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Cost of mortality in a trout production operation

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THE COST OF MORTALITY IN A TROUT PRODUCTION OPERATION

By

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CHAPTER I

INTRODUCTION

Mortality is a problem which every animal producer encounters. Some mortality can be prevented through the use of sound management practices and preventive medicine. Even with the best preventive measures, however, there are outbreaks of infection that are unpredictable and the producer must solve the crisis with skill and speed in order to save his animals.

The trout producer encounters mortality in many different forms. Invariably there is some "natural" mortality. These deaths are usually attributed to congenital disorders and physiological complications, and occur most frequently in the early stages of life. Disease is another cause of mortality that plagues trout producers. Trout can be attacked by parasites, bacteria or viruses.

Even though it would be nice to know the cause of each trout's death, it is impractical. The normal procedure is to recognize the symptoms of an epidemic when the mortality rises and to react rapidly through careful diagnosis and treatment. Other causes of mortality include losses from the handling of trout when loading and unloading, and the cleaning of the ponds or raceways. Any mortality that occurs,

however, must be recognized as a loss of a saleable product for the producer.

Rearing Season

The principle period of trout development is a rearing season. The rearing period starts when the eggs are in the 'eyed' condition. The trout producer may spawn his brood fish and incubate the eggs to the 'eyed' state or he may purchase 'eyed' eggs from another trout producer and have them shipped to his premises. The 'eyed' eggs require daily attention which usually consists of removing dead eggs and observing hatched eggs. Newly hatched trout called "fry" remain on the bottom of the receptacle and are rather inactive for about two weeks. During this time their food supply is the yolk sac which nature attached to them. Observation of the fry consists of checking to see if they have congregated into one corner. Since congregation promotes suffocation, it is best to keep the fry evenly distributed for maximum survival.

Upon consumption of the yolk sac the fry begin to swim-up in search of food. At this time they distribute themselves throughout the tank at all water depths and they become oriented toward the flow of water. It is natural for the fry to face the flow of water since the current carries food and helps respiration. The swim-ups require hourly feeding until they have learned to feed and know what food is in this artificial environment. The feeding schedule is

then gradually lessened to three or four times a day. The rearing period is completed when the fish are planted or stocked. If the trout are to be kept, the rearing period is usually a year.

Determining Mortality

The trout producer receives eggs in the 'eyed' state. These eggs are measured volumetrically. A count is made of the number of eggs per fluid ounce, the total shipment of eggs is measured to determine the number of ounces, and the total number of eggs is then calculated. This method of counting has been used for many years and has been proven reliable. From this initial inventory the producer has a record of the beginning number of trout shipped to his facility.

Carelessness in handling and treatment of the eggs causes some mortality. During the hatching period mortality consists of dead eggs, unhatched eggs and cripples. Physical and physiological problems are the main reason for mortality of the fry during hatching, yolk sac absorption and swim-up.

Some fry are genetically fast growers and some are genetically slow growers. This leads to cannabalism. This type of mortality can be accounted for only by periodic physical count. Usually the mortality can be determined by the number of dead trout picked out of the tank. This is the easiest means of counting mortality and the figures are relatively close to actual mortality. In an outdoor environment

additional mortality can be attributed to predators such as herons, ducks, muskrats and racoon. This cause of mortality is relatively minimal except under production at a remote location. As the trout grow, mortality is recorded daily and subtracted from the total initially received to arrive at a current number of trout on hand. Whenever the trout are moved from tank to tank or when trout are shipped into or out of the production site, the whole lot may be counted to adjust and compare the current records to the number of trout on hand. This procedure goes on continuously until the lot is completely distributed. This concludes the rearing period for that lot of trout.

Cost of Mortality

The need for a study concerning the cost of mortality in a trout production operation is exemplified by a November 11, 1971 letter from Dr. George W. Klontz to Senator Frank Moss. Dr. Klontz stated that "it has been established that 30 cents out of every dollar spent to raise fish commercially goes for some aspect of disease prevention and/or control."[1]

Several references were available on the cost production of a pound of trout at a production site, the cost of production for a state-wide trout production system, and the cost in relation to the size of the hatchery trout. No

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[1]"Fish Disease Control Bill Endorsed," American Fisheries Society Newsletter, September - December, 1971, p. 10.

references, however, were found on the subject of cost mortality at a trout production operation. Thus, there is a definite need for a documented study on this subject.

The present research will be limited to the cost of mortality derived from hatchery records. The records are from small state-operated hatcheries and should not be extrapolated to be indicative of a multiple hatchery system of any kind; state, federal or private. The records are from cold-water hatcheries producing rainbow trout (Salmo gairdneri) and the data should not be extrapolated to cover warm-water hatcheries or other trout species.

CHAPTER II

MATERIALS AND METHODS

Materials

This study will use records from two state-operated trout production operations. The records required contain food cost, mortality incurred, labor cost, number of fish per impoundment and weight of the trout at the beginning and the end of the month. The records show the time when fish are added and removed from the ponds and includes an inventory taken at these times.

Hatchery records were obtained from the Bluewater Rearing Station, Montana Fish and Game, Bridger, Montana, and from the Boulder Rearing Station, Wyoming Game and Fish, Boulder, Wyoming. Records of the completeness required for this study were very difficult to obtain.

