

PREDICTING GROWTH OF BROOK OR RAINBOW TROUT
BY USING THE TEMPERATURE UNIT

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Coates and Kifer (1963) presented a method which allows one to predict the growth of brook or rainbow trout. The temperature unit described in this paper serves as a basis for this method.

Research indicates that under normal conditions and at water temperatures greater than 38.6°F, the rate of growth in trout increases as water temperature increases when the food supply remains adequate. The rate of increase in length will remain constant at a given temperature except during periods when factors such as spawning or disease alter metabolism.

According to Coates, little or no trout growth occurs when the water temperature falls below 38.6°F. By designating this value as zero temperature, a temperature unit can be defined as being equal to one degree Fahrenheit above zero temperature (38.6°F) for a period of one month.

The temperature unite accumulated in one month can be calculated by subtracting the zero temperature (38.6°F.) from the average water temperature for the month.

To find the temperature units accumulated in more than one month take the number of months for which the water temperature was averaged times the difference between the average water temperature and the zero temperature:

$$\begin{aligned} \text{TU} &= \text{ntmher of months } (T_2 - T_1) \\ \text{where TU} &= \text{temperature units} \\ T_2 &= \text{average water temperature} \\ T_1 &= \text{zero temperature (38.6°F.)} \end{aligned}$$

Twenty-one temperature units will produce about one inch or 25 mm. of growth on brook or rainbow trout.. Inches of growth can be calculated by dividing the temperature units accumulated by 21.

Example:

How many inches of growth would rainbow trout show after 3 months in waters with an average temperature of 56.6°F.?

$$TU = 3(56.6 - 38.6)$$

$$TU = 3(18)$$

$$TU = 54 = \text{number of temp. units accumulated after 3 mo.}$$

$$\text{Inches of growth} = \frac{54}{21} \quad \text{or } 2.57$$

Hatcherymen can use temperature units as an aid when planning many of their operations. By collecting temperature data and calculating average water temperatures, production and planting schedules, egg shipment dates and even the practicability of future hatchery facilities can be determined.

The tables and graphs shown here can serve as a guide to hatcherymen when working with the temperature unit described in this paper.

Table 1. Predicted growth in inches of brook or rainbow trout at water temperatures from 40°F. to 59°F.

	TIME DURATION IN MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
40	.1	.2	.2	.3	.4	.4	.5	.5	.6	.7	.7	.8
41	.1	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.3	1.4
42	.2	.3	.5	.7	.8	1.0	1.1	1.3	1.5	1.6	1.8	1.9
43	.2	.4	.7	.9	1.0	1.3	1.5	1.7	1.9	2.1	2.3	2.5
44	.3	.5	.8	1.1	1.3	1.6	1.8	2.1	2.3	2.6	2.8	3.1
45	.3	.6	.9	1.3	1.6	1.8	2.1	2.4	2.7	3.0	3.3	3.7
46	.4	.7	1.1	1.5	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.2
47	.4	.8	1.2	1.7	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8
48	.5	.9	1.4	1.8	2.2	2.7	3.1	3.6	4.0	4.5	4.9	5.4
49	.5	1.0	1.5	2.0	2.5	3.0	3.4	4.0	4.5	5.0	5.5	5.9
50	.5	1.1	1.6	2.2	2.7	3.3	3.8	4.3	4.9	5.5	6.0	6.5
51	.6	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1
52	.7	1.3	1.9	2.6	3.2	3.8	4.5	5.1	5.7	6.4	7.0	7.7
53	.7	1.4	2.1	2.8	3.4	4.1	4.8	5.5	6.2	6.9	7.5	8.2
54	.7	1.5	2.2	3.0	3.7	4.4	5.1	5.9	6.6	7.3	8.1	8.8
55	.8	1.6	2.3	3.2	3.9	4.7	5.5	6.2	7.0	7.8	8.6	9.4
56	.8	1.7	2.5	3.3	4.1	5.0	5.8	6.6	7.5	8.3	9.1	9.9
57	.9	1.8	2.6	3.4	4.4	5.3	6.1	7.0	7.9	8.8	9.6	10.5
58	.9	1.8	2.8	3.6	4.6	5.6	6.5	7.4	8.3	9.2	10.2	11.1
59	1.0	1.9	2.9	3.9	4.9	5.9	6.8	7.8	8.7	9.7	10.7	11.7

