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MICHIGAN DEPARTMENT OF NATURAL RESOURCES

Fisheries Division

EVALUATION OF A TECHNIQUE FOR REGULATING THE GROWTH OF HATCHERY REARED RAINBOW TROUT (Salmo gairdneri).

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SUMMARY

Recent improvements in diet and in fish cultural techniques have combined to produce the unique situation of Rainbow Trout which grow too fast for planned liberation programs.

During 1972, a controlled feeding program was implemented at the Baldwin Rearing Station. The objective was to produce fish weighing ten per pound in April of their second year of life.

The regulation of feeding levels on a monthly basis did not produce the desired increase or decrease in growth. The reduction of yearly feeding levels may have contributed to the reduction of .7 inches in average yearly growth.

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INTRODUCTION

Michigan's hatchery section of the Fisheries Division is currently programmed for the production of Rainbow Trout measuring 6.27 inches in April of their second year of life. In 1971, Rainbows reached 6.27 inches in early October rather than the following April. The increased weight of fish could not be held over winter in existing hatcheries; therefore, the fish had to be planted into the decreasing fauna of winter rather than into the increasing fauna of spring. To correct this situation in 1972, a controlled feeding program was implemented at the Baldwin Rearing Station.

METHODS

Table 1 was compiled in the spring of 1972 from average monthly length gain data of 1970 and 1971. Average monthly length gains were used to extrapolate the number of fish per pound required on the first day of each month. Rainbow Trout, of the calculated size when transferred to Baldwin, should weigh ten per pound between April 1st and April 15th of their second year.

The Rainbow fingerlings, which were programmed to be received at Baldwin in the spring of 1972, were reared from eggs of the last fall spawning of 1971. Early rearing, via restricted feeding levels, was executed at Wolf Lake State Fish Hatchery.

The fish were transferred from Wolf Lake to Baldwin on March 22, 1972. Their average size was 337 per pound and average length was 1.94 inches.

The method of feeding proposed by Freeman, Haskell, Longacre, and Stiles[1] was chosen for use during the rearing cycle at Baldwin. It was selected because it allowed for direct correlation of desired length gains and of the quantitites of feed necessary to produce those gains. The conversion used was 1:1.6.

Model growth plans for each size population were designed according to the following formula:

1. Desired length April 1 (6.27 inches) minus incoming length = total length gain needed.
   (i.e. 6.27" - 1.94" = 4.33").
2. Average length gain of 70 and 71 (5.08" from Figure 1). minus total length gain needed = amount of growth that population would have to be held back.
   (i.e. 5.08" - 4.33" = .75")

3. Amount of growth to be held back divided by 8 = amount of growth to be held back per growing month (April to November).
   (i.e. $\frac{.75}{8}$ = approx. .1")
4. Subtract the product of step 3 from the average length gain of each month April through November.
   (i.e. May 70 & 71 = .54"-.1" = .44" for May 1972).
5. The desired length gains for each month of 1972, provide a model for growing that particular population to 10/lb. by April 1 (Table 2).

Growth plans for typical populations are represented in Figure 1 and Table II. The model in Table II was based on average size of the trout when received. The desired length increases used in the formula were adjusted each month to increase or decrease each pond population to the desired model. The amount of adjustment necessary per pond was based on monthly length increases as determined by sample weights.

During the months April to September, food was increased four times monthly to correspond with weight gain and increasing temperatures. During the months September to November, it was decreased four times monthly to correspond with decreasing water temperatures.

RESULTS

Planting, of the Rainbow at Baldwin Rearing Station, began March 12th, 1973. Five hundred fifty thousand one hundred and thirty-two fish were planted. Their average was 9.79 per pound and average length was 6.31 inches. The average yearly length gain was 4.37 inches, which was a reduction of .7 inches from the average of 1970 and 1971.

Length gain data and percent body weight fed data, from four pond populations, are summarized in Figure 2.

