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COST IN RELATION TO SIZE OF HATCHERY TROUT

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Cost in Relation to Size of Hatchery Trout

The number of 7-inch or larger trout planted annually from state operated hatcheries in Montana has increased steadily from 68,000 in 1948 to 675,000 in 1958 (Figure 1). Furthermore, the average size of these fish has increased from 7.5 inches to 8.5 inches during the last seven years for which size records are available. Obviously these large fish cost more than fry and fingerlings. To determine precisely how much they cost in relation to costs of smaller trout was the main objective of this analysis. Without this information, it is impossible to determine the cost of creeled hatchery trout. Hence no decisions can be reached as to what size fish are most economical to plant in the various management situations.

The Montana Fish and Game Department operates twelve trout hatcheries, one pike hatchery and a varying number of spawntaking stations. Excluded from this report are the cost and production of the pike hatchery, an annual allocation of funds to four federal hatcheries located in Montana, production of the federal stations, and central office administrative costs.

The annual cost of operating the state trout hatchery system has ranged from $232,000 to $396,000 for the last ten years. The trend has been towards progressively higher expenditures but the rate of increase has not been excessive in relation to the increase for the entire Fish and Game Department. For example, the total hatchery expenditure for the fiscal year ending in 1953 was $277,000 and in 1958 it was $396,000; a 43 percent increase. Expenditures by the entire Fish and Game Department increased from $1,281,000 to $2,427,000 or 89 percent during the same five years. Of the fishery division expenditures, 90 percent were spent by the hatcheries in the fiscal year 1948-49. This has gradually decreased to a record low of 51 percent in 1957-58. Most of the difference has been spent on water purchases for fish habitat, fishermen access, and rehabilitation of trout waters. Hatcheries are still the most expensive tool of fishery management and accurate cost analyses are necessary to insure proper control of this facility.

Numbers of fish planted annually during the last ten years have varied from nine million to twenty million with no prevailing trend towards higher or lower numbers. The total number of fish planted each year is determined mainly by availability of eggs and need for small fish in lakes and major rehabilitation projects. Species planted from state-operated trout hatcheries are: rainbow trout, cutthroat trout, golden trout, brown trout, brook trout, lake trout, kokanee, silver salmon, and grayling.

The Montana Fish and Game Department hatcheries use the Fish and Wildlife Service's method of hatchery bookkeeping and annual report described by Tunison (1957). Unfortunately, the annual report does not give us a breakdown of the cost of rearing and planting trout in relation to size. Therefore, supplemental calculations were used to estimate the cost of hatchery trout of any given size by one-inch class intervals. The over-all average cost per fish planted was computed for each trout hatchery. Because some hatcheries plant exclusively fry while others gear their production to maximum output of catchables or fingerlings of varying sizes, it was then possible to rough out a line graph depicting average cost per fish in relation to size of fish. By using four-years of cost and production data many points were established on the graph. Up to the three-inch size, the points fell close to a hypothetical line representing average cost per fish.