WATER TEMPERATURE IN DEGREES FAHRENHEIT

Table 1. (Continued)

	TIME DURATION IN MONTHS											
	13	14	15	16	17	18	19	20	21	22	23	24
40	.9	.9	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6
41	1.5	1.6	1.7	1.9	1.9	2.0	2.2	2.4	2.5	2.5	2.6	2.7
42	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.2	3.4	3.6	3.7	3.9
43	2.7	2.9	3.1	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
44	3.3	3.6	3.9	4.1	4.4	4.6	4.9	5.1	5.4	5.7	5.9	6.2
45	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1	6.4	6.7	7.0	7.3
46	4.6	4.9	5.3	5.6	6.0	6.3	6.7	7.0	7.4	7.8	8.1	8.5
47	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0	8.4	8.8	9.2	9.6
48	5.8	6.3	6.7	7.2	7.6	8.1	8.5	9.0	9.4	9.8	10.3	10.7
49	6.4	6.9	7.4	7.9	8.4	8.9	9.4	9.9	10.4	10.9	11.4	11.9
50	7.1	7.6	8.1	8.7	9.2	9.8	10.3	10.9	11.4	11.9	12.5	13.0
51	7.7	8.3	8.9	9.4	10.0	10.6	11.2	11.9	12.4	13.0	13.6	14.2
52	8.3	8.9	9.6	10.2	10.8	11.5	12.1	12.8	13.4	14.0	14.7	15.3
53	8.9	9.6	10.3	11.0	11.7	12.3	13.0	13.7	14.4	15.1	15.8	16.5
54	9.5	10.3	11.0	11.7	12.5	13.2	13.9	14.7	15.4	16.1	16.9	17.6
55	10.2	10.9	11.7	12.5	13.3	14.1	14.8	15.6	16.4	17.2	18.0	18.7
56	10.8	11.6	12.4	13.3	14.1	14.9	15.7	16.6	17.4	18.2	19.0	19.9
57	11.4	12.3	13.1	14.0	14.9	15.8	16.6	17.5	18.4	19.3	20.2	21.0
58	12.0	12.9	13.9	14.8	15.7	16.6	17.6	18.5	19.4	20.3	21.2	22.2
59	12.6	13.6	14.6	15.5	16.5	17.5	18.5	19.4	20.4	21.4	22.3	23.3

WATER TEMPERATURE IN DEGREES FAHRENHEIT

Table II. Predicted growth in millimeters (mm.) of brook or rainbow trout at
water temperatures from 40° to 59° F.

	TIME DURATION IN MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
40	2	3	5	7	8	10	12	13	15	17	18	20
41	3	5	8	11	14	17	20	23	26	29	32	35
42	4	8	12	16	21	25	29	33	37	42	46	50
43	5	11	16	22	27	32	38	43	49	54	59	64
44	7	13	20	26	33	40	47	53	60	66	73	79
45	8	16	24	31	39	46	53	61	69	77	85	93
46	9	18	26	35	44	53	62	71	80	89	98	107
47	10	20	31	41	51	62	72	82	92	102	112	123
48	11	23	34	46	57	68	80	91	102	114	125	136
49	12	25	37	50	63	75	88	101	113	126	138	151
50	14	28	41	55	69	82	96	110	124	137	151	165
51	15	30	45	60	75	90	105	120	135	150	165	180
52	16	32	48	64	80	97	113	129	145	161	177	194
53	17	34	52	69	86	104	121	139	157	174	191	209
54	19	37	56	74	93	111	130	148	167	185	204	223
55	20	40	60	80	100	119	139	159	179	199	219	238
56	21	42	62	82	103	123	143	164	185	206	226	247
57	22	44	66	89	111	133	156	178	201	223	245	267
58	24	47	71	94	118	141	165	188	212	235	259	282
59	25	49	74	98	123	148	173	197	221	246	271	296

WATER TEMPERATURE IN DEGREES FAHRENHEIT

Table II. (Continued)