Methods

This study began with an analysis and consolidation of the hatchery records. A price curve was then devised to simulate the revenue of the trout if they had been sold at the time of the mortality. From the price curve and the variable cost information, the contribution margin was attained. A graph was constructed to exhibit the contribution

margin lost versus time and also to exhibit the relationship between contribution margin loss, variable cost and total cost. Another graph was constructed exemplifying the relationship between mortality occurrence and time.

Assumptions

The first assumption made is that the construction of a price versus length curve can be considered realistic. Various price quotations in different publications of the fisheries profession substantiate the price curve. The price-length curve is important if the cost data is to be meaningful to the actual production market situation.

The second assumption is that the amount of mortality that occurs at a state trout production unit is comparable to the mortality at a private trout production unit. The lost contribution margin figures resultant from this study could probably benefit private trout production operations the most. Since the styles of production at private and state hatcheries are assumed to be comparable, the mortality rates should also be comparable.

The third assumption is required to facilitate the calculations. It is assumed that the trout could be sold immediately prior to the mortality. The purpose of this assumption is to bring out the fact that "if the trout were sold before mortality instead of after" the trout producer would have realized an added revenue. It is also assumed that mortality occurred on the last day of the month. Costs are figured on a monthly basis.

Techniques Used

In order to explain the techniques used in the calculations for this study it is important to define a few terms. Variable cost is defined in terms of how total cost changes in relation to fluctuation in the quantity of a chosen cost object. In this study the variable cost will be feed. The amount of feed varies with the size of the fish, number of fish and the feeding rate. The feed used varies directly in proportion to changes in activity. A fixed cost is a cost that remains unchanged in total for a given time period despite fluctuations in activity. In this study, labor is considered a fixed cost. The trout production manager does not change his labor staff with all fluctuations in activity. In this study, the cost due to overhead will be disregarded due to insufficient data. This does not mean that overhead is an insignificant cost but that the records available are of limited substance.

Another important term that needs to be defined is contribution margin. Contribution margin is the excess of sales over variable costs.

Sales price - Variable cost = Contribution Margin
Any contribution over variable cost covers the fixed costs and the net income.

Example

An example can best illustrate the lost contribution margin due to mortality. Take a lot of 100,000 trout with a

5 percent mortality rate and a total cost of $1500 or $15 per 1,000 trout. The 5 percent mortality occurred at the end of the month

Beginning Inventory	100,000	
Mortality (5%)	-5,000	
Ending Inventory	95,000	
Total Cost at $15/1,000	$ 1,500	
Variable Cost at $4/1,000	$ 400	
Fixed Cost at $11/1,000	1,100	
Sales Price at $22/1,000 (at the end of the month)		$22.00

The resulting contribution margin is:

Sales - Variable Cost = Contribution margin

$22.00 - $4.00 = $18.00

The mortality rate was 5 percent, this means that 5 percent of the trout that could have been sold yesterday are not alive to be sold today. So, instead of the total revenue being $2,200, ($22.00 x 100), the revenue is only $2,090, ($22.00 x 95). The lost variable cost is small.

$4/1,000 x 5,000 = $20.00

but the lost contribution margin is more substantial,

$18/1,000 x 5,000 = $90.00

This lost contribution margin is the difference that the trout producer would have received if he could have sold the trout at the time when 100 percent were alive instead of when 95 percent were alive. The mortality, in fact has cost $90.00 in lost contribution margin and another $20.00 in lost variable expenses.

Consolidation of Information

The data from the hatchery records were consolidated onto one form on a monthly basis. An example of the form used is illustrated in Figure 1. The cost for the month, the percentage cost and percentage mortality can easily be extracted from the monthly column.

A "lot" of trout was chosen from the records and the mortality costs and figures were calculated until they were distributed from the rearing station. The number of trout per pound demonstrates the size of the stocked trout. The data collection sheet has the number of trout at the beginning and the end of the month, the total cost for feed and for labor, the percentage of mortality and the number of trout per pound at the beginning and end of each month. From this a variable cost per 1,000 trout was obtained. The monthly labor cost was divided by the number of trout in the lot to reveal a fixed cost per 1,000 trout. By adding the variable cost per 1,000 and fixed cost per 1,000 the total cost was arrived at. In order to get an accurate sales price, the number of trout per pound was compared against charts developed by Haskell (1959)[2] to gain an accurate length. The length was then compared to the price versus length graph (Figure 2) to obtain a price. An accurate figure for the lost contribution margin

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[2]David C. Haskell, "Trout Growth in Hatcheries," New York Fish and Game Journal, Vol. 6, No. 2 (July 1959), 213-17.

was then easily obtained by multiplying the contribution margin times the mortality. This lost contribution margin is the amount that, due to the mortality, is unavailable to recover fixed costs and any net profit.

