Cost and Returns Budgets for a Semi-intensive Shrimp Farm

In Nicaragua, 1994-2000

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September 2001

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Cost and Returns Budgets for a Semi-intensive Shrimp Farm In Nicaragua, 1994-2000[1]

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1. INTRODUCTION

Most shrimp farms in Latin America are well-capitalized large-scale operations. Honduras, for instance, has a profitable industry. In Nicaragua, the future of shrimp farming is closely linked to that of Honduras since the prime sites of both countries depend on the water of the Gulf of Fonseca for pond water supply, drainage, and processing of wastes (Currie, 1994). Shrimp aquaculture in Honduras began in the early 1970s and was supported by international financial organizations and the government of Honduras. By the 1990s, shrimp farming had become one of the top revenue grossing industries of the country. However, the aquaculture industry is still relatively new and emerging in Nicaragua.

Shrimp aquaculture began in Nicaragua in 1978 with the support of the Central Bank of Nicaragua. Nicaragua had the most land area suitable for commercial shrimp farming in Central America with an estimated 39,250 hectares (ha). Of this total, about 28,150 ha. are located in the salt flats of the Estero Real and 11,100 ha. in other areas along the Pacific Coast. During the 1980s, there was limited activity in the industry due to political instability and technical problems. In 1987, a few cooperatives recognized the potential benefits from shrimp farming and put 100 hectares of rudimentary ponds into production. They recorded a production of 30,000 pounds of shrimp. From 1988 to 1993, shrimp production was still not significant due to the low yield (120 lbs/ha) of the artisanal methods employed. Nevertheless, the number of cooperatives increased and by

[1] This project is part of the National Oceanic and Atmospheric Administration small shrimp assistance program in Nicaragua. The project is funded via a contract with the University of Michigan, Michigan Sea Grant with funds coming from the U.S. Agency for International Development.

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1990 there were 1,000 hectares in production, yielding 250,000 pounds of shrimp (head-on) that year (Saborío, 1996).

Most land suitable for shrimp farming belongs to the government, which grants concessions to companies interested in building farms. Cooperatively owned farms are a major part of the industry. Cooperatives were the first participants in the shrimp industry because they received significant support from the Sandinista government. Due to the initial successes of the cooperatives, private investors began to engage in commercial shrimp farming. By 1999, 7,262 ha. were in production by cooperatives and 14,130 ha. were extended to commercial companies. The average size of private farms is around 300 hectares, with the largest about 600 hectares.[6] The private sector is now organized through the Association of Nicaraguan Aquaculturists (Asociación Nicaraguense de Acuacultores, ANDA).

2. INDUSTRY HISTORY

Original shrimp farming investments faced several serious constraints to development. These obstacles included lack of primary infrastructure, lack of formal financial support, and no secondary industries. Shrimp investors were forced to use personal funds to build moderately sized farms with which to experiment. Despite the obstacle, the industry achieved major advancements in developing infrastructure. Because shrimp farming is capital intensive, start-up investment costs were high. This has had a tremendous impact on the cost structure of the private sector shrimp farming in Nicaragua. Depreciation costs over the few years have been high; resulting in high indirect costs, meaning large biomasses must be produced per hectare in order to be profitable. To achieve large harvest levels requires assuming high risk levels since high seeding rates are necessary, further compounding investors' problems because operating financing costs are high.

Seafood exports are the second most important source of hard currency for Nicaragua. Because farm-raised shrimp is regarded as a non-traditional export product, the government grants import and tax incentives to aquaculture producers. When the pro-

[6] At the time this manuscript was drafted, data showed that the largest farm was on average 600 ha. Currently, the largest farm is 850 hectares, based on personal communication with Larry Drazba.

business government of Nicaragua began promoting foreign investment in export commodities such as shrimp, foreign investment became attractive. Nationals and foreign investors became interested and began to ask for land concessions. Shrimp farming and other supporting industries (processing, post larvae collection, transport, maintenance services, security, and others) generate around 16,500 direct and indirect jobs in rural areas. The government of Nicaragua developed and implemented a plan to promote further advancement in the aquaculture sector in 1994. The action of the Nicaraguan government caused a change in production systems from artisanal to semi-intensive production as shown in Table 1 (Jensen, Treece, and Wyban, 1997).

Table 1.

Shrimp Farm Hectares in Production by Type of Production System in Nicaragua, 1988-2000

Year	Production Method			
	Extensive	Artisanal	Semi-Intensive	Total
	----------	Hectares	----------	
1988		578 a		578 a
1989		771 a		771 a
1990		914 a		914 a
1991		1,283 a		1,283 a
1992		1,512 a	100 a	1,612 a
1993	271 a	1,109 a	380 a	1,760 a
1994	634 b	1,115 b	780 b	2,529 b
1995	1,262 b	700 b	2,070 b	4,032 b
1996	1,447 c	964 c	2,252 c	4,663 c
1997	1,782 e	566 e	3,720 e	6,068 e
1998	1,491 d	581 d	4,221 d	6,293 d
1999	1,872 d	759 d	5,668 d	8,299 d
2000	3,845 e	1,205 e	3,880 e	8,930 e

a Source: Jensen, Treece, and Wyban (1997)
b Source: Anuario Pesquero y Acuicola (1995)
c Source: Anuario Pesquero y Acuicola (1996)
d Source: Saborío (2000)
e Source: Saborío (2001)

The change in production systems and the increase in production area resulted in a tremendous growth in shrimp aquaculture in Nicaragua. The trend toward the adaptation of more intensive production methods was possible because informal and formal financing became more available. About 40 percent of the funds came from public

banks, while the remainder was from private investors or from buyers who provided operating capital to small producers to be repaid from harvest revenues. As a result, semi-intensive pond management has become more popular with the private sector, as well as with those cooperatives that can secure financing. Semi-intensive culture generates more predictable results and a greater return on investment than the extensive or artisanal methods. In addition, the trend toward semi-intensive methods has been aided by the availability of imported feeds. Nicaraguan shrimp farmers can import aquaculture feed as a duty-free product. The industry historically relied on wild seed due to its abundance along the Pacific coast of Nicaragua. In 1996, commercial hatcheries developed using brood-stock from coastal waters although this effort only lasted three months. The two seed sources together had been projected to supply the needs of a much larger grow-out industry, but that capability was not realized. Brood stock has since been imported principally from Panama.

Table 2.

Production of Cultivated Shrimp in Nicaragua 1991-2000

Year	Total Hectares in Production	Pounds Exported	Lbs/Ha	Export Value
1991		372,412 a		
1992		175,917 a		
1993	500 i	304,390 a		US$ 980,000 i
1994	2,529 a	2,260,000 b	862 c	US$ 7,351,000 b
1995	4,032 a	4,923,000 a	1,483 d	US$16,115,000 a
1996	4,663 g	5,706,000 b		US$17,000,000 b
1997	5,998 h	6,880,564 e		US$23,800,000 e
1998	8,258 h	8,800,000 h		US$30,000,000 h
1999	6,500 h	6,333,000 f		US$21,300,000 f
2000		8,000,000 i		US$33,800,000 i

a Source: Anuario Pesquero y Acuicola (1995)
b Source: Golden Maritime Resources Ltd. (1999)
c Source: Miranda (1996)
d Source: Saborío (1996)
e Source: Jory and Castañeda (1998)
f Source: Saborío (2000)
g Source: Anuario Pesquero y Acuicola (1996)
h Source: PASA Agreement NOAA/USAID/Nicaragua Work Plan
i Source: Saborío (2001)

Shrimp production has increased but at a declining rate in recent years (Table 2). The rate declined due to the combined effects of the introduction of the Taura Syndrome

Virus (TSV), El Niño Drought, Hurricane Mitch, and finally the outbreak of the White Spot Virus. These phenomena affected the production and the profitability of shrimp farms in Nicaragua. When TSV arrived in late 1995, survival rates were not good but were sufficient to justify continued production. Investors generated a large amount of cash, but due to the costs of financing and depreciation costs, some operations became unprofitable. The extra cash was reinvested to build more hectares of ponds and achieve economies of scale. Farms continued to increase in size and improve their survival rates as they suffered the El Niño drought and bacterial problems.

After the devastation of Hurricane Mitch in 1998, some farms that operated year-round ceased operations. Consequently, hectares in production dropped significantly. Large farms and cooperatives were damaged, but the damage depended on the location of the shrimp farm and ultimately on the quality of the farm infrastructure. Financial survival of the companies became the main concern while maintaining profitability was less important than maintaining cash flow. Larger and older farms were now able to seed lower density because of their size. They had lower depreciation and substantially lower indirect costs.

To ensure farm survival, better protocols were used for seeding and pond management. Shrimp farmers were advised to use pathogen free post-larvae (PL), place seed in ponds treated with chemicals to eliminate disease carriers, and use zero-water exchange systems. Some large farms followed these recommendations but smaller farms and cooperatives continued to seed with wild post-larvae. Survival rates did improve and high shrimp prices aided in a recovery of the industry.

One of the reasons for using wild post-larvae was lack of investment and operating capital. The financial institutions regarded shrimp aquaculture as a high-risk business and restrained the issuance of credit. In addition, farmers used wild-caught post-larvae because there are only four post-larvae production laboratories with a total monthly capacity of 40 million of post-larvae animals. Wild-caught post-larvae were also less expensive than hatchery produced post-larvae.