	TIME DURATION IN MONTHS											
	13	14	15	16	17	18	19	20	21	22	23	24
40	22	23	25	27	28	30	32	33	35	37	38	40
41	38	41	44	47	50	53	56	59	61	64	67	70
42	54	58	62	66	70	74	79	83	87	91	95	99
43	70	75	80	86	91	96	102	107	112	118	123	128
44	86	93	99	106	113	119	126	132	138	145	152	158
45	100	108	116	124	132	139	147	155	163	170	178	186
46	116	125	134	143	152	161	170	179	188	197	206	215
47	133	143	153	164	174	181	194	204	215	225	235	245
48	148	159	170	182	193	204	216	227	239	250	262	273
49	163	176	188	201	213	226	239	252	264	277	289	302
50	179	193	206	220	234	248	261	275	289	303	316	330
51	195	210	225	240	255	270	285	300	315	330	346	361
52	210	226	242	258	274	291	307	324	340	356	373	389
53	226	243	261	278	295	313	330	348	366	383	400	418
54	241	260	278	297	316	335	354	372	391	410	428	447
55	258	278	298	318	338	357	377	397	417	437	457	476
56	268	288	309	330	351	371	392	412	433	453	473	494
57	289	312	334	357	379	401	423	445	468	490	512	534
58	306	329	353	376	400	424	447	471	494	518	541	564
59	320	345	370	395	419	444	468	493	518	542	567	592

WATER TEMPERATURE IN DEGREES FAHRENHEIT

Table III. Number of months required to produce 2, 4, 6, 8, 10, or 12 inch rainbow or brook trout in hatcheries having water temperatures of 42, 44, 46, 48, 50, 52, 54, 56, or 59°Fahrenheit.