Fig. 1.--Data Collection Forms

Month _____ 19__ Species _____ Lot _____

Date of initial feeding _____ Date of initial inventory _____

		Months:			
1.	Fraction of month fish in pond				
2.	Number of fish at initial feeding				
3.	Weight of fish at initial feeding				
4.	Number of fish per pound first of month				
5.	Number of fish per pound end of month				
6.	Number of fish on hand first of month				
6a.	Number of fish planted out during the month				
7.	Number of fish on hand end of month				
8.	Mortality for month (6 - 7)				
9.	Weight of fish at end of month				
10.	Weight of fish shipped or added during month				
11.	Adjusted weight of fish end of month (9 ± 10)				
12.	Weight of fish at first of month				

Fig. 1. (Continued)

		Months:			
13.	Gain in weight of fish (11 - 12)	_____	_____	_____	_____
14.	Pounds of mortality ($8 / \frac{(4+5)}{2*}$)	_____	_____	_____	_____
15.	Diet cost per pound (also medicated if any)	$_____	_____	_____	_____
16.	Total pounds of food fed during month	_____	_____	_____	_____
17.	Food cost for month (15 x 16)	$_____	_____	_____	_____
18.	Food cost per pound of fish gained (17 / 13)	$_____	_____	_____	_____
19.	Food cost of mortality (18 x 14)	$_____	_____	_____	_____
20.	Percent mortality for month (8 / 6)	_____	_____	_____	_____
21.	Cubic feet of water in pond	_____	_____	_____	_____
22.	Loading factor (11 / 21) / 1	_____	_____	_____	_____
23.	Total labor cost for month	$_____	_____	_____	_____
	or				
	Total labor cost for year / 12* months	$_____	_____	_____	_____
24.	Number of ponds in production during month	_____	_____	_____	_____
25.	Labor cost per month per pond (23 / 24) x 1	$_____	_____	_____	_____
26.	Labor cost per pound of fish gained (25 / 9)	$_____	_____	_____	_____
27.	Labor cost of mortality (26 x 14)	$_____	_____	_____	_____
28.	Total cost for month's production (25 + 17)	$_____	_____	_____	_____

Fig 1. (Continued)

Months:

