-time	$40,560
Seasonal, part-time	$10,140
Plankton control	$3,686
Gas, fuel and oil	$33,280
Electricity	$73,984
Repairs and maintenance	$24,832
Bird depredation supplies	$1,600
Seining and hauling	$57,600
Telephone	$2,688
Office supplies	$2,816
Legal/accounting	$1,562
Insurance	$6,477
Total cash farm expenses	$610,322
Accounts payable	0
Prepaid expenses	0
Depreciation	$42,707
Total operating expenses	**$653,029**
Cash interest paid	
Interest on operating line of credit	$50,190
Interest paid on long-term loans	
Land	$21,043
Wells	$4,800
Pond construction	$35,789
Equipment	$38,757
Total interest paid	$150,579
Total expenses	**$803,608**
Net farm income from operations	**$2,792**

A complete income statement is presented in Table 1. For the 256-acre catfish farm example, net farm income is positive at $2,792. While this value is low, it is important to remember that it includes charges for non-cash expenses such as depreciation. Returns to labor and management are positive, as is the rate of return on assets (the value of all cash, equipment, buildings and land that are owned by the business), but the return on equity (capital contributed by the owner) is negative (Table 2). These financial indicators suggest a farm in which the majority of capital is in the form of debt (borrowed capital). The labor, management and capital resources used generated positive returns for the year. In the example, the returns to labor and management are greater than the net farm income because of high interest costs and relatively low opportunity costs for management and labor (what the owner could make working for someone else in these capacities).

Income statements can be prepared by farmers themselves or by their accountants. However, not all accountants calculate the financial indicators discussed here, and these indicators provide useful insights into the business. Fish farmers who choose to prepare their own income statements and calculate the associated indicators can use the spreadsheet template developed by Engle et al. (2009 a, b, c), the AgPlan website (University of Minnesota, 2010), or a purchased business planning tool.

Table 2. Financial indicators of the proportion of net farm income earned by each factor of production, 256-acre catfish farm, December 31.

Financial indicator	Value
Return to labor and management[a]	$24,786
Return to labor[b]	$14,616
Return to management[c]	$10,140
Rate of return on assets (ROA)[d]	10%
Rate of return on equity (ROE)[e]	-2%
Operating profit margin ratio (OPMR)[f]	16%

[a] Calculated from the income statement as follows: net farm income from operations + interest expenses = adjusted net farm income – opportunity cost of all capital.

[b] Calculated from the income statement as follows: return to labor and management – opportunity cost of management.

[c] Calculated from the income statement as follows: return to labor and management – opportunity cost of labor.

[d] Calculated from the income statement as follows: net farm income + interest expense = adjusted net farm income – opportunity cost of unpaid labor – opportunity cost of management = return to assets ÷ average asset value x 100.

[e] Calculated from the income statement as follows: net farm income – opportunity cost of labor – opportunity cost of management = return on equity ÷ average equity x 100.

[f] Calculated from the income statement as follows: net farm income + interest expense – opportunity cost of unpaid labor – opportunity cost of management = operating profit ÷ total revenue x 100.

Cash-based versus accrual-based income statements

Table 3 presents a cash-based income statement for the same 256-acre catfish farm used as an example in Table 1, but for a year in which fish from a number of off-flavor ponds could not be sold. Farm revenue in Year 1 was half what it would have been without off-flavor fish, which resulted in negative net farm income. The fish that could not be sold in Year 1 were then sold in Year 2 along with the Year 2 crop, generating higher than normal cash revenue for Year 2. Such variations in net farm income on cash-based income statements contribute to the perception by many bankers that catfish farming is a high-risk enterprise. That is why the Farm Financial Standards Task Force recommends accrual-based accounting, although cash-based accounting is also an acceptable accounting practice.

Table 3. Income statement (cash-based accounting) for a 256-acre catfish farm with off-flavor fish restricting sales in Year 1, December 31.