LENGTH OF FISH IN INCHES

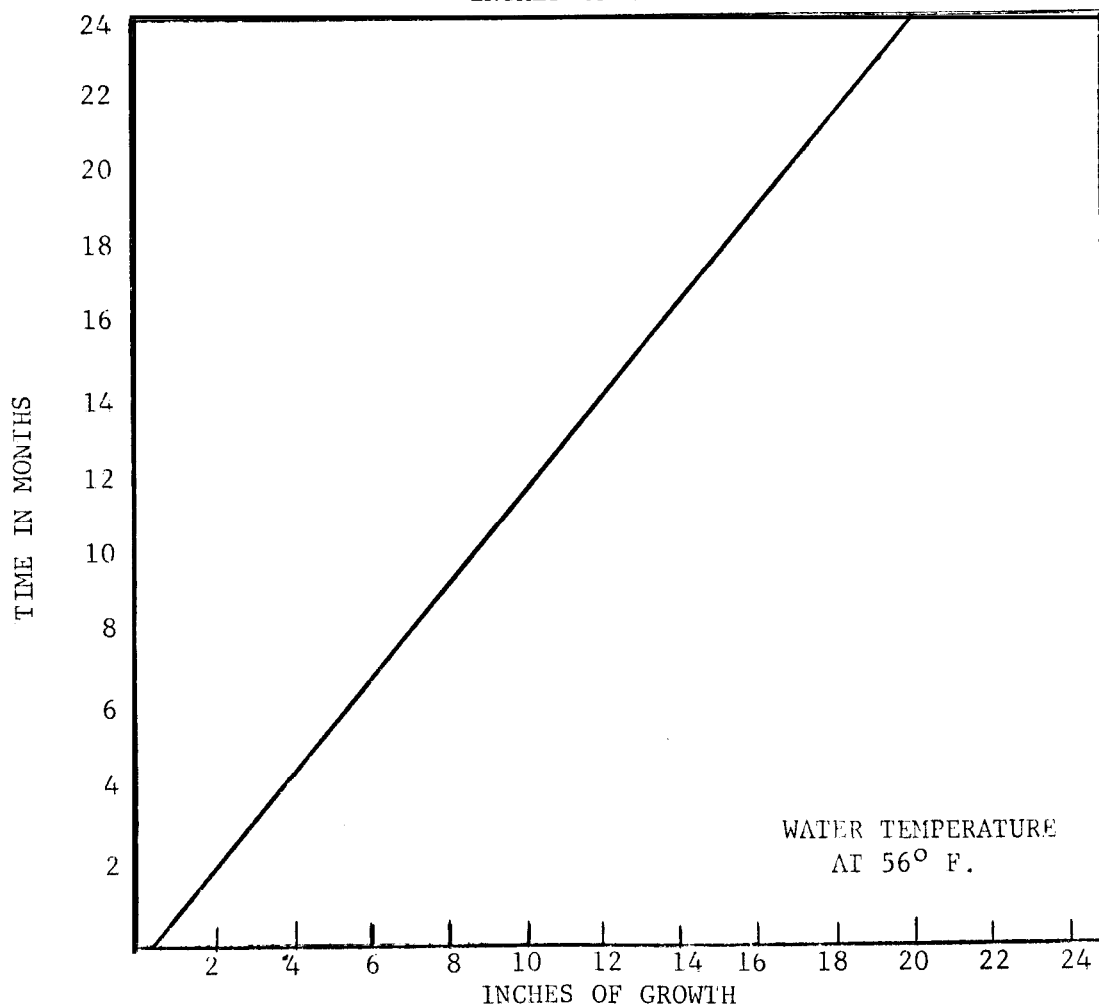
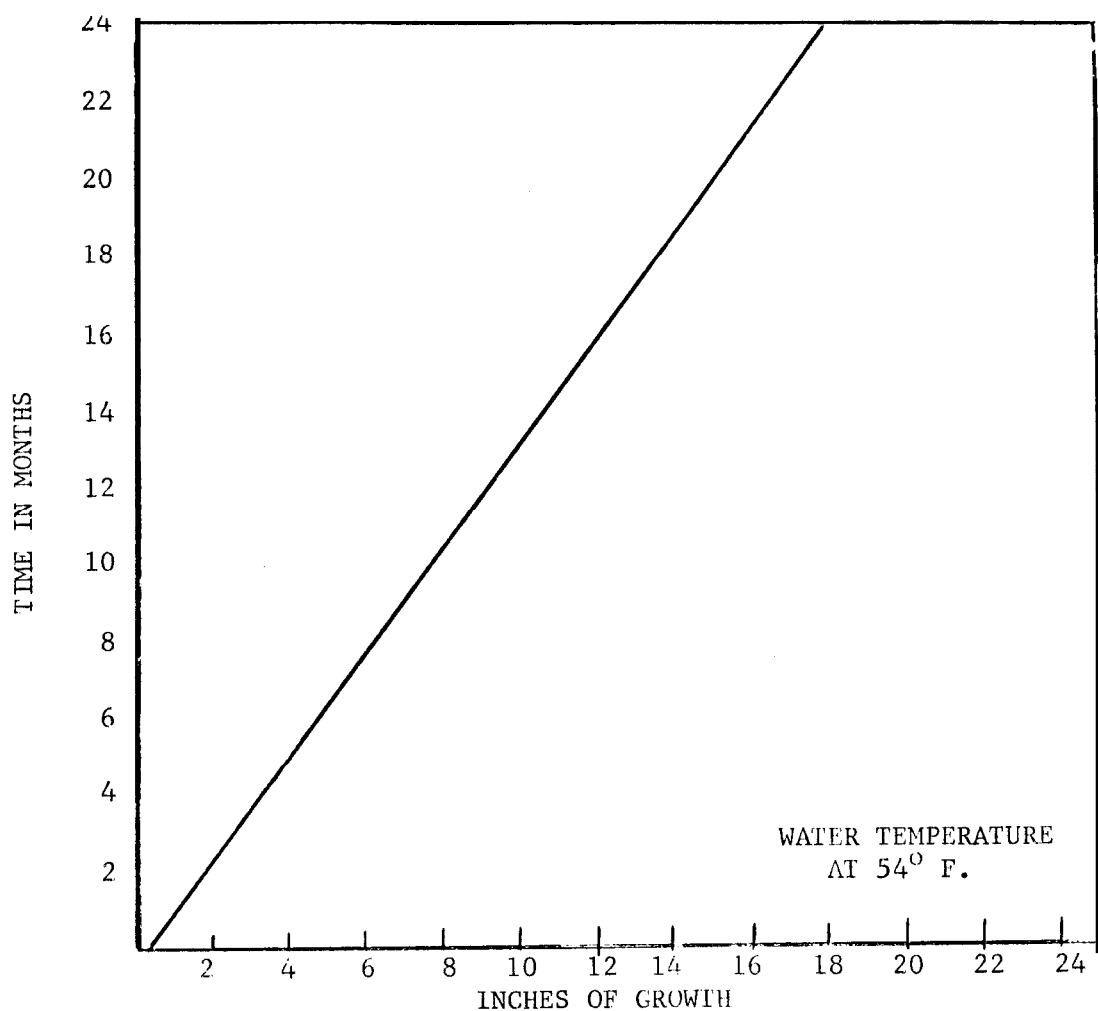
WATER TEMPERATURE IN DEGREES F.	LENGTH OF FISH IN INCHES					
	2"	4"	6"	8"	10"	12"
42	12.3	24.6	36.9	49.2	61.5	73.8
44	7.8	15.5	23.3	31.1	38.9	46.7
46	5.7	11.4	17.1	22.8	28.5	34.2
48	4.5	9.0	13.5	18.0	22.5	27.0
50	3.8	7.4	11.0	14.8	18.6	22.3
52	3.2	6.3	9.5	12.7	15.8	19.0
54	2.7	5.5	8.2	10.9	13.6	16.3
56	2.4	4.8	7.2	9.6	12.1	14.5
59	2.1	4.1	6.2	8.2	10.3	12.3