Shrimp farmers have since taken important measures to manage White Spot Virus and to exclude all the existing and potential diseases from the shrimp culture system. First, stocking density has been reduced by half. Initially, farmers stocked from 15 to 25

PL/m². Current stocking rates are now from 7.5 to 12 PL/m² Some farms have avoided water exchange but there are producers who continue to exchange water.

The large shrimp farms are maturing and the rest of the industry, principally the farms owned by cooperatives, are improving their technology and moving from extensive to semi-intensive practices. Shrimp farmers have also begun using better cash management practices.

The overall effect is a more positive industry although the culture sector needs to develop further and mature. Assistance needed to facilitate the progress of the shrimp farming industry in Nicaragua includes technical expertise, equipment, hatchery development, sale of hatchery products, and feed products (Jensen, Treece, and Wyban, 1997).

There is a lack of trained, experienced professionals to conduct the operations of a viable shrimp aquaculture industry. There are at least four plants that process farm-raised shrimp. Current processing capacity is adequate except during periods of peak harvest. In Nicaragua, there is only one PL laboratory for every 1,800 ha in production, which is also a limiting factor (Saborío, 1998).

In recent years, neither the government nor the financial institutions have provided much support to the shrimp farming industry. For the industry to grow, it is necessary to promote economic profitability of shrimp farming and have access to credit and financial support. Shrimp farming is capital intensive and the availability of financing for sound, well-planned projects is critical for expansion.

3. ECONOMIC ASPECTS OF SEMI-INTENSIVE SYSTEMS IN NICARAGUA

The analysis in this paper includes economic cost and returns budgets for semi-typical intensive shrimp farm in Nicaragua. Data from both secondary sources based on an in-depth literature review and primary data from current shrimp farms in Nicaragua were used to create a base budget. Sensitivity analysis was then used to vary stocking density, survival rates, and post-larvae cost. Changes in shrimp price were then used to demonstrate the effect of changes in these three variables on the level of net returns that can be expected from a typical operation and on break-even levels of operation. Finally,

since depreciation is such a large component of indirect cost, budgets were developed to demonstrate the difference between newer farms and older farms where depreciation may not be a factor.

3.1 Secondary Data

For farms using semi-intensive methods, seeding densities vary between 10 and 25 PL/M². The cost to build a hectare of ponds using semi-intensive systems ranges from US$9,000 to US$14,000. This construction cost includes land movement, plumbing, electrical, etc. Shrimp production levels have been estimated between 1,100 and 5,000 pounds per hectare per year. In 1999, semi-intensive systems produced an average of 1,200 pounds per hectare per cycle. Most farms harvest two crops per year, with some getting 2.5 crops (Saborío, 2000).

The price of laboratory post-larvae ranges from US$4.00 to US$4.50 FOB[7] Panama per thousand, while a thousand wild post-larvae average US$2.00. Some farms also import post-larvae from Costa Rica, Mexico, Venezuela, and the United States. Production costs vary between US$2.00 and US$2.50 per pound of live harvested shrimp if wild seed is used and between US$2.50 and US$3.00 if lab seed is used (Saborío, 2000).

Industrial quantities of feeds are not produced in Nicaragua and therefore farmers are forced to import their feed. Feed expenses represent the largest operating cost associated with semi-intensive production methods. Prices vary between US$18.00 and US$30.00 per hundred pound unit. Another significant cost in semi-intensive farm systems is fuel. The price for a gallon of diesel was US$1.70 in 1999 (Saborío, 2000).

Shrimp farmers utilize similar fertilizers as used in general agriculture, including "18-46-0" and "0-46-0." A 100 pound bag of "18-46-0" costs on average US$14.50 while the price of a 100 pound bag of urea is US$8.00 delivered. Farmers also require lime, which is used as a soil conditioner prior to pond filling. The price of agricultural lime is US$3.00 per 100 pounds. Calcium carbonate, which is used for buffering the PH of the water, is US$1.05 per 100-pound unit. Because sufficient supply of ice does not exist in the area, the price of ice can be as high as US$2.20 per 100 pounds. Other costs associated with shrimp farming include the annual leasing cost of land at US$30.00 per

[7]The term FOB stands for Freight On Board.

hectare, insurance estimated to be US$1.00 per every US$1,000 of total investment, and processing costs that vary between US$0.82 per kg (head-on) and US$0.42 per kg (head-off)[8] (Saborío, 2000).

The selling price of shrimp has fluctuated in recent years. In 1996, the average price reached its lowest level (Table 3). Data from primary sources and a literature review were not adequate for use in estimating cost and returns budget for semi-intensive shrimp farms in Nicaragua. Actual data from current producers were used to estimate cost and returns budgets. The secondary data were then used as comparison with the estimates generated. Nicaragua exports mainly head-off shrimp to the United States and head-on shrimp to Europe. Average prices for both head-off and head-off shrimp are shown below.

Table 3.

Average Shrimp Selling Price for All Size Counts and Product Forms in Nicaragua, 1994-2000

Year	US$/lb/FOB
1994	3.25
1995	3.27
1996	2.98
1997	3.50
1998	3.41
1999	3.36
2000	3.72

Source: (Saborío, 2001)

3.2 Primary Data

Data necessary for assessing the economic viability of the shrimp aquaculture industry in Nicaragua were obtained via interviews with Agnés Saborío Coze (Universidad Centroamericana, UCA) and local commercial shrimp farmers including Mario Callejas (Asociación de Nicaraguense de Acuicultores, ANDA), Larry Drazba (Camarones de Nicaragua, CAMANICA), and Gary Cummings (Sahlman Seafoods of Nicaragua, S. A.). Technical, social science, and financial information from typical semi-intensive shrimp farms was also obtained from a 1999 UCA survey of 98 shrimp culture

[8] Some processors indicated that processing costs could reach US$0.925 per kilo of head-off shrimp. (Larry Drazba, personal communication)

cooperatives in Nicaragua. The data in the survey present information on the farms by union and cooperatives within each union.

Three of the six unions in the survey contain many semi-intensive farms. For the other unions, a large variation of farming methods existed. Thus, data for this analysis focused on the unions and cooperatives employing semi-intensive culture systems. Total area in production, stocking densities per m^2, production based on lbs/ha, number of ponds, production cycles, and other technical and social information were reported per cooperative.

Personal interviews were also conducted with the people mentioned above to obtain detailed information on costs and revenues on semi-intensive shrimp farming. The information from all sources was used to develop the baseline budget. The primary data also made it possible to compare, contrast, and check technical and financial characteristics and assumptions with the data obtained from the literature.

4. BUDGETS FOR TRADITIONAL SEMI-INTENSIVE SHRIMP CULTURE SYSTEMS

This study assesses the economic feasibility of shrimp farming in Nicaragua using semi-intensive technology. Camarones de Nicaragua, CAMANICA, is a shrimp farm with an average of 324 total hectares in production in Nicaragua in 1999[9]. Larry Drazba, general manager of CAMANICA provided an eight-year financial history on a traditional semi-intensive commercial shrimp farm. Financial information from 1994 to 1999 was considered as the baseline production years from the eight years. Over that period of time, the Taura Syndrome Virus, El Niño Drought, the devastation of Hurricane Mitch on the shrimp industry, and the outbreak of the White Spot Virus, all occurred. Including all of these factors is vital for evaluating shrimp farm viability in Nicaragua within the context of the risk that exists. CAMANICA's financial budgets contained some basic performance parameters to allow a preliminary evaluation of the profitability of shrimp farming. Input and output factors include the sale price of shrimp, post-larvae cost, survival rate, stocking density (PL/m^2), growth rate, feed conversion ratio, duration of grow-out cycle, number of production cycles per year, average production (lbs/ha/cycle),

[9] Currently, the total area in production of Camanica is 555 hectares.

etc. In addition, the cost of feed, chemicals, direct labor and other indirect costs were also available.

Using the CAMANICA production budgets as baseline data, input and output parameters were adjusted using similar detailed data obtained from the farms of Mario Callejas, Sahlman Seafoods of Nicaragua, S. A. and the detailed information provided by the UCA survey of shrimp unions and cooperatives. The combination of and use of data from these sources resulted in the baseline cost and returns budget for a semi-intensive shrimp farm in Nicaragua.

Sensitivity analysis was also performed on changes in stocking density, post-larvae cost, survival rate, and price. This analysis provides insight into the responsiveness of earnings and cost to a change in a single designated variable. The sensitivity analysis is accomplished by changing one variable at a time, while holding all others constant. Allowing one variable to change at a time provides insight into the relative importance of that particular variable to the performance of the shrimp farm (Appendixes A and B).

4.1 Assumptions

To generate the baseline budget for an average year, all financial and production data over the 1994-1999 year period were averaged. Actual survival rates were calculated based on the budget information. In addition, the budget provides a useful benchmark from which to assess the effects on profits from changes in certain key variables, such as stocking density, post-larvae cost, and survival rate. The various formulas used in the analysis are provided in Appendix C.