Item	Year 1	Year 2
Catfish farm revenue		
Cash catfish sales	$403,200	$1,209,600
Accounts receivable	0	0
Change in market livestock inventory	0	0
Total catfish farm revenue	**$403,200**	**$1,209,600**
Catfish farm expenses		
Cash operating expenses		
Feed	$278,265	$278,265
Fingerlings	$72,832	$72,832
Labor		
Year-round, full-time	$40,560	$40,560
Seasonal, part-time	$10,140	$10,140
Plankton control	$3,686	$3,686
Gas, fuel and oil	$33,280	$33,280
Electricity	$73,984	$73,984
Repairs and maintenance	$24,832	$24,832
Bird depredation supplies	$1,600	$1,600
Seining and hauling	$57,600	$57,600
Telephone	$2,688	$2,688
Office supplies	$2,816	$2,816
Legal/accounting	$1,562	$1,562
Insurance	$6,477	$6,477
Total cash farm expenses	$610,322	$610,322
Accounts payable	0	0
Prepaid expenses	0	0
Depreciation	$42,707	$42,707
Total operating expenses	**$653,029**	**$653,029**
Cash interest paid		
Interest on operating line of credit	$50,190	$50,190
Interest paid on long-term loans		
Land	$21,043	$21,043
Wells	$4,800	$4,800
Pond construction	$35,789	$35,789
Equipment	$38,757	$38,757
Total interest paid	$150,579	$150,579
Total expenses	**$803,608**	**$803,608**
Net farm income from operations	**-$400,408**	**$405,992**

Table 4 presents the same farm example illustrated in Table 3, but with an accrual-based income statement. (Expenses in Year 2 in both Tables 3 and 4 are assumed to be identical so that the differences between cash- and accrual-based accounting will be clear.) In Table 4, the value of the off-flavor fish inventory is included as revenue for Year 1 in the income statement. In this manner, expenses are matched with the value of the crop produced from those expenses regardless of when the crop was sold. Thus, the value in the "Cash catfish sales" line item in Year 1 is the same as that in Table 3, but an additional line item has been created ("Change in market livestock inventory") to account for the positive change in the value of the inventory of market-sized fish on the farm at the end of Year 1. Adding the value of the swimming inventory to that of "Cash catfish sales" results in total farm revenue equal to what would have been received had the off-flavor fish been sold. Net farm income, while low, is positive in Year 1 and equal to that on the cash-based income statement in Table 3. In Year 2, the sale of the off-flavor fish from the previous year results in a decrease in end-of-year inventory of market-sized fish. This negative value enters the income statement on the line labeled "Change in market livestock inventory." The result is net farm income that is the same for both years in spite of the delayed sales from Year 1.

Using enterprise budgets and income statements to improve efficiency and profitability

The income statement indicates whether the farm made a profit or a loss for the year. However, a farm does not need to make a true economic profit to stay in business for another year. To survive the short run (the next year), the farm business must be able to sell fish at a price that is greater than its break-even price above variable costs (BEP/VC; calculated by dividing total variable costs by the quantity of fish or shellfish sold), not necessarily above its break-even price above total costs (BEP/TC; calculated by dividing total costs by the quantity of fish or shellfish sold). The business must also have adequate liquidity, or cash revenue, to make payments when due

(see SRAC Publication No. 4403 for more details on liquidity/cash flow). A quick way to evaluate whether the farm can survive the short run is to calculate its BEP/VC and compare that to the price the farmer expects to receive. Determining the BEP/VC is best done with an enterprise budget. Estimated BEP/VC is approximately $0.63 to $0.64 per pound (at feed prices of $300 per ton). At feed prices of $350 per ton, the BEP/VC increases by about $0.06 per pound and farmers would need to sell fish at a price greater than $0.70 per pound to stay in business for the short run. To stay in business for the long run, prices must be above BEP/TC, estimated to be $0.83 to $0.88 per pound, depending on farm size.

Table 4. Income statement (accrual-based accounting) for a 256-acre catfish farm with off-flavor fish restricting sales in Year 1.