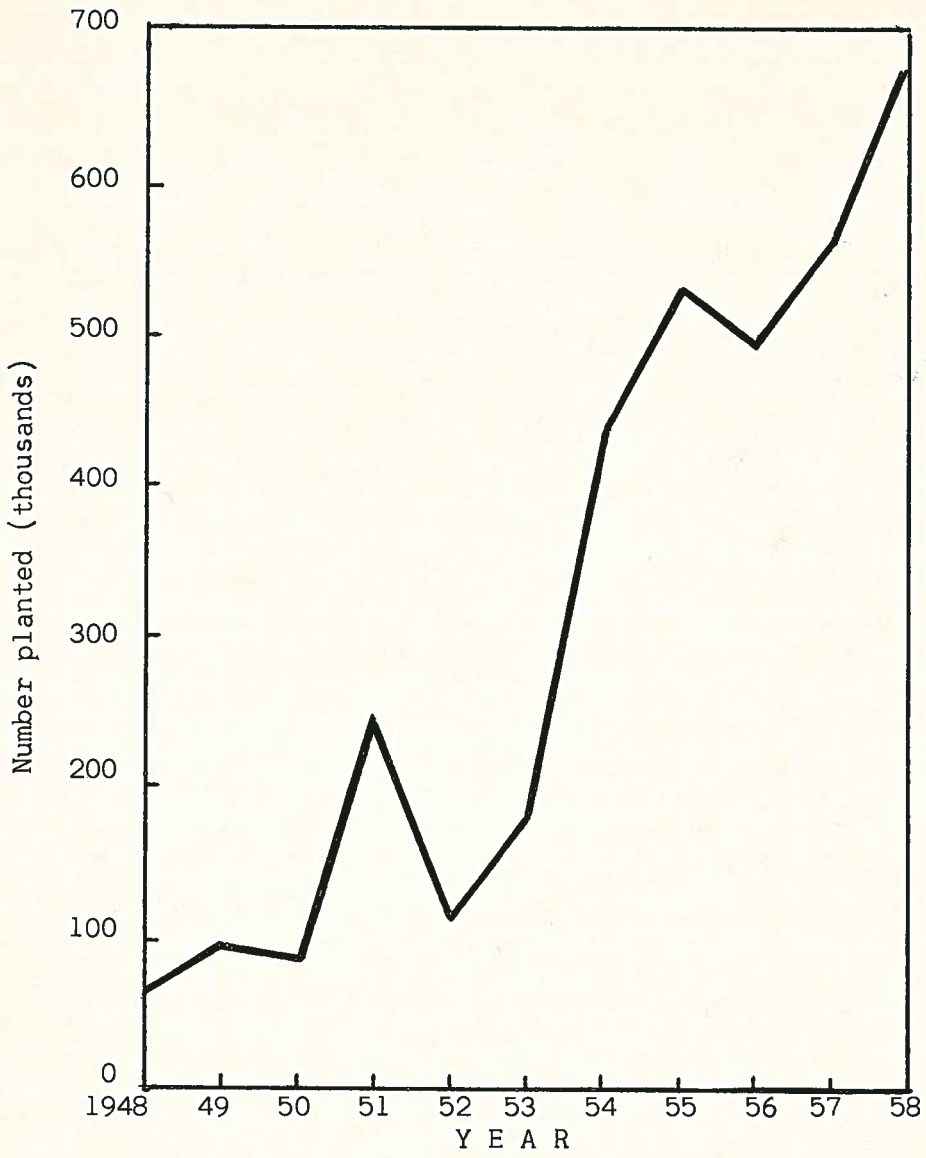


FIGURE 1.--Showing the steadily rising trend in numbers of 7-inch or larger trout planted during the period 1948 through 1958.

Hatcheries specializing in catchable trout also plant widely fluctuating numbers of smaller fish from year to year; hence the relationship between size and cost was not clearly defined beyond the three-inch size class. Therefore, it was necessary to verify the estimated costs of larger sizes by another method. Since it could be calculated how much weight gain was necessary to rear fish from the three-inch size to the four-inch size class, four-inch to five-inch, etc; and accurate cost per pound data was available from the annual reports, it was a simple matter of arithmetic to progress from cost per fish at one size class to cost per fish at the next size class. This was done for sizes up to ten inches (Table 1). By way of checking the accuracy of these cost estimates, the fish that were planted in 1956 and 1957 were multiplied by the appropriate costs at one-inch class intervals. The total values thus obtained were $330,000 for 1956 and $330,500 for 1957. There may be some question as to what figure these values might be compared. It is obvious that a ten-year average ($308,000) is too low to accept because of the indicated trend towards higher operating costs of the hatchery system. The average expenditure for these two years, 1956 and 1957, was $327,000. This is within one percent of the total values calculated from the cost estimates in Table 1. Actual total expenditures for operating the hatcheries were $261,000 for the fiscal year 1955-56 and $392,000 for 1956-57. Therefore, it appears that the estimates of cost per fish in relation to size are accurate enough for management purposes.

TABLE 1.

The total cost of rearing and planting fish of any given size up to ten inches in length from Montana Fish and Game Department trout hatcheries.

1956 - 1957

Size (inches)	Cost per fish ($)	Cost per pound ($)
Eggs	$ 0.003	
Kokanee and Grayling Fry	0.003	
1	0.005	$ 12.72
2	0.010	3.04
3	0.023	2.03
4	0.048	1.81
5	0.09	1.77
6	0.14	1.62
7	0.22	1.62
8	0.33	1.63
9	0.47	1.63
10	0.64	1.62