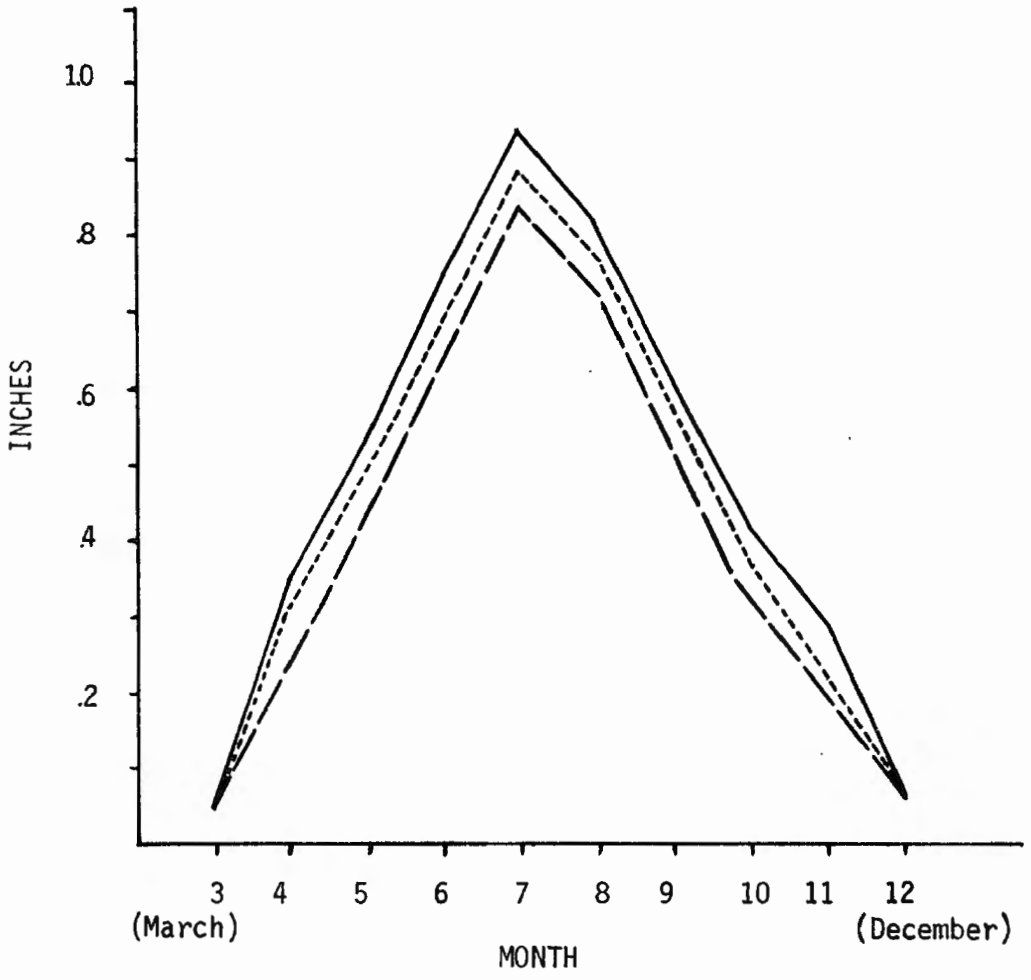
Figure 3 represents a combination of the four sets of data, after each was corrected for obvious sampling errors.

Figures 2 and 3 reveal a relatively poor correlation between the percent body weight fed and the length gain produced. That is: a monthly increase or decrease in feeding level did not necessarily cause a corresponding monthly increase or decrease in growth.

This lack of correlation is also evident in examination of Table II The length gain used in the formula for calculating feed evidences little correlation with the length gain produced.

FIGURE 1

MONTHLY LENGTH INCREASES - BALDWIN



——— Average 1970 and 1971 length increases per month
— — — Proposed length increases for incoming fish at 650/lb.
------ Proposed length increases for incoming fish at 300/lb.