29. Total cost of mortality (28 + 19) $_____ _____ _____ _____

30. Mortality cost percent of total cost (30 / 29) _____ _____ _____ _____

31. Water temperature _____°F Approx. Flow (gpm) _____ _____ _____ _____

32. Estimate of cost of disinfectant and drugs used $_____ _____ _____ _____

33. Estimate of extra labor involved with disease prevention (administering drugs or diagnosis) $_____ _____ _____ _____

34. Causes of mortality if known (diagnosis) (comments): _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

INCH	PRICE/1000
1	$ 22.50
2	45.00
3	90.00
4	145.00
5	200.00
6	260.00

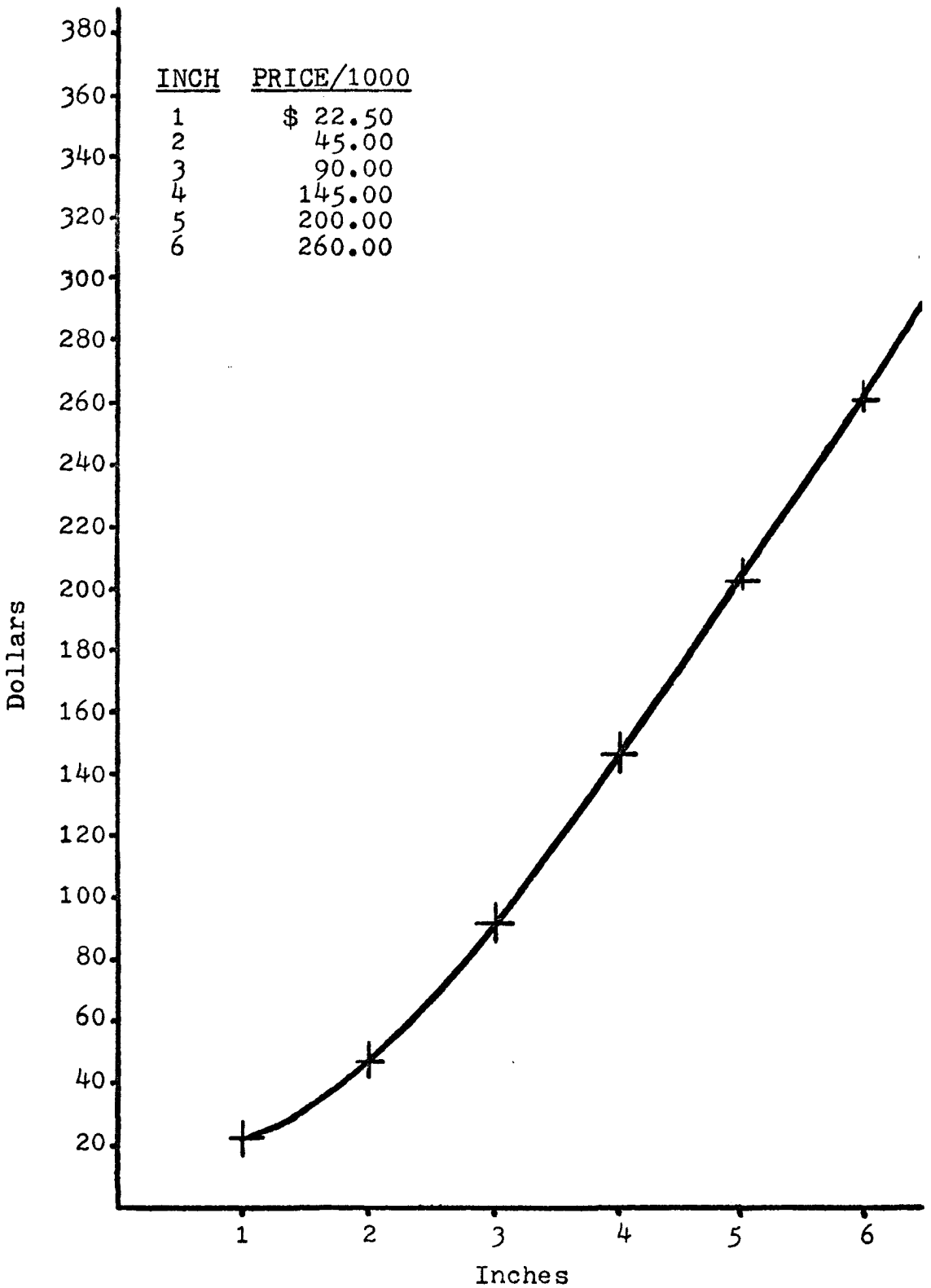

Fig. 2.--Sales Price Versus Length.

CHAPTER III

PRESENTATION OF DATA

Sales Price Versus Length Curve

The above curve (Figure 2) was derived from sales information accumulated from various fisheries publications. The slope of the curve increases at an increasing rate. This means that for increase in length the increase in sales price goes up at an increasing rate. The sales prices were for lots of a thousand trout. A sales price for each individual trout can be obtained by dividing the sales price for the particular length trout by a thousand.

Mortality Versus Time Graph

Figure 3 shows the mortality for lots of trout taken from the Boulder Rearing Station. As the graph demonstrates, mortality is generally estimated in the first and second months at the station, thus, the sharp increase of lines after a couple of months shows when an accurate inventory was taken and the mortality that was realized at these inventory points. There is some justification in this type of management because of the small size and fragile condition of the trout when young. Once the trout grow and become more hardy they can be handled easier, an accurate inventory can be taken, and mortality can be properly accounted for.