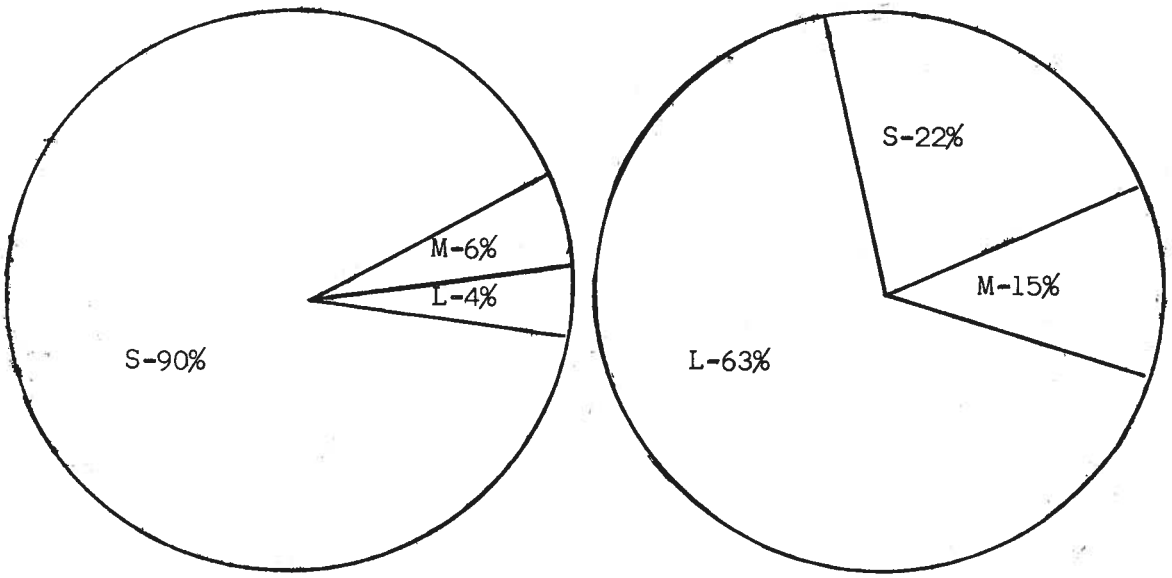
It is of prime concern to anyone analyzing trout production costs to know exactly what expenses are included. The costs presented in the foregoing portion of this report and including those in Table 1 are total costs based on the philosophy that all money allotted to the fish hatchery portion of the Fish and Game Department should be charged against fish production. Tunison (1957) lists the costs that are included in the "cost of production" under the federal cost-accounting system and formally adopted by the Montana Fish and Game Department in 1957. He states that on the average, 60 percent of the funds allotted to hatcheries are used for producing fish and the remainder is spent on such items as "new construction, 'park' maintenance, experimental work, hatchery assistance given other activities in the agency, central office overhead, and amortization of the facilities."

The percentage charged to production will be higher for large hatcheries than it is for small hatcheries. The percentage of funds charged to production of fish at Montana's state-operated hatcheries has ranged from 25 to 71 percent and averaged roughly 50 percent. This is lower than the 60 percent reported by Tunison for federal hatcheries and is probably a reflection of the fact that several of the state hatcheries are quite small in comparison to the federal hatcheries reported by Tunison (1957). Seven of the twelve state-operated trout hatcheries seldom exceeded 8,000 pounds (range: 300 - 9,000 pounds) annual production which was the smallest hatchery described by Tunison. Also, the difference is partly due to new construction costs being included in state reports (but not charged against production); whereas, federal hatcheries exclude certain new construction costs from their reports. To convert the cost per fish and cost per pound estimates in Table 1 to "cost of production" for comparison with federal hatcheries and other hatcheries using the same system of accounting it is necessary to divide the total costs by two. For example, seven-inch fish cost 22 cents each to rear and plant according to Table 1 but only 11 cents each if the total cost is converted to "production cost." The average production cost for Montana trout hatcheries in 1957 was $0.84 per pound.

In 1957, four percent (563,362) of the 12,700,000 fish planted were seven inches long or larger. Using the appropriate cost estimates from Table 1 these catchable fish accounted for 63 percent ($207,480) of the $330,500 total value of fish for that year (Figure 2). This does not mean that 63 percent of the hatchery budget could have been diverted to other forms of fishery management had no catchables been reared. The only savings would be in the food and distribution costs of the catchables. In this hypothetical instance, it would have amounted to $42,528 for food ($0.30 X 141,760 pounds of catchables planted) and $11,341 for distribution ($0.08 X 141,760 pounds) since food costs amounted to roughly 30 cents a pound and distribution costs about 8 cents a pound at hatcheries where most of the catchables were reared in 1957. It is necessary to assume that the fish planted as catchables would not have been reared at all to achieve these hypothetical savings($53,869) which amount to only one-fifth of the total estimated value of the catchables ($207,480). The savings would be even less if one assumes that the fish would be reared to some subcatchable size. The remainder of the difference between theoretical savings and estimated value of the fish would in all cases have to be absorbed in higher estimated values for the subcatchable sizes. This leads to the dangerous fallacy that catchable size trout are a by-product which can be produced at little extra cost because the labor force, plant, and equipment are already there for the purpose of producing subcatchables. The author does not subscribe to this line of thinking but believes that catchables should share alike with smaller fish in justification for the hatchery and its operation.