4.2 Production

The grow-out phase averages 134 days. The ponds are stocked at a density of 18.16 PL/m^2. Although survival rates varied over the years due to the presence of natural disasters and viruses, the base budget survival rate was estimated at approximately 14 percent. On average, shrimp harvest size was 12.96 grams (head-on). For the baseline farm budget, the number of production cycles per year was on average 2.04. Finally, feed conversion rate was 1.81 to 1. In Nicaragua, shrimp farmers must contend with dry and rainy season conditions and associated production differences. Both rainfall and salinity fluctuate sharply between these two seasons. As a result, yields, survival rates, and average weight also vary between the rainy and dry seasons.

Estimated survival rates from stocking to harvest tend to vary among farms. In many instances, farmers rely on assumptions based on their experience in shrimp farming. Practical survival rates are estimated by counting the number of live PL per liter of water or per gram of PL. The number of PL per liter or per gram coming from the lab and during the acclimation process is compared and thus establishes the first measure of survival rate. After a period of time from the stocking date, a net is used to harvest samples of shrimp from the pond in order to establish the number of shrimp in the pond. Sampling is performed randomly about the pond and with farmers weighing one or more kg of every shrimp sample and then counting the number of animals in the sample. Comparing this number of animals and the number of PL per kg stocked results in the survival rate percentage for a pond. The entire process at the pond is repeated several times during the grow-out cycle. Sampling across all ponds then provides the survival rate at a given point in time.

The final survival rate is computed by counting the number of animals at the processing plant. First, the shrimp is weighted to determine the total pounds harvested. Second, the weighted average of the different count sizes of shrimp is estimated. Once the average harvest size is determined, the number of animals per kilogram is calculated. This final estimate is then compared to the number of PL per kg stocked to determine the final survival rate.

In this study, survival rates were calculated using theoretical methods. Based on the available production information, a formula was derived to calculate survival rates.

$$\text{Theoretical Survival Rate} = \frac{\text{Total Pounds Harvested}}{(\text{Stocking Density} * (\text{Total seeded Ha} * 10{,}000\ m^2) * \text{Harvest Weight} * \text{Cycles per year}) / 453.59237}$$

While survival rates in the original budgets ranged from 19 percent to 54 percent, calculated survival rates ranged from 7.46 percent to 51.92 percent based on the theoretical model and the total number of post-larvae seeded.

Practical survival rates and their equivalent theoretical and predicted practical survival rates are shown in order to equate practical field measures with the theoretical rates shown in the base budgets (Table 4).

Table 4.

Practical, Theoretical, and Predicted Practical Survival Rate Comparisons

Practical Survival Rate	Theoretical Survival Rate	"Predicted" Practical Survival Rate
--Percentage--		
15-16	5	13.49
17-18	6	15.40
19	7	17.32
20	8	19.24
21-22	9	21.15
23	10	23.07
24	11	24.99
25	12	26.91
26	13	28.82
27-28-29	14	30.74
30-31	15	32.66
32-33	16	34.58
34-35-36	17	36.49
37-38-39	18	38.41
40-41-42	19	40.33
43-44-45	20	42.25
46-47	21	44.16
48	22	46.08
49	23	48.00
50	24	49.91

Since survival rates employed in this study are stated in a different form from those in the original financial and production statements, a simple regression was used to calculate equivalent practical survival rates as a function of theoretical survival rates (Table 4). Equivalent practical survival rates were obtained simply by averaging survival rates and other production parameters in the original budgets and then estimating their corresponding theoretical survival rates. The model that resulted from the regression is as follows below. The equation calculates the "predicted" practical survival rates shown in the third column in table 4.

"Predicted" Practical Survival Rate = 3.899248 + (1.917293* Theoretical Survival Rate)

4.3 Financial

Profitability of the baseline operation depends on assumptions regarding the financial aspects of the business. Selling price (head-on) averaged US$2.17 per pound of shrimp. Post larvae cost averaged US$3.97 per thousand PL. Feed cost was computed using a price of US$0.26 per pound of feed. On a per hectare basis, the cost of chemicals was US$ 90.93. Other indirect costs accounted for US$1,455.81. Other indirect costs include fuel, diesel[10], technical supervision, interest, concession fee, governmental taxes, and depreciation, the latter being the most important. Finally, direct labor cost is US$0.06 per pound of shrimp harvested. According to producer, indirect costs can be extremely high.

In the baseline budget (Appendix Table A1), the cost per pound of shrimp harvested is US$2.00. Assuming a market price of US$2.17, the operation is returning US$0.17 per pound of shrimp harvested to the shrimp farmer.

4.4 Sensitivity Analysis (One parameter changed)

Sensitivity analysis was used to examine the changes in output and financial performance, given a change in stocking density, post-larvae cost, survival rate, or shrimp price.

*4.4.1 **Stocking Density***. The density of post-larvae stocked is varied from 10 to 30 PL/m². Altering stocking density affects every cost and return category. Total cost changes as the number of post-larvae for initial stocking changes. Gross profit decreases as the stocking density decreases and increases as the stocking density increases. As the stocking density falls to 10 PL/m² from the baseline, the cost per pound of shrimp harvested increases to $2.82 as total costs are spread across fewer shrimp harvests. Net returns are negative at this stocking density. As the stocking density increases to 20 and 30 PL/m², total operating cost per pound of shrimp harvested decreases to US$1.91 and US$1.61 respectively, allowing profits per pound to increase. To break even, a shrimp farmer should stock 15.52 PL/m² (Appendix Tables A2, A3, A4, and A5).

*4.4.2 **Post-Larvae Cost***. Three prices per thousand post-larvae are considered: US$2.00, US$5.00, and US$6.00 Changes in the cost of post-larvae affects total cost and hence

[10] Normally, fuel and diesel costs are allocated as direct costs but in this study these costs have been categorized as indirect costs.

profit. Revenue remains constant. As the cost per thousand of post-larvae decreases, the cost per pound of shrimp harvested decreases as well. At US$2.00 per thousand PL, the cost per pound of shrimp harvested falls to US$1.77 from the baseline, resulting in an increase in gross profit. Meanwhile, total operating cost per pound of shrimp harvested increases to US$2.12 if PL cost increases to US$5.00 per thousand. In that case, profits decrease to US$0.05 per pound. At US$5.42 per thousand PL, a shrimp farmer breaks even. At US$6.00 per thousand PL, the farm is not profitable (Appendix Tables A6, A7, A8, and A9).

4.4.3 Survival Rate[11]. Survival rates were varied from 5 percent to 20 percent. As survival rates dropped from the baseline 14 percent, net returns decreased. With a 5 percent or 10 percent survival rate, shrimp farming is unprofitable. Increases in overall survival produces higher returns to the farmer. With a 20 percent rate of survival, the farmer could generate a profit of US$0.58 per pound of shrimp harvested as opposed to only US$0.17 from the baseline. The break-even survival rate of the base budget is 12.98 percent (theoretical rate) or 28.78 percent (practical rate) (Appendix Tables A10, A11, A12, A13, and A14).

4.4.4 Shrimp Price. Three different shrimp prices per pound were considered: US$2.50, US$3.00 and US$3.50. For all the price levels, net returns are positive. The break-even price of the baseline budget is US$2.00 per pound of shrimp harvested (Appendix Tables A15, A16, A17, and A18).

A summary of the sensitivity analysis conducted on stocking density, post-larvae cost, survival rate, and shrimp price is presented in table 5. The measures of financial performance examined include total revenue, total costs, and net profit on per pound and per hectare basis. The table also shows the pounds per hectare that could be harvested given a change in one of the production variables.

[11] Survival rates in this section are theoretical survival rates.

Table 5.

Summary of Sensitivity Analysis (Depreciation Included)

	Stocking Density	Post-larvae Cost	Survival Rate	Price US$/Lb	Total Lbs/ha		Total US$ Per Lb Harvested	US $Per Seeded Ha	Appendix Table
						US $			
Base Budget	18.16 PL/m²	3.97	0.14 =(.31)*	2.17	1,536 Revenue	2,247,385.99	2.17	3,339.41	**A1**
					Cost	2,069,833.71	2.00	3,075.59	
					Profit	177,552.29	0.17	263.83	
Stocking Density (PL/m²)	10.00				846 Revenue	1,237,411.07	2.17	1,838.68	**A2**
					Cost	1,607,449.55	2.82	2,388.53	
					Profit	(370,038.47)	(0.65)	(549.84)	
	20.00				1,691 Revenue	2,474,822.15	2.17	3,677.36	**A3**
					Cost	2,173,957.95	1.91	3,230.31	
					Profit	300,864.20	0.26	447.06	
	30.00				2,537 Revenue	3,712,233.22	2.17	5,516.05	**A4**
					Cost	2,740,466.36	1.61	4,072.09	
					Profit	971,766.87	0.57	1,443.96	
Break-Even	15.52				1,312 Revenue	1,919,909.04	2.17	2,852.81	**A5**
					Cost	1,919,909.04	2.17	2,852.81	
					Profit	0.00	0.00	0.00	
Post-larvae Cost		2.00			1,536 Revenue	2,247,385.99	2.17	3,339.41	**A6**
					Cost	1,829,650.91	1.77	2,718.70	
					Profit	417,735.08	0.40	620.72	
		5.00			1,536 Revenue	2,247,385.99	2.17	3,339.41	**A7**
					Cost	2,740,466.36	2.12	3,263.56	
					Profit	51,050.84	0.05	75.86	
		6.00			1,536 Revenue	2,247,385.99	2.17	3,339.41	**A8**
					Cost	2,318,563.24	2.24	3,445.18	
					Profit	(71,177.24)	(0.07)	(105.76)	
Break-Even		5.42			1,536 Revenue	2,247,385.99	2.17	3,339.41	**A9**
					Cost	2,247,385.99	2.17	3,339.41	
					Profit	0.00	0.00	0.00	
Survival Rate			0.05 =(.13)*		530 Revenue	775,574.70	2.17	1,152.43	**A10**
					Cost	1,713,402.45	4.80	2,545.96	
					Profit	(937,827.75)	(2.63)	(1,393.53)	
			0.10 =(.23)*		1,060 Revenue	1,551,149.40	2.17	2,304.87	**A11**
					Cost	1,901,224.81	2.66	2,825.05	
					Profit	(350,075.41)	(0.49)	(520.18)	
			0.15 =(.33)*		1,590 Revenue	2,326,724.11	2.17	3,457.30	**A12**
					Cost	2,089,047.16	1.95	3,104.14	
					Profit	237,676.94	0.22	353.17	
			0.20 =(.42)*		2,120 Revenue	3,102,298.81	2.17	4,609.74	**A13**
					Cost	2,276,869.52	1.60	3,383.22	
					Profit	825,429.29	0.58	1,226.51	