Table IV. Table indicating the approximate month and year that eggs must be received at hatcheries with 42, 44, 46, 48, 50, 52, 54, 56, 59°F. water to produce 2, 4, 6, 8, 10, or 12 inch rainbow trout for planting in May, 1972. (eggs to hatch 15 days after shipment is received)

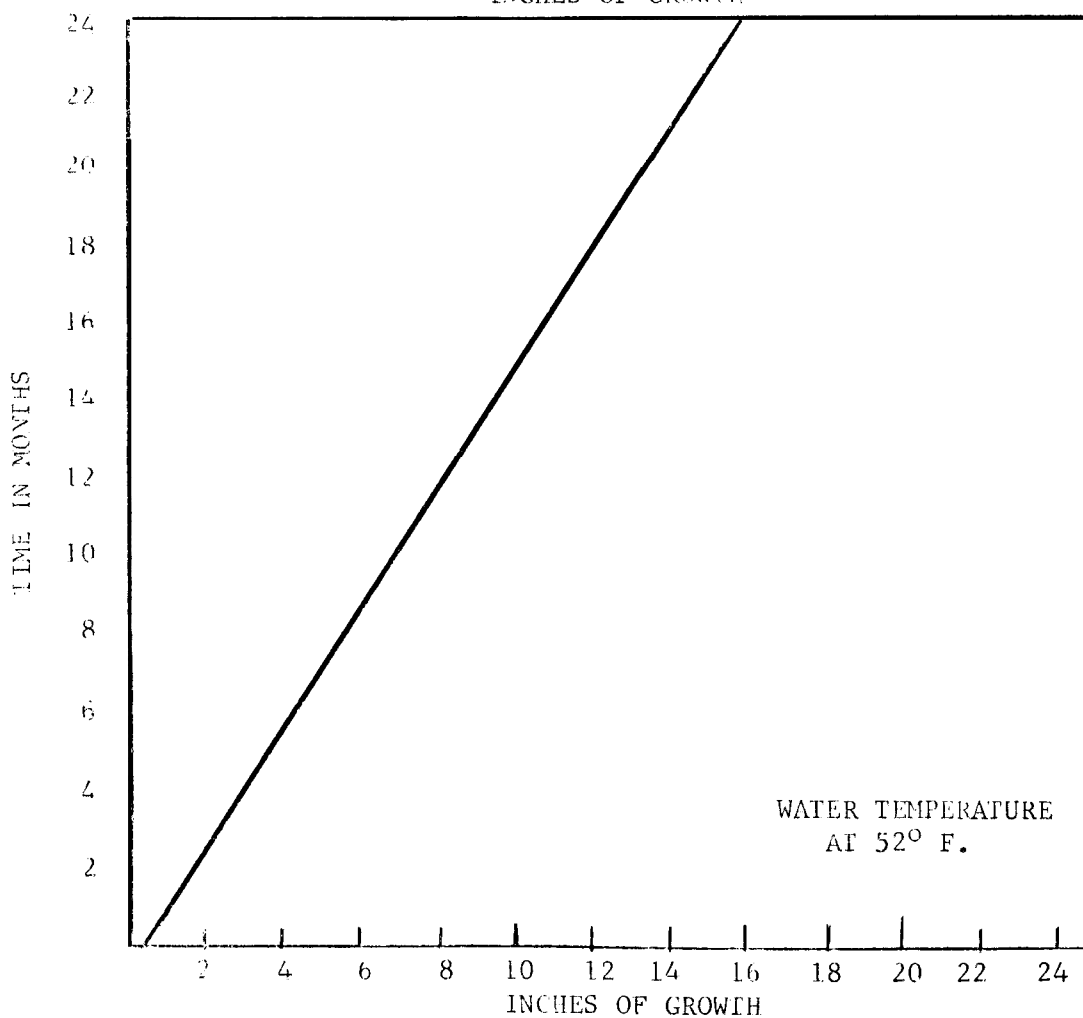
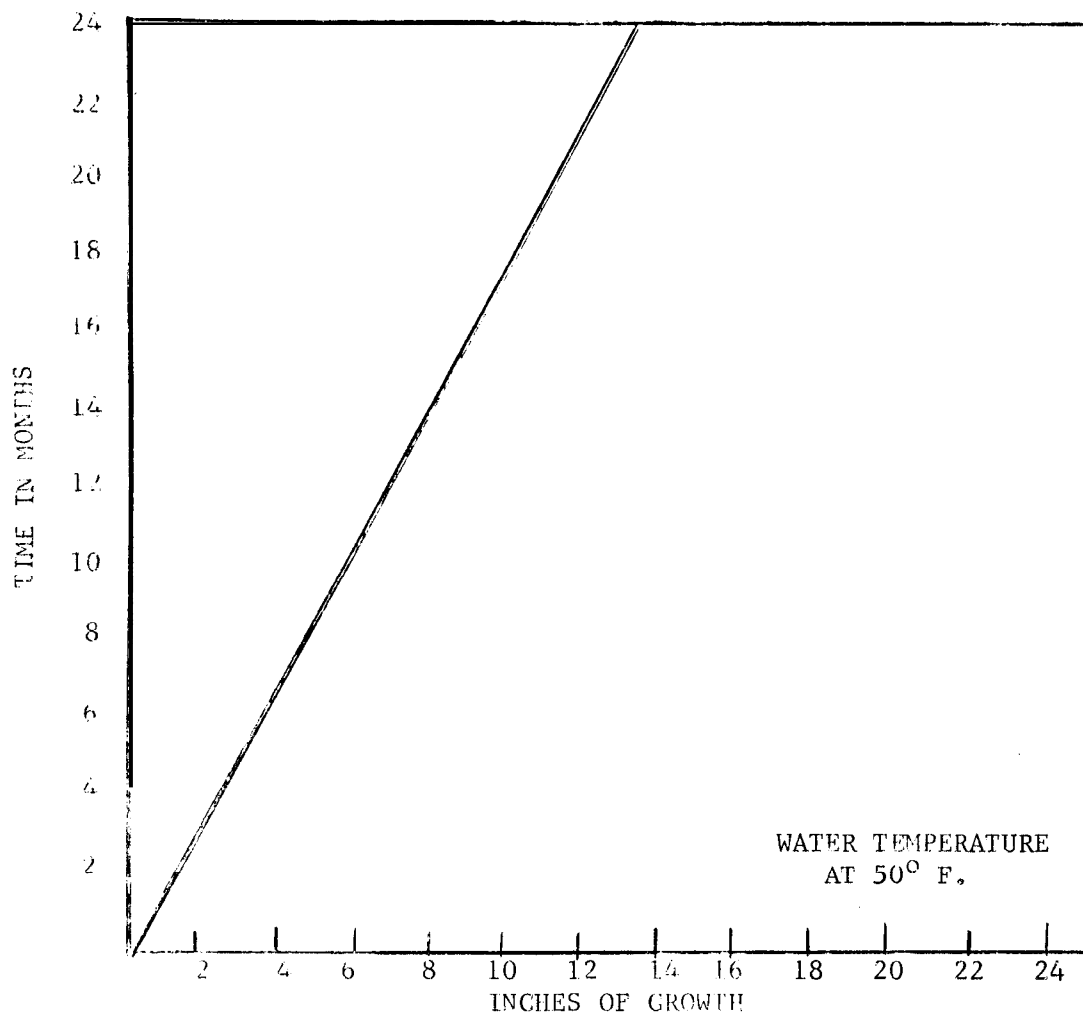
LENGTH OF FISH IN INCHES