RAINBOW TROUT GROWTH PLAN FOR BALDWIN REARING STATION

TABLE I

	Average Gain for month during 70 & 71	No./lb. needed to produce 10/lb. at average growth
April	.35	1461
May	.54	672
June	.75	273
July	.94	108
August	.82	46
September	.60	25.3
October	.42	17.6
November	.28	13.9
December	.06	12.0
January	.05	11.7
February	.01	11.4
March	.08	11.35
April	.18	10.9
April 15	Total Length Gain 5.08"	10.0

FIGURE 2

FEEDING & GROWTH DATA PER POND POPULATION

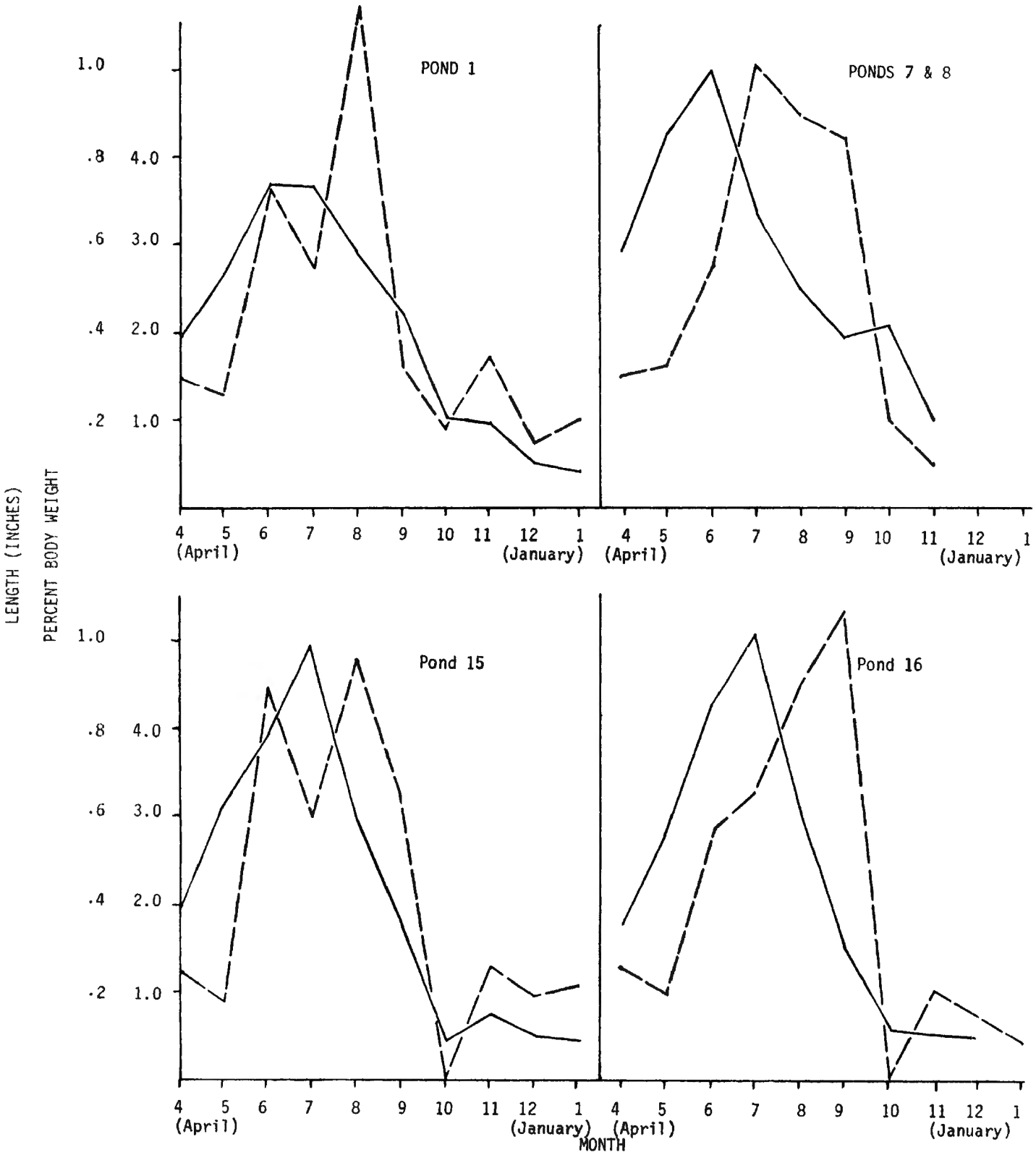
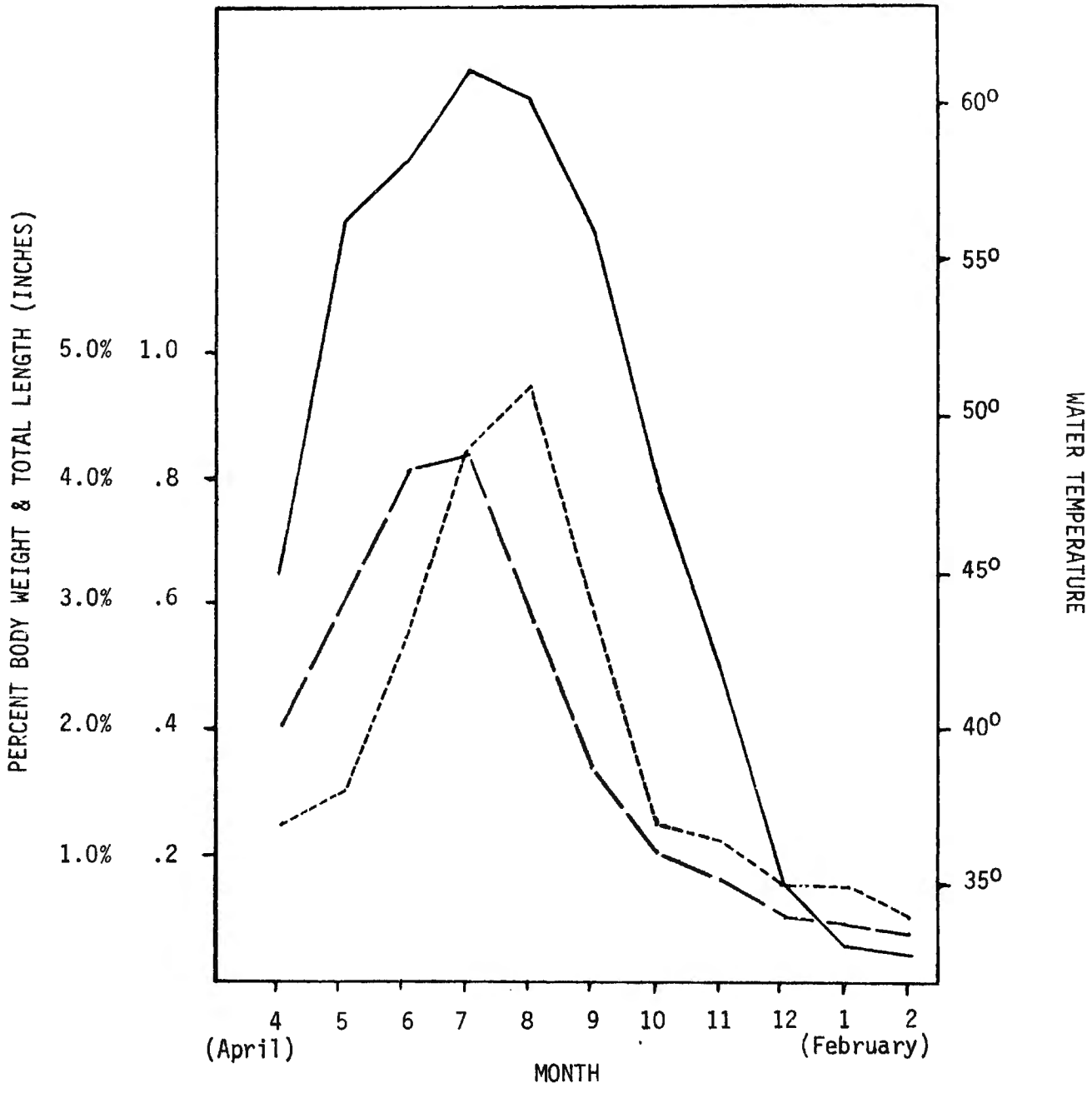