(Continued) Break-Even		0.13	1,376	Revenue	2,013,095.04	2.17	2,991.28	A14
				Cost	2,013,095.04	2.17	2,991.28	
				Profit	0.00	0.00	0.00	
Price		2.50	1,536	Revenue	2,584,152.78	2.50	3,839.82	A15
				Cost	2,069,833.71	2.00	3,075.59	
				Profit	514,319.08	0.50	764.23	
		3.00	1,536	Revenue	3,100,983.34	3.00	4,607.78	A16
				Cost	2,069,833.71	2.00	3,075.59	
				Profit	1,031,149.63	1.00	1,532.20	
		3.50	1,536	Revenue	3,617,813.90	3.50	5,375.75	A17
				Cost	2,069,833.71	2.00	3,075.59	
				Profit	1,547,980.19	1.50	2,300.16	
Break-Even		2.00	1,536	Revenue	2,069,833.71	2.00	3,075.59	A18
				Cost	2,069,833.71	2.00	3,075.59	
				Profit	0.00	0.00	0.00	

* Predicted practical survival rates calculated by using the equation included above.

4.5 Sensitivity Analysis (Two parameters changed)

In this section, two parameters were varied at the same time. They were stocking density and survival rate and stocking density and shrimp price. The corresponding changes in net returns (expressed in US Dollars) for each of these combinations are shown below (Tables 6A and 6B).

Net returns vary as stocking density and survival rates change. At 28.78 percent survival rate, a shrimp farmer will break even (B-E) with a stocking rate of 18.16 PL/m². Meanwhile, a shrimp farmer, stocking 15.52 PL/m², will require a survival rate of 31.68 percent to cover costs.

Table 6A.

Stocking Density vs. Survival Rate

			Stocking Density (PL/m²)					
			B-E (Dep.)	Base Budget				
	Predicted	**Theoretical**	**10**	**15.52**	**18.16**	**20**	**30**	
	13.49	5.00	(984,167)	(952,853)	(937,828)	(927,393)	(870,618)	
Survival Rate	23.07	10.00	(660,550)	(450,745)	(350,075)	(280,160)	100,231	Price = $2.17/lb
B-E (Dep.)	28.78	12.98	(467,799)	(151,680)	0	105,344	678,486	PL cost= $3.97/1000
Base Budget	31.68	14.49	(370,038)	0	177,552	300,864	971,767	
	32.66	15.00	(336,934)	51,364	237,677	367,073	1,071,081	
	42.25	20.00	(13,317)	553,472	825,429	1,014,307	2,041,930	

Holding survival rate constant at 30.7 percent and post-larvae cost at US$3.97 per thousand PL, net profits increase as price and stocking density increase. Higher market prices require less PL/m² to be profitable.

Table 6B.

Stocking Density vs. Price

		Stocking Density (PL/m²)					
		B-E (Dep.)		Base Budget			
Price (US/Lb)		**10**	**15.52**	**18.16**	**20**	**30**	
B-E (Dep.)	**2.00**	(467,799)	(151,680)	0	105,344	678,486	Predicted rate =30.7%
Base Budget	**2.17**	(370,038)	0	177,552	300,864	971,767	Theoretical rate=14.0%
	2.50	(184,615)	287,695	514,319	671,712	1,528,038	PL cost = $3.97/1000
	3.00	99,952	729,216	1,031,150	1,240,846	2,381,739	
	3.50	384,519	1,170,737	1,547,980	1,809,980	3,235,440	

4.6 Sensitivity Analysis (Three parameters changed)

To demonstrate the effects of management strategies corresponding to different production and cost levels, another sensitivity analysis was performed. Three parameters, including stocking density, shrimp price, and survival rate, were varied simultaneously. Post-larvae cost (US$ 3.97/1000) remained constant across management strategies. The variations in total revenue are illustrated below (Tables 7A-7F).

At 13.49 percent survival rate, a shrimp farm will not be profitable at any of the levels of stocking density and market price considered in this analysis. As survival rate increases, lower levels of stocking density are required for achieving positive net returns. Stocking density levels decline further if both survival rate and market price increases simultaneously.

Table 7A.

		Stocking Density (PL/m²)						
		B-E (Dep.)		Base Budget				
Price (US/Lb)		**10**	**15.52**	**18.16**	**20**	**30**	**Theoretical**	**Predicted**
B-E (Dep.)	**2.00**	(1,017,904)	(1,005,198)	(999,101)	(994,867)	(971,830)	5.00	13.49
Base Budget	**2.17**	(984,167)	(952,853)	(937,828)	(927,393)	(870,618)		
	2.50	(920,177)	(853,569)	(821,609)	(799,413)	(678,649)		
	3.00	(821,973)	(701,200)	(643,251)	(603,004)	(384,036)		
	3.50	(723,768)	(548,831)	(464,892)	(406,596)	(89,423)		

Table 7B.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (Dep.) 10	15.52	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (Dep.)	2.00	(728,025)	(555,435)	(472,622)	(415,108)	(102,192)	10.00	23.07
Base Budget	2.17	(660,550)	(450,745)	(350,075)	(280,160)	100,231		
	2.50	(532,571)	(252,177)	(117,638)	(24,200)	484,171		
	3.00	(336,162)	52,561	239,079	368,617	1,073,396		
	3.50	(139,753)	357,300	595,796	761,434	1,662,622		

Table 7C.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (Dep.) 10	15.52	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (Dep.)	2.00	(555,368)	(287,548)	(159,042)	(69,794)	415,780	12.98	28.78
Base Budget	2.17	(467,799)	(151,680)	0	105,344	678,486		
	2.50	(301,705)	106,022	301,659	437,530	1,176,766		
	3.00	(46,805)	501,514	764,609	947,332	1,941,468		
	3.50	208,096	897,006	1,227,560	1,457,133	2,706,170		

Table 7D.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (Dep.) 10	15.52	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (Dep.)	2.00	(467,799)	(151,680)	0	105,344	678,486	14.49	31.68
Base Budget	2.17	(370,038)	0	177,552	300,864	971,767		
	2.50	(184,615)	287,695	514,319	671,712	1,528,038		
	3.00	99,952	729,216	1,031,150	1,240,846	2,381,739		
	3.50	384,519	1,170,737	1,547,980	1,809,980	3,235,440		

Table 7E.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (Dep.) 10	15.52	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (Dep.)	2.00	(438,145)	(105,671)	53,857	164,651	767,446	15.00	32.66
Base Budget	2.17	(336,934)	51,364	237,677	367,073	1,071,081		
	2.50	(144,964)	349,215	586,332	751,013	1,646,990		
	3.00	149,649	806,322	1,121,408	1,340,239	2,530,829		
	3.50	444,262	1,263,430	1,656,484	1,929,465	3,414,667		

Table 7F.

Stocking Density (PL/m²)

Price (US/Lb)		10	15.52 (B-E (Dep.))	18.16 (Base Budget)	20	30	Theoretical	Predicted
B-E (Dep.)	2.00	(148,266)	344,092	580,336	744,409	1,637,084	20.00	42.25
Base Budget	2.17	(13,317)	553,472	825,429	1,014,307	2,041,930		
	2.50	242,642	950,607	1,290,303	1,526,226	2,809,809		
	3.00	635,460	1,560,084	2,003,738	2,311,860	3,988,261		
	3.50	1,028,277	2,169,560	2,717,172	3,097,495	5,166,712		

4.7 Sensitivity Analysis (one parameter changed) Depreciation not included

Depreciation costs are generally a large portion of indirect costs and may play an important role, especially in newer shrimp farms. However, there are older farms that may have little or no depreciation. Therefore, this new sensitivity analysis excludes depreciation and demonstrates changes in cost and revenues, given a change in one of the four key variables, including stocking density, survival rate, post-larvae cost, and shrimp price (Table 8). A new baseline budget excluding depreciation was generated (Appendix Table B1).

Total cost per pound harvested and on per hectare basis drops significantly, thus generating higher profits. Break-even stocking density, survival rate, and shrimp price declines as well as depreciation is excluded.