Item	Year 1	Year 2
Catfish farm revenue		
Cash catfish sales	$403,200	$1,209,600
Accounts receivable	0	0
Change in market livestock inventory	$403,200	-$403,200
Total catfish farm revenue	**$806,400**	**$806,400**
Catfish farm expenses		
Cash operating expenses		
Feed	$278,265	$278,265
Fingerlings	$72,832	$72,832
Labor		
Year-round, full-time	$40,560	$40,560
Seasonal, part-time	$10,140	$10,140
Plankton control	$3,686	$3,686
Gas, fuel and oil	$33,280	$33,280
Electricity	$73,984	$73,984
Repairs and maintenance	$24,832	$24,832
Bird depredation supplies	$1,600	$1,600
Seining and hauling	$57,600	$57,600
Telephone	$2,688	$2,688
Office supplies	$2,816	$2,816
Legal/accounting	$1,562	$1,562
Insurance	$6,477	$6,477
Total cash farm expenses	$610,322	$610,322
Accounts payable	0	0
Prepaid expenses	0	0
Depreciation	$42,707	$42,707
Total operating expenses	**$653,029**	**$653,029**
Cash interest paid		
Interest on operating line of credit	$50,190	$50,190
Interest paid on long-term loans		
Land	$21,043	$21,043
Wells	$4,800	$4,800
Pond construction	$35,789	$35,789
Equipment	$38,757	$38,757
Total cash interest paid	$150,579	$150,579
Total expenses	**$803,608**	**$803,608**
Net farm income from operations	**$2,792**	**$2,792**

Production costs vary from farm to farm depending on a number of factors. A farm with no debt capital will have substantially lower costs of production than a farm with high levels of debt capital. Farms also have different patterns of labor use, different equipment costs, and different aeration strategies. It is important for farmers to estimate production costs each year.

What is the best way for a catfish farmer to calculate the costs of production? The Aquaculture/Fisheries Center of the University of Arkansas at Pine Bluff (UAPB) has developed Excel-based spreadsheet models for five farm sizes. Farm-specific values for acreage, stocking rate, yields, and costs can be substituted into the spreadsheets, and the spreadsheet will automatically develop the calculations.

The high feed prices of recent years have focused attention on the economics associated with different feeding and management practices that affect feed efficiencies. For example, using less expensive 28% protein diets will reduce costs by about $0.02 per pound as compared to 32% protein feed. However, this is true only if the farmer is feeding to satiation. With high feed prices, it is essential to maximize the fishes' weight gain from every pound of feed. Lower stocking densities cause fish to grow faster and improve feed conversion ratios. Feeding every other day also lowers feed conversion ratios, but studies at UAPB and at Mississippi State University have shown that every-other-day feeding reduces yields of carryover fish. In the short run (considering only the large fish that will be sold that year), it is more profitable to feed every other day, especially when feed prices are high. However, the disadvantage is that the understocked fingerlings grow poorly and will not be large enough to sell the following year. Thus, every-other-day feeding is a better strategy for ponds with fish that are closer to market size. If a farmer plans to feed every other day, it would be best not to understock fingerlings in those ponds.

Economic models developed at UAPB show that the profit-maximizing stocking density varies with feed and fish prices. For example, at a feed price of $350 per ton and a fish price of $0.70 per pound, the best stocking rate would be slightly less than 5,000 per acre, but at a fish price of $.80 per pound, a higher stocking rate would be more profitable.

The most important decision for a farmer is the stocking rate needed to ensure that financial payments can be made. Careful planning is needed to project fish growth and revenue by month with alternative stocking rates and

sizes of fish. Some of the key biological relationships that affect this decision are that 1) fish grow faster at lower densities, and 2) higher stocking rates produce higher yields of smaller fish. A farmer who has borrowed a substantial portion of capital will have difficulty making payments if stocking densities are below 5,000 per acre. However, a farmer who owns all his/her land, ponds and equipment will be able to operate the farm profitably at low stocking densities of 2,000 to 3,000 fish per acre. High stocking densities produce the highest yields but have lower stock turnover than lower stocking densities. This is because fish stocked at high densities grow more slowly than fish stocked at low densities and take longer to reach market size.

Income statements and enterprise budgets are the tools needed to evaluate profits from the aquaculture business. Used in combination with balance sheets to assess the business's financial position and cash flow budgets to assess cash flow, these financial statements provide the basis for careful analysis, planning, and the decision making necessary for successful businesses.

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