WATER TEMPERATURE IN DEGREES F.	LENGTH OF FISH IN INCHES					
	2"	4"	6"	8"	10"	12"
42	Apr. 71	Apr. 70	Apr. 69	Mar. 68	Mar. 67	Mar. 66
44	Sept. 71	Jan. 71	May 70	Sept. 69	Jan. 69	May 68
46	Nov. 71	May 71	Nov. 70	June 70	Dec. 69	June 69
48	Dec. 71	Aug. 71	Mar. 71	Nov. 70	June 70	Jan. 70
50	Dec. 71	Sept. 71	May 71	Feb. 71	Oct. 70	June 70
52	Jan. 72	Oct. 71	July 71	Apr. 71	Jan. 71	Sept. 70
54	Jan. 72	Nov. 71	Aug. 71	June 71	Mar. 71	Dec. 70
56	Feb. 72	Dec. 71	Sept. 71	June 71	Apr. 71	Feb. 71
59	Feb. 72	Dec. 71	Oct. 71	Aug. 71	June 71	Apr. 71

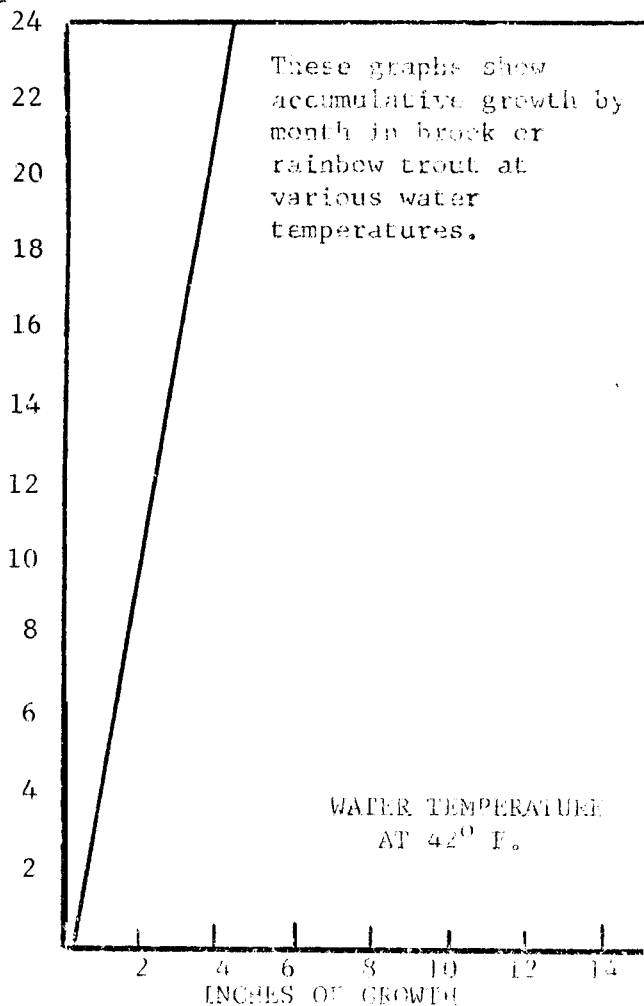
Graphs showing
accumulative
growth by
month in
brook or
rainbow trout
at various
water
temperatures.