*4.7.1 **Stocking Density**.* Stocking density is allowed to change from 10 to 30 PL/m². By excluding depreciation, total cost decreases and gross profit increases. The break-even stocking density is 9.38 PL/m² (Appendix Tables B2, B3, B4, and B5).

*4.7.2 **Post-Larvae Cost**.* Three different post-larvae costs were analyzed: US$2.00, US$5.00, and US$6.00. Break-even post-larvae cost changes from US$5.42 when depreciation is included to US$8.78 when depreciation is not included (Appendix Tables B6, B7, B8, and B9).

*4.7.3 **Survival Rate**.* Survival rates were varied from 5 percent to 20 percent (theoretical survival rates). At any survival rate above 9 percent, a shrimp farmer generates positive net returns (Appendix Tables B10, B11, B12, B13, and B14).

*4.7.4 **Shrimp Price**.* The price levels considered were US$2.50, US$3.00, and US$3.50 per pound of shrimp. Gross profits are positive at all these different prices. The break-

even price is US$1.60 per pound when depreciation is not included (Appendix Tables B15, B16, B17, and B18).

Table 8.

Summary of Sensitivity Analysis (Depreciation not Included)

	Stocking Density	Post-larvae Cost	Survival Rate	Price US/Lb	Total Lbs/ha		Total US $	US$ Per Lb Harvested	US $Per Seeded Ha	Appendix Table
Base Budget	18.16 PL/m²	3.97	0.14 =(.32)*	2.17	1,536	Revenue	2,247,385.99	2.17	3,339.41	**B1**
						Cost	1,658,340.47	1.60	2,464.15	
						Profit	589,045.52	0.57	875.27	
Stocking Density (PL/m²)	10.00				846	Revenue	1,237,411.07	2.17	1,838.68	**B2**
						Cost	1,195,956.31	2.10	1,777.08	
						Profit	41,454.76	0.07	61.60	
	20.00				1,691	Revenue	2,474,822.15	2.17	3,677.36	**B3**
						Cost	1,762,464.71	1.55	2,618.86	
						Profit	712,357.44	0.63	1,058.50	
	30.00				2,537	Revenue	3,712,233.22	2.17	5,516.05	**B4**
						Cost	2,328,973.12	1.36	3,460.65	
						Profit	1,383,260.11	0.81	2,055.40	
Break-Even	9.38				793	Revenue	1,160,952.03	2.17	1,725.07	**B5**
						Cost	1,160,952.02	2.17	1,725.07	
						Profit	0.00	0.00	0.00	
Post-larvae Cost		2.00			1,536	Revenue	2,247,385.99	2.17	3,339.41	**B6**
						Cost	1,418,157.67	1.37	2,107.26	
						Profit	829,228.32	0.80	1,232.16	
		5.00			1,536	Revenue	2,247,385.99	2.17	3,339.41	**B7**
						Cost	1,784,841.92	1.73	2,652.12	
						Profit	462,544.08	0.45	687.30	
		6.00			1,536	Revenue	2,247,385.99	2.17	3,339.41	**B8**
						Cost	1,907,070.00	1.8*4	2,833.74	
						Profit	340,316.00	0.33	505.68	
Break-Even		8.78			1,536	Revenue	2,247,385.99	2.17	3,339.41	**B9**
						Cost	2,247,385.99	2.17	3,339.41	
						Profit	0.00	0.00	0.00	
Survival Rate			0.05 =(0.13)*		530	Revenue	775,574.70	2.17	1,152.43	**B10**
						Cost	1,301,909.22	3.65	1,934.52	
						Profit	(526,334.51)	(1.48)	(782.09)	
			0.10 =(0.23)*		1,060	Revenue	1,551,149.40	2.17	2,304.87	**B11**
						Cost	1,489,731.57	2.09	2,213.61	
						Profit	61,417.83	0.09	91.26	
			0.15 =(0.33)*		1,590	Revenue	2,326,724.11	2.17	3,457.30	**B12**
						Cost	1,677,553.93	1.57	2,492.70	
						Profit	649,170.18	0.61	964.61	

(Continued)		0.20	=(0.42)*	2,120	Revenue	3,102,298.81	2.17	4,609.74	**B13**
					Cost	1,865,376.28	1.31	2,771.78	
					Profit	1,236,922.53	0.87	1,837.96	
Break-Even		0.09	=(0.22)*	1,005	Revenue	1,470,104.87	2.17	2,184.44	**B14**
					Cost	1,470,104.87	2.17	2,184.44	
					Profit	0.00	0.00	0.00	
Price		2.50		1,536	Revenue	2,584,152.78	2.50	3,839.82	**B15**
					Cost	1,658,340.47	1.60	2,464.15	
					Profit	925,812.32	0.90	1,375.67	
		3.00		1,536	Revenue	3,100,983.34	3.00	4,607.78	**B16**
					Cost	1,658,340.47	1.60	2,464.15	
					Profit	1,442,642.87	1.40	2,143.64	
		3.50		1,536	Revenue	3,617,813.90	3.50	5,375.75	**B17**
					Cost	1,658,340.47	1.60	2,464.15	
					Profit	1,959,473.43	1.90	2,911.60	
Break-Even		1.60		1,536	Revenue	1,658,340.47	1.60	2,464.15	**B18**
					Cost	1,658,340.47	1.60	2,464.15	
					Profit	0.00	0.00	0.00	

Predicted practical survival rate calculated by using equation included above p. 16.

4.8 Sensitivity Analysis (Two parameters changed) Depreciation not included

In a real world setting, several variables may change simultaneously, which compounds their individual effect. In this case, not only depreciation has been excluded but also stocking density and survival rate, and stocking density and price have been varied at the same time. Lower stocking densities and survival rates are required to cover costs when depreciation is excluded of the baseline budget. (Tables 9A and 9B)

Post-larvae cost and shrimp price remained constant at US$3.97 per thousand PL and at US$2.17 per pound, respectively. Break-even survival rate is 22.07 percent when stocking density is 18.16 PL/m². If stocking density declines to 9.38 PL/m², the break-even survival rate rises to 31.68 percent.

Table 9A.
Stocking Density vs. Survival Rate

			Stocking Density (PL/m²)					
			B-E (No Dep.)		Base Budget			
	Predicted	Theoretical	9.38	10	18.16	20	30	
Survival Rate	13.49	5.00	(576,182)	(572,674)	(526,335)	(515,899)	(459,125)	
B-E (No Dep.)	22.07	9.48	(304,288)	(282,874)	0	63,700	410,274	
	23.07	10.00	(272,561)	(249,057)	61,418	131,334	511,724	Price = $2.17/lb
Base Budget	31.68	14.49	0	41,455	589,046	712,357	1,383,260	PL cost= $3.97/10
	32.66	15.00	31,059	74,559	649,170	778,567	1,482,574	
	42.25	20.00	334,680	398,176	1,236,923	1,425,800	2,453,424	

Holding survival rate constant at 30.7 percent and post-larvae cost at US$3.97 per thousand PL, the first break-even stocking density and shrimp price is 18.16 PL/m² and US$1.60 per pound. The next break-even point is reached at a stocking density of 9.38 PL/m² and at a market price of US$2.17 per pound of shrimp.

Table 9B.

Stocking Density vs. Price

		Stocking Density (PL/m²)					
		B-E (No Dep.)		Base Budget			
Price (US/Lb)		**9.38**	**10**	**18.16**	**20**	**30**	
B-E (No Dep.)	**1.60**	(304,288)	(282,874)	0	63,700	410,274	
Base Budget	**2.17**	0	41,455	589,046	712,357	1,383,260	Predicted rate =30.7%
	2.50	173,967	226,879	925,812	1,083,205	1,939,532	Theoretical rate=14.0%
	3.00	440,950	511,446	1,442,643	1,652,339	2,793,233	PL cost = $3.97/1000
	3.50	707,934	796,013	1,959,473	2,221,473	3,646,934	

4.9 Sensitivity Analysis (Three parameters changed) Depreciation not included

Simultaneous variations in stocking density, survival rate, and price create fluctuations in break-even prices, survival rate, stocking density and net returns. When depreciation is not included in the baseline budget, a shrimp farm can be profitable at 13.49 percent of survival rate but it requires high levels of both stocking rate and shrimp price. As survival rate increases, lower levels of stocking density and shrimp price are necessary to generate positive net returns. (Tables 10A-10F)

Table 10A.