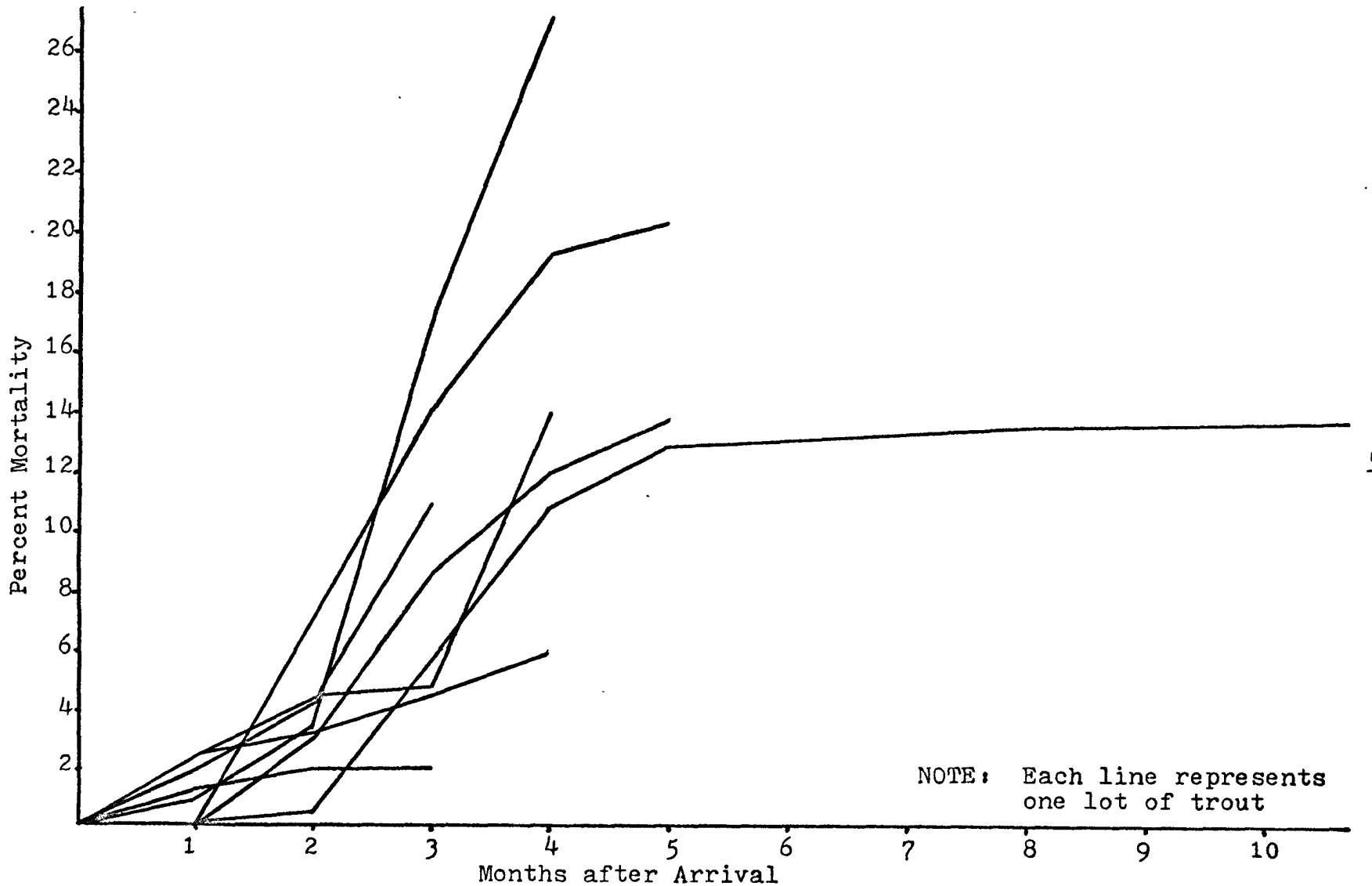

Fig. 3.--Mortality Versus Time Graph (Boulder Rearing Station)

Trout were usually kept at the station for three to five months before stocking. One lot, however, was kept at the station for more than one year. Mortality in the lots of trout kept at the station ranged from 2.1 percent to 27 percent, with the average mortality being about 14.5 percent. The graph shows that four out of the eight lots substained mortality of 10 to 14 percent.

The mortality versus time graph for trout taken from the Bluewater Rearing Station is shown in Figure 4. The graph illustrates that mortality is accounted for at the end of the first month at the station. The graph also clearly shows that after the first month at the station, mortality is not accounted for during the next one or two months. This means that when inventory is taken there will be a sharp increase in the slope of the lines.

Three out of the five lots of trout used from the Bluewater Rearing Station were held at the station for eleven months or more. The longer period of rearing may be due to a requirement of larger trout for stocking from this station. After five to six months at the station the mortality reaches a plateau. The longer rearing period clearly illustrates this plateau over an extended period of time.

The mortality ranged from a low of 8.8 percent to a high of 57.3 percent with the average being approximately 33 percent. The wide range of mortality makes it difficult to predict a specific rate at the Bluewater Rearing Station.