FIGURE 3

FEEDING & GROWTH DATA - ENTIRE POPULATION



——— Average Water Temperature in Degrees Farenheit

— — Average Length Gain Per Month Corrected for Sampling Errors

----- Average Percent Body Weight Fed Daily

SUMMARY OF LENGTH GAIN DATA

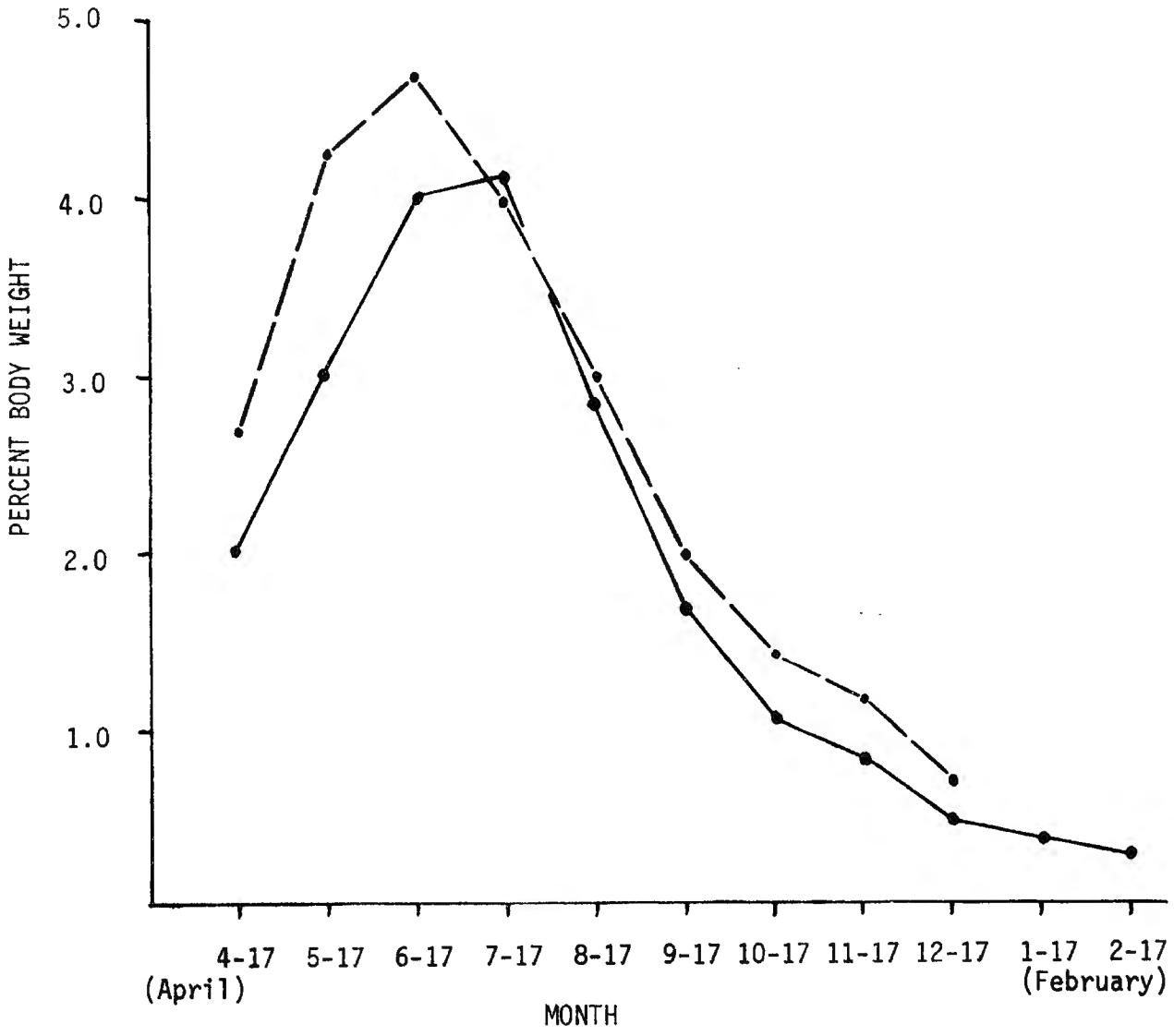
TABLE II

	Model 337/lb. Length 1.94"		Pond 1 In at 318/lb. Length 1.97"			Pond 15 In at 351/lb. Length 1.91"			Pond 16 In at 339/lb. Length 1.94"		
	Used	Ac.	Used	Obt.	Ac.	Used	Obt.	Ac.	Used	Obt.	Ac.
Apr.	.25	.25	.25	.27	.27	.25	.25	.25	.25	.26	.26
May	.45	.70	.43	.26	.53	.45	.17	.42	.44	.21	.47
Jun.	.65	1.35	.70	.76	1.29	.70	.88	1.30	.70	.56	1.03
Jul.	.82	2.17	.90	.55	1.84	.90	.58	1.88	1.0	.72	1.75
Aug.	.70	2.87	.90	1.08	2.92	.90	.96	2.84	.90	.89	2.64
Sep.	.50	3.37	.45	.32	3.24	.53	.65	3.49	.73	1.06	3.70
Oct.	.35	3.72	.50	.17	3.41	.23	-.01	3.48	.10	.02	3.72
Nov.	.23	3.95	.30	.36	3.77	.48	.26	3.75	.20	.24	3.96
Dec.	.06	4.01	.14	.16	3.93	.24	.17	3.92	.10	.13	4.09
Jan.	.05	4.06	.04	.18	4.18	.10	.18	4.10	.10	.09	4.18
Feb.	.01	4.07	.04	.10	4.21	.10	.12	4.22	.10	.10	4.28
Mar.	.08	4.15	.10	.08	4.29	.10	.09	4.31	.10	.04	4.32
Apr.-Apr. 15	.18	4.33		.09	4.38						
Yearly Length Gain		4.33			4.38			4.31			4.32
	6.27" by 4-15-73				6.35" on 4-8-73			6.225" on 3-19-73			6.264" on 3-19-72

Used = Length Gain used in Formula.
Obt. = Length Gain obtained. Based on sample weights.
Ac. = Accumulative length gain.

FIGURE 4

AVERAGE PERCENT BODY WEIGHT FED PER MONTH



The total yearly length gains, for the populations given in Table II are, however, consistant enough to be significant. All three ponds were fed at different rates and, according to the data, they grew at different rates. However, all three populations gained relatively the same amount of length in a 12 month period (Range 4.31" to 4.38"). Since all three populations grew the same length, it seems plausable they would all have grown at the same rate. Consequently, observed fluctuations in monthly length gain were the result of sampling technique and not the result of differences in growth rates. Hence, monthly adjustments to increase or decrease growth were needless.