Stocking Density (PL/m²)

		B-E (No Dep.)		Base Budget				
Price (US/Lb)		**9.38**	**10**	**18.16**	**20**	**30**	**Theoretical**	**Predicted**
B-E (No Dep.)	**1.60**	(681,192)	(684,600)	(729,615)	(739,751)	(794,903)	5.00	13.49
Base Budget	**2.17**	(576,182)	(572,674)	(526,335)	(515,899)	(459,125)		
	2.50	(516,146)	(508,684)	(410,116)	(387,920)	(267,155)		
	3.00	(424,009)	(410,479)	(231,757)	(191,511)	27,457		
	3.50	(331,873)	(312,275)	(53,399)	4,898	322,070		

Table 10B.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (No Dep.) 9.38	10	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (No Dep.)	1.60	(503,336)	(495,030)	(385,318)	(360,612)	(226,194)	9.48	22.07
Base Budget	2.17	(304,288)	(282,874)	0	63,700	410,274		
	2.50	(190,490)	(161,581)	220,293	306,287	774,154		
	3.00	(15,845)	24,566	558,372	678,580	1,332,594		
	3.50	158,799	210,713	896,452	1,050,873	1,891,034		

Table 10C.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (No Dep.) 9.38	10	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (No Dep.)	1.60	(482,582)	(472,909)	(345,142)	(316,371)	(159,832)	10.00	23.07
Base Budget	2.17	(272,561)	(249,057)	61,418	131,334	511,724		
	2.50	(152,489)	(121,077)	293,855	387,293	895,664		
	3.00	31,783	75,331	650,572	780,111	1,484,890		
	3.50	216,056	271,740	1,007,289	1,172,928	2,074,115		

Table 10D.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (No Dep.) 9.38	10	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (No Dep.)	1.60	(304,288)	(282,874)	0	63,700	410,274	14.49	31.68
Base Budget	2.17	0	41,455	589,046	712,357	1,383,260		
	2.50	173,967	226,879	925,812	1,083,205	1,939,532		
	3.00	440,950	511,446	1,442,643	1,652,339	2,793,233		
	3.50	707,934	796,013	1,959,473	2,221,473	3,646,934		

Table 10E.

Stocking Density (PL/m²)

Price (US/Lb)		B-E (No Dep.) 9.38	10	Base Budget 18.16	20	30	Theoretical	Predicted
B-E (No Dep.)	1.60	(283,971)	(261,219)	39,330	107,010	475,240	15.00	32.66
Base Budget	2.17	31,059	74,559	649,170	778,567	1,482,574		
	2.50	211,167	266,529	997,826	1,162,506	2,058,483		
	3.00	487,576	561,142	1,532,902	1,751,732	2,942,322		
	3.50	763,985	855,755	2,067,977	2,340,958	3,826,161		

Table 10F.

Stocking Density (PL/m²)

		B-E (No Dep.)		Base Budget				
Price (US/Lb)		**9.38**	**10**	**18.16**	**20**	**30**	**Theoretical**	**Predicted**
B-E (No Dep.)	**1.60**	(85,361)	(49,528)	423,802	530,391	1,110,311	20.00	42.25
Base Budget	**2.17**	334,680	398,176	1,236,923	1,425,800	2,453,424		
	2.50	574,824	654,136	1,701,796	1,937,719	3,221,303		
	3.00	943,369	1,046,953	2,415,231	2,723,353	4,399,754		
	3.50	1,311,914	1,439,770	3,128,666	3,508,988	5,578,206		

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TABLE A 1. BASE BUDGET

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha) (Dep Included)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,069,833.71**	2.00	3,075.59
Gross Profit $	**177,552.29**	0.17	263.83
Profit Margin	7.90%		

TABLE A 2. STOCKING DENSITY 10 PL/M2

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	10.00	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	569,134
Lbs Harvested/ha (head-on)	846
Lbs Harvested/ha/year (head-on)	1,725

Cash Flow Budget for Shrimp Farm Item		Per Harvested Pound	Per Seeded Ha
Pounds Harvested	569,134		
Price (US$/lb)	2.17		
Total Revenue $	**1,237,411.07**	2.17	1,838.68
Operating Expenses:			
Postlarvae $	266,842.28	0.47	396.50
Feed $	264,025.34	0.46	392.32
Chemicals/Fertilizer $	61,195.34	0.11	90.93
Direct Labor $	35,640.78	0.06	52.96
Indirect Costs $	979,745.81	1.72	1,455.81
Total Operating Expenses $	**1,607,449.55**	2.82	2,388.53
Gross Profit $	**(370,038.47)**	(0.65)	(549.84)
Profit Margin	-29.90%		

TABLE A 3. STOCKING DENSITY 20 PL/M2

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	20.00	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,138,268
Lbs Harvested/ha (head-on)	1,691
Lbs Harvested/ha/year (head-on)	3,450

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,138,268		
Price (US$/lb)	2.17		
Total Revenue $	**2,474,822.15**	2.17	3,677.36
Operating Expenses:			
Postlarvae $	533,684.57	0.47	793.01
Feed $	528,050.69	0.46	784.64
Chemicals/Fertilizer $	61,195.34	0.05	90.93
Direct Labor $	71,281.55	0.06	105.92
Indirect Costs $	979,745.81	0.86	1,455.81
Total Operating Expenses $	**2,173,957.95**	1.91	3,230.31
Gross Profit $	**300,864.20**	0.26	447.06
Profit Margin	12.16%		

TABLE A 4. STOCKING DENSITY 30 PL/M2

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	30.00	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,707,402
Lbs Harvested/ha (head-on)	2,537
Lbs Harvested/ha/year (head-on)	5,176

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,707,402		
Price (US$/lb)	2.17		
Total Revenue $	**3,712,233.22**	2.17	5,516.05
Operating Expenses:			
Postlarvae $	800,526.85	0.47	1,189.51
Feed $	792,076.03	0.46	1,176.95
Chemicals/Fertilizer $	61,195.34	0.04	90.93
Direct Labor $	106,922.33	0.06	158.88
Indirect Costs $	979,745.81	0.57	1,455.81
Total Operating Expenses $	**2,740,466.36**	1.61	4,072.09
Gross Profit $	**971,766.87**	0.57	1,443.96
Profit Margin	26.18%		

BASE BUDGET

TABLE A 5. Break-Even Stocking Density

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	15.52	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	883,042
Lbs Harvested/ha (head-on)	1,312
Lbs Harvested/ha/year (head-on)	2,677

Cash Flow Budget for Shrimp Farm

Item		Per Harvested Pound	Per Seeded Ha
Pounds Harvested	883,042		
Price (US$/lb)	2.17		
Total Revenue $	**1,919,909.04**	2.17	2,852.81
Operating Expenses:			
Postlarvae $	414,019.98	0.47	615.20
Feed $	409,649.35	0.46	608.70
Chemicals/Fertilizer $	61,195.34	0.07	90.93
Direct Labor $	55,298.56	0.06	82.17
Indirect Costs $	979,745.81	1.11	1,455.81
Total Operating Expenses $	**1,919,909.04**	2.17	2,852.81
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE A 6. POSTLARVAE COST (US $/ 1000) 2.00

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	2.00	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	244,456.16	0.24	363.24
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**1,829,650.91**	1.77	2,718.70
Gross Profit $	**417,735.08**	0.40	620.72
Profit Margin	18.59%		

TABLE A 7. POSTLARVAE COST (US $/ 1000) 5.00

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	5.00	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvested Pound	Per Seeded Ha
Item			
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	611,140.40	0.59	908.10
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,196,335.15**	2.12	3,263.56
Gross Profit $	**51,050.84**	0.05	75.86
Profit Margin	2.27%		

TABLE A 8. POSTLARVAE COST (US $/ 1000) 6.00

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	6.00	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661.1		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	733,368.48	0.71	1,089.72
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,318,563.24**	2.24	3,445.18
Gross Profit $	**(71,177.24)**	(0.07)	(105.76)
Profit Margin	-3.17%		

BASE BUDGET

TABLE A 9. Break-Even Post-Larvae Cost

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	5.42	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	662,191.24	0.64	983.96
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,247,385.99**	2.17	3,339.41
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE A 10. SURVIVAL RATE 5 %

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.05	0.13
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	356,717
Lbs Harvested/ha (head-on)	530
Lbs Harvested/ha/year (head-on)	1,081

Cash Flow Budget for Shrimp Farm Item		Per Harvested Pound	Per Seeded Ha
Pounds Harvested	356,717		
Price (US$/lb)	2.17		
Total Revenue $	**775,574.70**	2.17	1,152.43
Operating Expenses:			
Postlarvae $	484,638.96	1.36	720.13
Feed $	165,483.71	0.46	245.89
Chemicals/Fertilizer $	61,195.34	0.17	90.93
Direct Labor $	22,338.64	0.06	33.19
Indirect Costs $	979,745.81	2.75	1,455.81
Total Operating Expenses $	**1,713,402.45**	4.80	2,545.96
Gross Profit $	**(937,827.75)**	(2.63)	(1,393.53)
Profit Margin	-120.92%		

TABLE A 11. SURVIVAL RATE 10 %

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.10	0.23
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	713,435
Lbs Harvested/ha (head-on)	1,060
Lbs Harvested/ha/year (head-on)	2,163

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	713,435		
Price (US$/lb)	2.17		
Total Revenue $	**1,551,149.40**	2.17	2,304.87
Operating Expenses:			
Postlarvae $	484,638.96	0.68	720.13
Feed $	330,967.42	0.46	491.79
Chemicals/Fertilizer $	61,195.34	0.09	90.93
Direct Labor $	44,677.29	0.06	66.39
Indirect Costs $	979,745.81	1.37	1,455.81
Total Operating Expenses $	**1,901,224.81**	2.66	2,825.05
Gross Profit $	**(350,075.41)**	(0.49)	(520.18)
Profit Margin	-22.57%		

TABLE A 12. SURVIVAL RATE 15 %

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.15	0.33
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,070,152
Lbs Harvested/ha (head-on)	1,590
Lbs Harvested/ha/year (head-on)	3,244