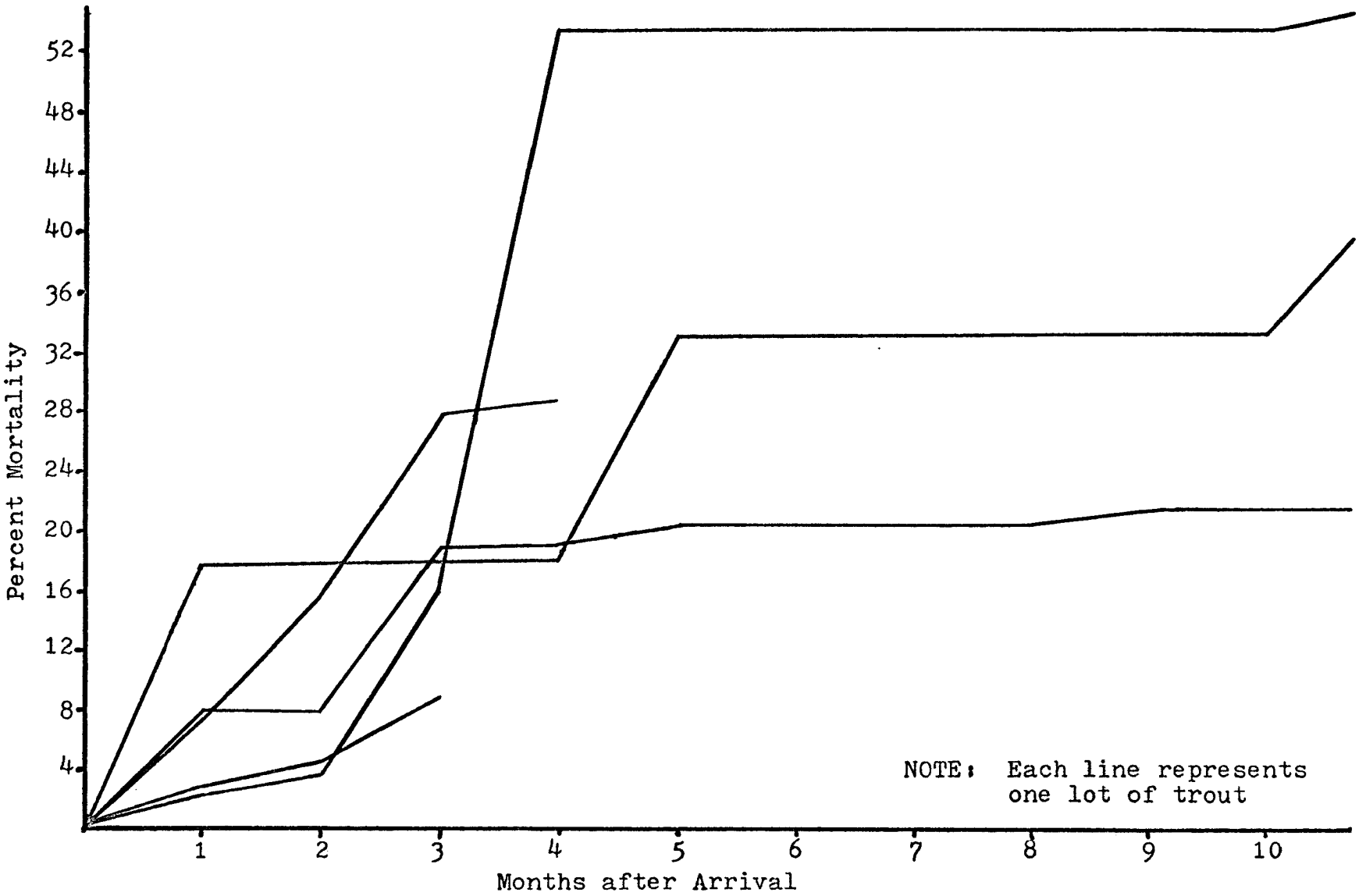

Fig. 4.--Mortality Versus Time Graph (Bluewater Rearing Station)

Lost Revenue Versus Accumulated Lost Contribution Margin Comparison Table

The comparison table (Table 1) shows first, the revenue, total variable cost, contribution margin, lost revenue, lost variable cost and accumulated lost contribution margin. Secondly, the table shows revenue, total variable cost, contribution margin and total lost revenue. The comparison table illustrates that for all practical purposes the total lost revenue is a good approximation of the accumulated lost contribution margin. The lost variable cost is actually a very minimal amount in each case. Therefore, total lost revenue is a practical estimate of the lost contribution margin.

Monthly Revenue, Variable Cost, Contribution Margin and Total Lost Revenue Tables

The tables (Tables 2 through 14) show the revenue available to the trout producer in any given month, the total variable cost involved with the month's production, and the contribution margin available to the trout producer. When a proportion of the trout are stocked, the resultant figures in the tables reflect only the portion of costs and revenues that are allocated to the remaining trout. This means that accumulative revenue and costs are adjusted proportionately when trout are stocked. The column titled, "total lost revenue" illustrates the lost revenue due to the occurring mortality. The figures show that the mortality is frequently a considerable portion of the available revenue. In two

instances, (Tables 4 and 5), the total revenue was 80 percent and 83.7 percent of the revenue available from the sale of the live trout. In the majority of the lots, the total lost revenue as compared to the revenue available ranged between 10 and 20 percent. If this mortality had not occurred, the trout producer could have realized the revenue that was lost to mortality.

Cost of Disease Prevention

Data from the Boulder Rearing Station included estimates of the cost of preventing disease. The estimates were for the cost of disinfectants, drugs, and the cost of administering the drugs and diagnosis of disease. The cost of disease prevention as compared to the month's production can be expressed as a percentage. One month the cost of disease prevention was 68.2 percent when compared to the cost of the month's production (food cost plus labor cost). The normal range of the cost of disease prevention was normally 15 to 20 percent of the total month's production cost. There was no disease prevention cost in several months.

The cost of disease prevention is important because when mortality is high, the need for disease diagnosis and drug and disinfectant administration is also high. When mortality is low, the need for disease prevention costs are minimal or nonexistent. The cost of disease prevention depends somewhat on the severity of the disease outbreak, the time lag between the outbreak and diagnosis, and the length of time required to effectively control the disease.

TABLE 1

LOST REVENUE VERSUS ACCUMULATED LOST
CONTRIBUTION MARGIN COMPARISON TABLE

Month	Revenue	Accumulative Total Variable Cost	Contribution Margin
January	$ 5,775.19	$ 12.48	$ 5,762.71
February	8,923.74	48.90	8,874.84
March	12,228.67	141.34	12,067.33
April	15,496.00	255.76	15,240.24
May	16,190.00	315.69	15.874.77

*This column represents total mortality to date times the latest monthly sales price. It does not represent accumulative monthly lost revenue.

TABLE 1--Continued

Monthly Lost Revenue	Accumulative Total Lost Revenue*	Accumulative Lost Variable Cost	Accumulative Lost Contribution Margin
$149.96	$ 149.96	$ .96	$ 149.00
59.89	293.16	1.17	291.99
732.00	1,157.78	8.78	1,149.00
541.60	2,060.00	18.25	2,041.75
274.04	2,462.79	31.52	2,431.27

TABLE 2

BLUEWATER REARING STATION MORTALITY COSTS (LOT 1)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
March	$11,700.00	$ 25.08	$11,674.92	$ 419.40
April	20,790.00	179.49	20,610.51	813.21
May	29,131.34	374.21	28,757.13	2,553.36[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]8.8 percent of Revenue.

TABLE 3

BLUEWATER REARING STATION MORTALITY COSTS (LOT 2)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
February	$ 6,750.00	$ 16.41	$ 6,733.59	$ 560.21
March	11,000.00	97.47	10,902.53	1,995.92
April	15,039.96	197.56	14,842.40	5,103.72
May	6,790.98	135.63	6,655.35	2,355.93[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]34.7 percent of Revenue.