Two factors are now operating to induce fish-culturists to produce increasingly larger numbers of increasingly larger trout. First there is the emphasis on cost per pound of fish produced as the single most significant figure in judging hatchery efficiency. Second is the fact that to produce at peak efficiency, hatcheries must operate at full capacity the year around (Tunison, 1957 and Kingsbury, 1951). Public sentiment is easily swayed to support the catchable fish program because of its immediate positive yield to the creel. Consequently the catchable fish program continues to grow without clear demonstration of need or superiority over other management tools. Indeed, the fishery manager who requests large numbers of small trout and but few catchables finds himself unpopular with fish-culturists who are competing to produce pounds of fish as cheaply as possible.

1957



13,000,000 fish $ 330,500

FIGURE 2. --Pie charts illustrating the large amount of money necessary for rearing and planting only a small fraction of the fish as catchables. (S = eggs, fry, 1- and 2-inch fingerlings; M = 3-, 4-, 5-, and 6-inch fingerlings; L = 7-inch or larger fish).

Tunison (1957), however, stated that "capacity production at a hatchery may not be required for management purposes and this fact should be recognized in evaluating its production record." To this we would like to add that "cost per creeled fish" should be equally if not more important than "cost per pound" in evaluation of hatcheries. Due consideration, of course, must be given to size and quality of the creeled fish. The analysis of cost in relation to size of fish presented here is a necessary step in this direction. Ultimately, it may be desirable to make separate cost in relation size estimates for each hatchery. Annual revisions will probably be necessary to keep pace with changing management demands and improving hatchery efficiency.

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1951. Production statistics and costs in relation to fish hatcheries. Trans. Am. Fish. Soc. 80: 148-153.

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APPENDIX A -- TOTAL EXPENDITURES

Number and Weight of Fish Planted From State Trout Hatcheries

Calendar Year	Number (Millions)	Weight	Pounds	Fiscal Year	Expenditures*
1948	16.6			1948-1949	$278,878
1949	13.2			1949-1950	317,883
1950	15.3			1950-1951	232,046
1951	20.1			1951-1952	277,509
1952	14.3	64,534		1952-1953	276,913
1953	12.5	88,544		1953-1954	320,222
1954	14.1	140,369		1954-1955	348,583
1955	18.5	128,834		1955-1956	261,217
1956	18.5	159,281		1956-1957	391,899
1957	12.7	189,655		1957-1958	396,010
1958	9.4	213,866		1958-1959	

* Includes: All State Hatchery Budgets (except McNeil)
All Spawntaking Stations
Fisheries General
Other Field Projects up to 1955-1956
Hatchery Biologist (1951-1952 through 1956-1957)

Does Not Include: Helena Office Administrative Costs
McNeil Hatchery
Approximately $15,000 Spent by Federal Hatcheries Each Year

APPENDIX B

Number, Weight and Size of Catchable Trout Planted from State Hatcheries
(Catchable Size = 7" or 9.15/lb. and Larger)

Year	Number	Weight	No./lb.	Length (inches)
1948	67,640		No Wt. Data	No Data
1949	95,420		" " "	" "
1950	85,283		" " "	" "
1951	245,041		" " "	" "
1952	114,666	19,617	5.9	7.5
1953	186,864	42,649	4.4	8.3
1954	435,688	97,080	4.5	8.2
1955	531,239	97,580	5.5	7.7
1956	490,865	114,762	4.3	8.4
1957	563,362	141,760	4.0	8.6
1958	675,570	163,909	4.1	8.5

APPENDIX C — EXPENDITURES

By the Fish & Game Dept., Fisheries Div. and Fish Hatcheries

Year	Total Fish.Div. Expend.	Total Hatchery Expend.*	Hatchery Expend. (No Exclusions)	Total F&G Disbursements	% of Total F&G Spent by Hatcheries	% of Fish Div. Money Spent by Hatcheries
1948-49	$331,247	$278,878	$300,080	$1,117,757	27	90
1949-50	370,277	317,883	329,555	1,135,715	29	89
1950-51	278,085	232,046	242,084	985,874	24	87
1951-52	352,222	277,509	287,610	1,106,873	26	82
1952-53	360,707	276,913	286,913	1,280,649	22	80
1953-54	404,067	320,222	330,222	2,081,172	16	82
1954-55	461,587	348,583	358,583	2,142,918	17	78
1955-56	390,481	261,217	271,217	1,699,952	16	69
1956-57	545,451	391,899	401,899	2,217,664	18	74
1957-58	792,855	396,010	407,289	2,426,828	17	51

* Excluding McNeil, aid to Federal Stations and Central Office Administration