Cash Flow Budget for Shrimp Farm

Item		Per Harvested Pound	Per Seeded Ha
Pounds Harvested	1,070,152		
Price (US$/lb)	2.17		
Total Revenue $	**2,326,724.11**	2.17	3,457.30
Operating Expenses:			
Postlarvae $	484,638.96	0.45	720.13
Feed $	496,451.14	0.46	737.68
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	67,015.93	0.06	99.58
Indirect Costs $	979,745.81	0.92	1,455.81
Total Operating Expenses $	**2,089,047.16**	1.95	3,104.14
Gross Profit $	**237,676.94**	0.22	353.17
Profit Margin	10.22%		

TABLE A 13. SURVIVAL RATE 20 %

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.20	0.42
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,426,869
Lbs Harvested/ha (head-on)	2,120
Lbs Harvested/ha/year (head-on)	4,325

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,426,869		
Price (US$/lb)	2.17		
Total Revenue $	**3,102,298.81**	2.17	4,609.74
Operating Expenses:			
Postlarvae $	484,638.96	0.34	720.13
Feed $	661,934.85	0.46	983.58
Chemicals/Fertilizer $	61,195.34	0.04	90.93
Direct Labor $	89,354.57	0.06	132.77
Indirect Costs $	979,745.81	0.69	1,455.81
Total Operating Expenses $	**2,276,869.52**	1.60	3,383.22
Gross Profit $	**825,429.29**	0.58	1,226.51
Profit Margin	26.61%		

BASE BUDGET
TABLE A 14. Break-Even Survival Rate

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.13	0.29
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	925,901
Lbs Harvested/ha (head-on)	1,376
Lbs Harvested/ha/year (head-on)	2,807

Cash Flow Budget for Shrimp Farm		Per Harvested	Per Seeded
Item		Pound	Ha
Pounds Harvested	925,901		
Price (US$/lb)	2.17		
Total Revenue $	**2,013,095.04**	2.17	2,991.28
Operating Expenses:			
Postlarvae $	484,638.96	0.52	720.13
Feed $	429,532.37	0.46	638.25
Chemicals/Fertilizer $	61,195.34	0.07	90.93
Direct Labor $	57,982.57	0.06	86.16
Indirect Costs $	979,745.81	1.06	1,455.81
Total Operating Expenses $	**2,013,095.04**	2.17	2,991.28
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE A 15. PRICE US$2.50

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.50	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.50		
Total Revenue $	**2,584,152.78**	2.50	3,839.82
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,069,833.71**	2.00	3,075.59
Gross Profit $	**514,319.08**	0.50	764.23
Profit Margin	19.90%		

TABLE A 16. PRICE US$3.00

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	3.00	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	3.00		
Total Revenue $	**3,100,983.34**	3.00	4,607.78
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,069,833.71**	2.00	3,075.59
Gross Profit $	**1,031,149.63**	1.00	1,532.20
Profit Margin	33.25%		

TABLE A 17. PRICE US$3.50

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	3.50	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	3.50		
Total Revenue $	**3,617,813.90**	3.50	5,375.75
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,069,833.71**	2.00	3,075.59
Gross Profit $	**1,547,980.19**	1.50	2,300.16
Profit Margin	42.79%		

BASE BUDGET
TABLE A 18. Break-Even Price

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.00	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)	1,455.81	
Depreciation (42% of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep not Included)	844.37	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm

Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.00		
Total Revenue $	**2,069,833.71**	2.00	3,075.59
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	979,745.81	0.95	1,455.81
Total Operating Expenses $	**2,069,833.71**	2.00	3,075.59
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE B 1. BASE BUDGET
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		**Pound**	**Ha**
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,658,340.47**	1.60	2,464.15
Gross Profit $	**589,045.52**	0.57	875.27
Profit Margin	26.21%		

TABLE B 2. Stocking Density (10 PI/M2)
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	10.00	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	569,134
Lbs Harvested/ha (head-on)	846
Lbs Harvested/ha/year (head-on)	1,725

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	569,134		
Price (US$/lb)	2.17		
Total Revenue $	**1,237,411.07**	2.17	1,838.68
Operating Expenses:			
Postlarvae $	266,842.28	0.47	396.50
Feed $	264,025.34	0.46	392.32
Chemicals/Fertilizer $	61,195.34	0.11	90.93
Direct Labor $	35,640.78	0.06	52.96
Indirect Costs $	568,252.57	1.00	844.37
Total Operating Expenses $	**1,195,956.31**	2.10	1,777.08
Gross Profit $	**41,454.76**	0.07	61.60
Profit Margin	3.35%		

TABLE B 3. Stocking Density (20 PI/M2)
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	20.00	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not include	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,138,268
Lbs Harvested/ha (head-on)	1,691
Lbs Harvested/ha/year (head-on)	3,450

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,138,268		
Price (US$/lb)	2.17		
Total Revenue $	**2,474,822.15**	2.17	3,677.36
Operating Expenses:			
Postlarvae $	533,684.57	0.47	793.01
Feed $	528,050.69	0.46	784.64
Chemicals/Fertilizer $	61,195.34	0.05	90.93
Direct Labor $	71,281.55	0.06	105.92
Indirect Costs $	568,252.57	0.50	844.37
Total Operating Expenses $	**1,762,464.71**	1.55	2,618.86
Gross Profit $	**712,357.44**	0.63	1,058.50
Profit Margin	28.78%		

TABLE B 4. Stocking Density (30 PI/M2)
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	30.00	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,707,402
Lbs Harvested/ha (head-on)	2,537
Lbs Harvested/ha/year (head-on)	5,176

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		**Pound**	**Ha**
Pounds Harvested	1,707,402		
Price (US$/lb)	2.17		
Total Revenue $	**3,712,233.22**	2.17	5,516.05
Operating Expenses:			
Postlarvae $	800,526.85	0.47	1,189.51
Feed $	792,076.03	0.46	1,176.95
Chemicals/Fertilizer $	61,195.34	0.04	90.93
Direct Labor $	106,922.33	0.06	158.88
Indirect Costs $	568,252.57	0.33	844.37
Total Operating Expenses $	**2,328,973.12**	1.36	3,460.65
Gross Profit $	**1,383,260.11**	0.81	2,055.40
Profit Margin	37.26%		

TABLE B 5. BASE BUDGET Break-Even Stocking Density
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	9.38	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	533,967
Lbs Harvested/ha (head-on)	793
Lbs Harvested/ha/year (head-on)	1,619

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		**Pound**	**Ha**
Pounds Harvested	533,967		
Price (US$/lb)	2.17		
Total Revenue $	**1,160,952.03**	2.17	1,725.07
Operating Expenses:			
Postlarvae $	250,354.22	0.47	372.00
Feed $	247,711.34	0.46	368.08
Chemicals/Fertilizer $	61,195.34	0.11	90.93
Direct Labor $	33,438.55	0.06	49.69
Indirect Costs $	568,252.57	1.06	844.37
Total Operating Expenses $	**1,160,952.02**	2.17	1,725.07
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE B 6. Post-Larvae Cost (US$2.00)
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	2.00	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	244,456.16	0.24	363.24
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,418,157.67**	1.37	2,107.26
Gross Profit $	**829,228.32**	0.80	1,232.16
Profit Margin	36.90%		

TABLE B 7. Post-Larvae Cost (US$5.00)
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	5.00	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		**Pound**	**Ha**
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	611,140.40	0.59	908.10
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,784,841.92**	1.73	2,652.12
Gross Profit $	**462,544.08**	0.45	687.30
Profit Margin	20.58%		

TABLE B 8. Post-Larvae Cost (US$6.00)
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	6.00	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	733,368.48	0.71	1,089.72
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,907,070.00**	1.84	2,833.74
Gross Profit $	**340,316.00**	0.33	505.68
Profit Margin	15.14%		

TABLE B 9. Base Budget Break-Even Post-Larvae Cost (US$8.75)
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	8.78	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	2.17		
Total Revenue $	**2,247,385.99**	2.17	3,339.41
Operating Expenses:			
Postlarvae $	1,073,684.48	1.04	1,595.40
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**2,247,385.99**	2.17	3,339.41
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE B 10. Survival Rate 5 %
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.05	0.13
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	356,717
Lbs Harvested/ha (head-on)	530
Lbs Harvested/ha/year (head-on)	1,081

Cash Flow Budget for Shrimp Farm

Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	356,717		
Price (US$/lb)	2.17		
Total Revenue $	**775,574.70**	2.17	1,152.43
Operating Expenses:			
Postlarvae $	484,638.96	1.36	720.13
Feed $	165,483.71	0.46	245.89
Chemicals/Fertilizer $	61,195.34	0.17	90.93
Direct Labor $	22,338.64	0.06	33.19
Indirect Costs $	568,252.57	1.59	844.37
Total Operating Expenses $	**1,301,909.22**	3.65	1,934.52
Gross Profit $	**(526,334.51)**	(1.48)	(782.09)
Profit Margin	-67.86%		

TABLE B 11. Survival Rate 10 %
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.10	0.23
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	713,435
Lbs Harvested/ha (head-on)	1,060
Lbs Harvested/ha/year (head-on)	2,163