TABLE 4

BLUEWATER REARING STATION MORTALITY COSTS (LOT 3)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
February	$38,761.60	$ 355.35	$38,426.25	$ 1,226.40
March	63,589.68	863.88	62,725.80	2,390.52
April	64,323.07	1,363.04	62,960.03	11,388.99
May	18,025.50	277.25	17,748.25	14,348.47
June	4,476.47	166.97	4,309.50	3,561.97
July	5,411.12	327.99	5,083.13	4,305.68
August	7,371.00	536.95	6,833.05	5,879.10
September	7,616.70	759.35	6,857.35	6,075.07
October	10,119.13	1,000.29	9,118.84	8,077.67
November	10,943.95	1,266.59	9,677.37	8,754.53[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]80.0 percent of Revenue.

TABLE 5

BLUEWATER REARING STATION MORTALITY COSTS (LOT 4)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
June	$ 2,415.00	$ 17.98	$ 2,397.02	$ 517.77
July	4,305.00	57.62	4,247.38	922.99
August	5,985.00	97.04	5,887.96	1,283.18
September	8,925.00	162.30	8,762.70	1,913.52
October	10,676.40	251.24	10,425.16	4,625.04
November	4,636.16	148.80	4,487.36	2,007.87
December	5,795.20	216.33	5,578.87	2,509.80
January	4,212.67	206.33	4,006.34	2,785.88
February	5,275.33	273.39	5,001.94	3,488.62
March	5,882.56	355.41	5,527.15	3,890.19
April	5,885.88	388.12	5,497.76	4,927.19[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]83.7 percent of Revenue.

TABLE 6

BLUEWATER REARING STATION MORTALITY COSTS (LOT 5)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
January	$32,184.00	$ 142.78	$32,041.22	$ 2,746.03
February	60,345.00	578.32	59,766.68	5,148.81
March	93,777.84	1,305.83	92,472.01	19,744.76
April	81,558.06	1,702.12	79,255.94	17,169.43
May	98,842.66	2,786.18	95,056.48	23,474.92
June	99,086.73	3,504.51	95,582.22	23,834.51
July	96,397.37	3,800.97	92,596.40	23,215.72
August	73,387.77	3,192.73	70,195.04	17,671.65
September	39,647.49	2,224.83	37,422.66	9,985.29
October	12,643.47	880.37	11,763.11	3,183.70
November	14,394.11	1,172.42	13,221.69	3,624.52[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]25.2 percent of Revenue.

TABLE 7

BOULDER REARING STATION MORTALITY COSTS (LOT 1)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
January	$ 5,771.19	$ 12.48	$ 5,762.71	$ 149.96
February	8,923.74	48.90	8,874.84	293.16
March	12,228.67	141.34	12,087.23	1,157.78
April	15,496.00	255.76	15,240.24	2,060.00
May	16,190.46	315.69	15,874.77	2,462.79[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]15.2 percent of Revenue.

TABLE 8

BOULDER REARING STATION MORTALITY COSTS (LOT 2)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
February	$ 9,859.96	$ 16.63	$ 9,843.33	$ 24.20
March	14,636.30	124.59	14,511.71	1,088.50
April	17,460.00	273.22	17,186.78	2,757.60
May	8,465.64	187.06	8,278.58	2,492.71
June	8,524.37	180.77	8,343.60	2,626.24[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]30.8 percent of Revenue.

TABLE 9

BOULDER REARING STATION MORTALITY COSTS (LOT 3)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
January	$ 5,590.07	$ 3.47	$ 5,586.60	$ 9.92
February	8,450.82	36.86	8,413.96	46.09
March	12,623.40	121.50	12,501.90	816.60
April	15.615.60	246.13	15,369.47	1,856.40
May	18,808.13	363.61	18,444.52	2,695.87
June	4,999.60	176.98	4,822.62	730.80
July	6,532.96	251.28	6,281.68	975.84
August	6,134.80	265.96	5,868.84	930.02
September	2,314.73	160.82	2,153.91	350.86
October	2,667.60	195.65	2,471.95	407.97
November	2,892.50	226.22	2,666.28	445.07
December	3,233.42	260.51	2,972.91	502.82[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]15.6 percent of Revenue.

TABLE 10

BOULDER REARING STATION MORTALITY COSTS (LOT 4)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
June	$2,970.00	$ 18.69	$2,951.31	$ 30.00
July	4,680.75	66.24	4,614.51	59.25
August	6,548.48	146.55	6,401.93	1,131.52
September	7,560.23	203.88	7,356.35	2,279.76[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]30.2 percent of Revenue.

TABLE 11

BOULDER REARING STATION MORTALITY COSTS (LOT 5)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
July	$1,738.80	$ 5.93	$1,732.87	$ 59.40
August	3,154.80	34.05	3,120.75	141.90
September	4,950.40	89.54	4,860.86	244.40
October	4,833.69	97.67	4,736.02	760.70[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]15.7 percent of Revenue.

TABLE 12

BOULDER REARING STATION MORTALITY COSTS (LOT 6)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
July	$2,162.80	$ .21	$2,162.59	$ 1.95
August	3,367.00	19.83	3,347.17	115.44
September	5,208.40	69.67	5,138.73	205.56
October	6,541.01	109.75	6,431.26	423.87[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]6.5 percent of Revenue.