The monthly "average" percent body weight fed, as used in Figures 2 and 3, gives an incomplete picture of what actually took place. For example, the average percent body weight fed to pond 1 during the month of June (Table IV) was approximately 3.7 percent. The percent body weight actually fed during June fell from 4.04 to 2.41; then, in July it increased to 3.10 only to fall back to 2.75. This type fluctuation in feeding level occurred for all populations throughout the growing period.

DISCUSSION

Application of this technique neither effected monthly growth rate nor provided for correct application of feed to the fish population.

The goal of Rainbow Trout weighing ten per pound in April was nearly met, due to the right combination of: fish coming in at the correct size; and yearly production potential in terms of temperature units.

Another factor, which may have contributed to the .7 inch reduction in growth, was the application of an average feeding level that was below the level of previous years. See Figure 4.

The assumption that growth can be controlled by predetermined amounts may be correct. However, it is correct only to the extent that the entire year's feeding levels are controlled. The monthly calibration of feeding levels to increase or decrease growth is meaningless.

A more applicable approach to the regulation of trout growth may be to calculate an entire year's desired growth and required feed in advance; then, barring abnormal losses, adhere to the calculated feeding schedule.

LITERATURE CITED

1. Freeman, R. I., Haskell, D. C., Longrace, D. L., and Stiles, E. W., "Calculations of Amounts to Feed in Trout Hatcheries". Progressive Fish Culturist Vol. 29, No. 4.