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	713,435		
Price (US$/lb)	2.17		
Total Revenue $	**1,551,149.40**	2.17	2,304.87
Operating Expenses:			
Postlarvae $	484,638.96	0.68	720.13
Feed $	330,967.42	0.46	491.79
Chemicals/Fertilizer $	61,195.34	0.09	90.93
Direct Labor $	44,677.29	0.06	66.39
Indirect Costs $	568,252.57	0.80	844.37
Total Operating Expenses $	**1,489,731.57**	2.09	2,213.61
Gross Profit $	**61,417.83**	0.09	91.26
Profit Margin	3.96%		

TABLE B 12. Survival Rate 15 %
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.15	0.33
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,070,152
Lbs Harvested/ha (head-on)	1,590
Lbs Harvested/ha/year (head-on)	3,244

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,070,152		
Price (US$/lb)	2.17		
Total Revenue $	**2,326,724.11**	2.17	3,457.30
Operating Expenses:			
Postlarvae $	484,638.96	0.45	720.13
Feed $	496,451.14	0.46	737.68
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	67,015.93	0.06	99.58
Indirect Costs $	568,252.57	0.53	844.37
Total Operating Expenses $	**1,677,553.93**	1.57	2,492.70
Gross Profit $	**649,170.18**	0.61	964.61
Profit Margin	27.90%		

TABLE B 13. Survival Rate 20 %
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.20	0.42
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,426,869
Lbs Harvested/ha (head-on)	2,120
Lbs Harvested/ha/year (head-on)	4,325

Cash Flow Budget for Shrimp Farm Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	1,426,869		
Price (US$/lb)	2.17		
Total Revenue $	**3,102,298.81**	2.17	4,609.74
Operating Expenses:			
Postlarvae $	484,638.96	0.34	720.13
Feed $	661,934.85	0.46	983.58
Chemicals/Fertilizer $	61,195.34	0.04	90.93
Direct Labor $	89,354.57	0.06	132.77
Indirect Costs $	568,252.57	0.40	844.37
Total Operating Expenses $	**1,865,376.28**	1.31	2,771.78
Gross Profit $	**1,236,922.53**	0.87	1,837.96
Profit Margin	39.87%		

TABLE B 14. BASE BUDGET Break-Even Survival Rate
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.09	0.22
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.17	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not included)	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	676,159
Lbs Harvested/ha (head-on)	1,005
Lbs Harvested/ha/year (head-on)	2,050

Cash Flow Budget for Shrimp Farm Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	676,159		
Price (US$/lb)	2.17		
Total Revenue $	**1,470,104.87**	2.17	2,184.44
Operating Expenses:			
Postlarvae $	484,638.96	0.72	720.13
Feed $	313,675.02	0.46	466.09
Chemicals/Fertilizer $	61,195.34	0.09	90.93
Direct Labor $	42,342.99	0.06	62.92
Indirect Costs $	568,252.57	0.84	844.37
Total Operating Expenses $	**1,470,104.87**	2.17	2,184.44
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

TABLE B 15. Price US$2.50
Depreciation not Included

Production Assumptions and Unit Cost		
Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	2.50	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		**Pound**	**Ha**
Pounds Harvested	1,033,661		
Price (US$/lb)	2.50		
Total Revenue $	**2,584,152.78**	2.50	3,839.82
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,658,340.47**	1.60	2,464.15
Gross Profit $	**925,812.32**	0.90	1,375.67
Profit Margin	35.83%		

TABLE B 16. Price US$3.00
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	3.00	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm

Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	3.00		
Total Revenue $	**3,100,983.34**	3.00	4,607.78
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,658,340.47**	1.60	2,464.15
Gross Profit $	**1,442,642.87**	1.40	2,143.64
Profit Margin	46.52%		

TABLE B 17. Price US$3.50
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions		Predicted
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	3.50	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm		Per Harvest	Per Seeded
Item		Pound	Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	3.50		
Total Revenue $	**3,617,813.90**	3.50	5,375.75
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,658,340.47**	1.60	2,464.15
Gross Profit $	**1,959,473.43**	1.90	2,911.60
Profit Margin	54.16%		

TABLE B 18. BASE BUDGET Break-Even Price US$1.60
Depreciation not Included

Production Assumptions and Unit Cost

Production Assumptions	Predicted	
Stocking Density (PL/m2)	18.16	
Survival Rate	0.14	0.32
Days Shrimp in Pond/cycles	133.29	
Weeks Shrimp in Pond/cycles	19.04	
Harvest Size (g) Fixed	12.98	
Number of cycles per year	2.04	
Food Conversion Ratio	1.81	
Total Seeded Ha	673	
Total Seeded Ha in m2	6,729,880	
Unit Costs		
Shrimp Price (US$/lb)	1.60	
Postlarvae (US$/1000)	3.97	
Feed (US$/lb)	0.26	
Chemical (US$/ha)	90.93	
Direct Labor (US$/lb harvested)	0.06	
Indirect Cost (US$/ha)(Dep. not includec	844.37	
Depreciation (42 % of Indirect Costs)	611.44	
Indirect Cost (US$/ha) (Dep. Included)	1,455.81	

Farm Production	
Total Surface Hectares in production	324
Total Pounds Harvested	1,033,661
Lbs Harvested/ha (head-on)	1,536
Lbs Harvested/ha/year (head-on)	3,133

Cash Flow Budget for Shrimp Farm Item		Per Harvest Pound	Per Seeded Ha
Pounds Harvested	1,033,661		
Price (US$/lb)	1.60		
Total Revenue $	**1,658,340.47**	1.60	2,464.15
Operating Expenses:			
Postlarvae $	484,638.96	0.47	720.13
Feed $	479,522.83	0.46	712.53
Chemicals/Fertilizer $	61,195.34	0.06	90.93
Direct Labor $	64,730.78	0.06	96.18
Indirect Costs $	568,252.57	0.55	844.37
Total Operating Expenses $	**1,658,340.47**	1.60	2,464.15
Gross Profit $	**0.00**	0.00	0.00
Profit Margin	0.00%		

Table C1. Formulas used in Analysis

Formulas

Weeks Shrimp in Pond/cycle	=	(Days Shrimp in Pond per cycle) / 7
Total Seeded Ha in m2	=	Total Seeded Ha * 10,000
Total Pounds Harvested	=	(Stocking Density * Total Seeded Ha in m2 * Survival rate * cycles * Harvest Weight) / 453.59237
Lbs Harvested/ha (head-on)	=	Total Pounds Harvested/ Total Seeded Ha
Lbs Harvested/ha/year (head-on)	=	(Total Pounds Harvested / Total Seeded Ha) * Cycles/ha/yr
Total Revenue	=	Lbs Harvested/ha (head-on) * Total Seeded Ha * Shrimp Price (US$/Lb)
Postlarvae	=	(Postlarvae (US$/1000) * Stocking Density * Total Seeded Ha in m2) / 1000
Feed	=	Total Pounds Harvested * FCR * Feed US$/lb
Chemicals/Fertilizer	=	Chemical (US$/ha) * Total Seeded Ha
Direct Labor	=	Direct Labor (US$ per lb harvest) * Total Pounds Harvest
Indirect Costs	=	Indirect Cost(US$ per ha) * Total Seeded Ha
Gross Profit	=	Total Revenue - Total Cost
Profit Margin	=	Gross Profit / Total Revenue

To calculate Unit Costs

Postlarvae (US$/1000)	=	Total PostlarvaeCost /((Stocking Density * (Total Seede Ha * 10000m2) * 1000)
Feed (US$/lb)	=	Total Feed Cost / (Total Pounds harvested * FCR)
Chemicals (US$/ha)	=	Total Chemicals Cost / Total Seeded Ha
Direct Labor (US$/harvested lb)	=	Total Direct Labor Cost / Total Pounds Harvested
Indirect Costs (US$/seeded ha)	=	Total Indirect Cost / Total Seeded Ha
Computed Survival Rate	=	**Total Pounds Harvested / ((Stocking Density* (Total Seeded Ha *10000m2) * Harvest Weight * Cycles per year) / 453.59237))**
1 ha	=	10,000 m2
1lb	=	453.59237 grams

Per Lb Harvested

Total Revenue	=	Total Revenue / Total Pounds Harvest
Postlarvae (US$/1000)	=	Total Cost Postlarvae / Total Pounds Harvest
Feed (US$/lb)	=	Total Cost Feed / Total Pounds Harvest
Chemicals (US$/ha)	=	Total Cost Chemicals / Total Pounds Harvest
Direct Labor (US$/harvested lb)	=	Total Cost Direct Labor / Total Pounds Harvest
Indirect Costs (US$/seeded ha)	=	Total Indirect Cost / Total Pounds Harvest
Total Operating Costs	=	Total Operating Costs / Total Pounds Harvest
Gross Profit	=	Total Gross Profit / Total Pounds Harvest

Per Seeded Ha

Total Revenue	=	Total Revenue / Total Seeded Ha
Postlarvae (US$/1000)	=	Total Cost Postlarvae/ Total Seeded Ha
Feed (US$/lb)	=	Total Cost Feed / Total Seeded Ha
Chemicals (US$/ha)	=	Total Cost Chemicals / Total Seeded Ha
Direct Labor (US$/harvested lb)	=	Total Cost Direct Labor/ Total Seeded Ha
Indirect Costs (US$/seeded ha)	=	Total Indirect Cost / Total Seeded Ha
Total Operating Costs	=	Total Operating Costs / Total Seeded Ha
Gross Profit	=	Total Gross Profit / Total Seeded Ha