TABLE 13

BOULDER REARING STATION MORTALITY COSTS (LOT 7)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
August	$3,435.20	$19.60	$3,415.60	$ 51.68
September	5,253.30	78.89	5,174.41	114.66
October	5,887.68	87.87	5,799.81	117.60[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]2.0 percent of Revenue.

TABLE 14

BOULDER REARING STATION MORTALITY COSTS (LOT 8)

Month	Revenue	Accumulative Total Variable Cost	Contribution[a] Margin	Accumulative Total[b] Lost Revenue
August	$2,520.00	$ 4.90	$2,515.10	$ 50.12
September	4,400.00	39.55	4,360.05	189.50
October	5,009.81	69.76	4,940.05	589.38[c]

[a]Revenue minus Accumulative Total Variable Cost equals Contribution Margin.

[b]Accumulative Total Lost Revenue is Mortality times Sales Price.

[c]11.8 percent of Revenue.

CHAPTER IV

DISCUSSION

Overall Mortality

Trout mortality is important to the trout producer because it represents lost sales. The mortality has essentially robbed the trout producer of a saleable product. In order to compensate for this mortality the trout producer may use the overall mortality percentage to his advantage. If the trout producer can forecast a specific number of trout needed in the future, then he may use the mortality percentage as a guide to order more trout eggs at the beginning of the rearing season. For example, if the trout producer has a definite order for 100,000 trout of a specific size and a good estimate of his mortality to that specific size is 15 percent, then he should order about 118,000 eggs to have the required 100,000 trout available for sale.

At the Boulder Rearing Station, four out of the eight lots tested had overall mortalities between 10 and 14 percent. Two lots of trout had mortalities greater than 14 percent and two lots had mortalities of less than 10 percent. Part of the reason for the lower mortality was due to this station's practice of receiving the trout at the "fry" stage.

At this stage the high loss due to hatching is not accounted for in the resulting mortality figures. The management of the Boulder Rearing Station could effectively use 14 percent as an overall mortality percentage when matching trout stocking requirements with their ordering of trout for the rearing season.

The Bluewater Rearing Station has a different situation to cope with. Three out of the five lots of trout had overall mortalities under 30 percent. Two of the lots had overall mortalities over 40 percent. Part of the reason for the increased mortality was due to the fact that the management receives "eyed" eggs at the station. The overall mortality percentage, therefore, included the mortality due to hatching losses. The management of the Bluewater Rearing Station could effectively use 25 percent to 30 percent as an overall mortality percentage when planning ahead in their needs for the coming year's stocking program.

Total Lost Revenue

The seriousness of mortality is reflected in lost revenue. If the trout producer makes a sale, he realizes revenue. Mortality robs him of revenue. The amount of lost revenue is proportional to the loss due to mortality. In two cases, (see Tables 4 and 5), the total lost revenue was 80 and 83.7 percent of the realized revenue. The seriousness of the occurring mortality is obvious when 80 or 83.7 percent of the realizable revenue is lost to mortality. The majority

of the lots, however, incurred total lost revenue in the 10 to 20 percent range. Even at these figures mortality accounts for a significant portion of realizable revenue.

Disease Prevention

The realizable revenue could be increased significantly through a lowering of the mortality. Mortality that occurs in larger trout amounts to more lost revenue than does mortality occurring in the smaller trout. By developing an effective disease prevention program, the mortality could be decreased significantly and, furthermore, the revenue would increase due to the increased number of trout alive and available for sale. The increased total revenue can then be used to cover fixed costs and variable costs. Any excess revenue can be used for expansion of the trout production operation, increasing the efficiency of the operation.

Future Considerations

Any trout producer can arrive at an estimate of his overall mortality through the use of complete records. By keeping records of mortality on a day-to-day basis and with the use of periodic, approved inventory techniques, the trout producer should be able to account for his trout. By noting the sales price of the trout, the producer can determine the lost revenue due to mortality.

Diseases can be effectively controlled through the use of a reliable method of diagnosis and treatment. A

disease prevention program can be devised for each particular trout producer to reduce mortality on a prophylactic basis. Through the use of good records the trout producer can determine the benefit of the disease program by weighing the cost of the program against the lost revenue.

CHAPTER V

SUMMARY

This study has shown that the cost of mortality in a trout production operation can be significant. By comparing the total lost revenue against the realizable revenue, the trout producer can readily see that a significant portion of his sales is lost to mortality. By reducing mortality, the trout producer can realize more revenue.

In order to reduce mortality an effective disease prevention program may be devised. The cost of a disease prevention program is in the range of 10 to 20 percent of the total month's production costs (feed and labor). Mortality may also be reduced through the use of good management practices such as proper handling, frequent grading, and personal attention.

The overall mortality percentage can be used by management to good advantage in ordering trout for future sales. The mortality percentage can be used as a guide to the expected mortality and, therefore, "keys" the trout producer to the mortality that may occur. If the overall mortality decreases the total lost revenue will also decrease. If decreased mortality is realized, the trout producer can proportionately reduce his purchases and increase his realizable revenue.

Through the use of these practical procedures, the trout producer should be able to increase his total revenue. The increased total revenue should place the trout producer in a better financial position and increase his business survivability.

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