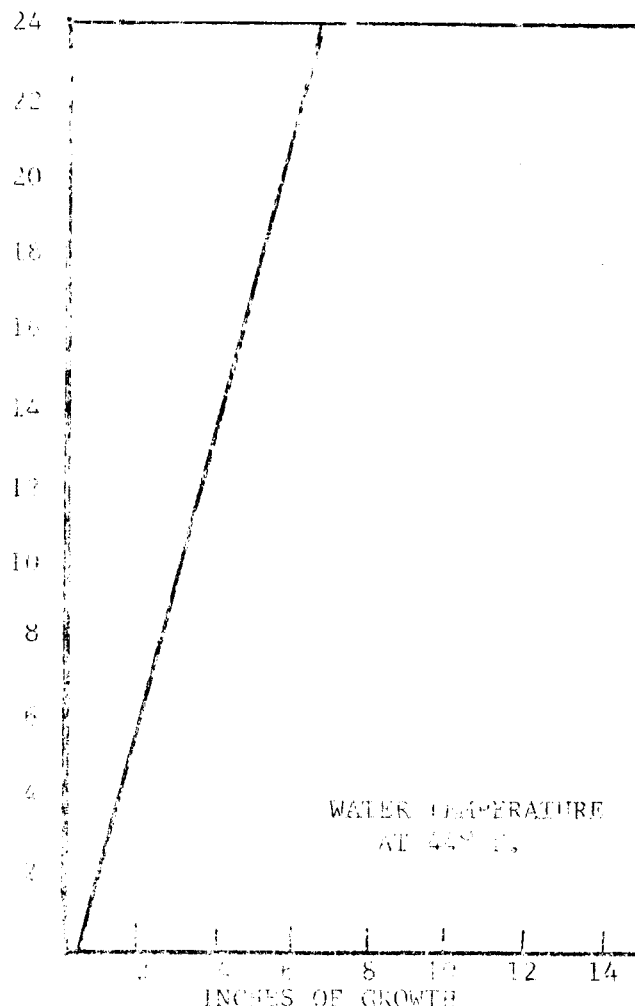
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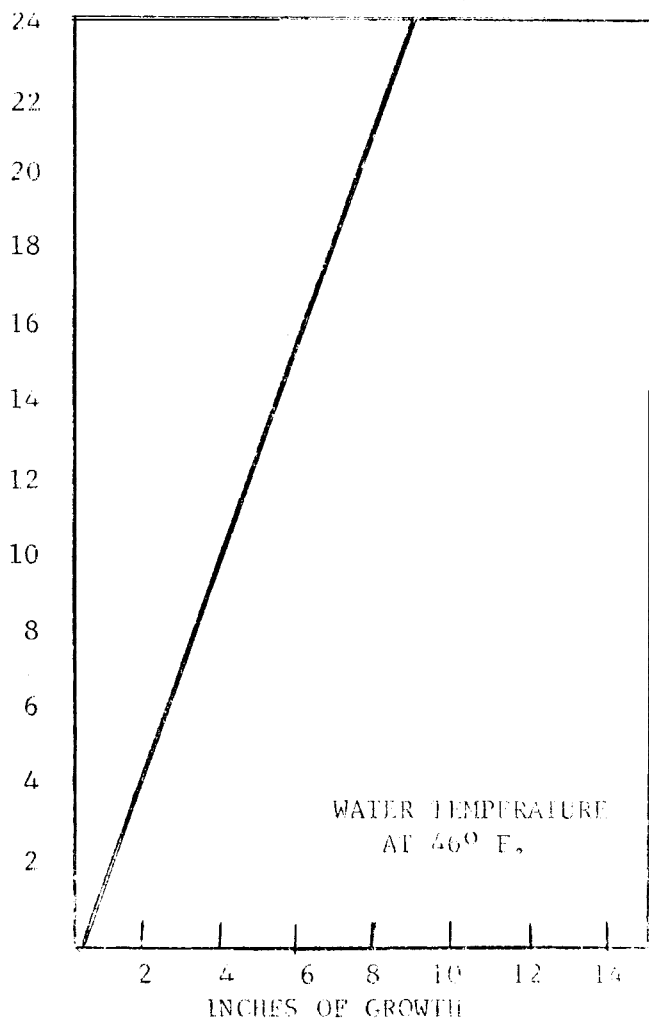
TIME IN MONTHS



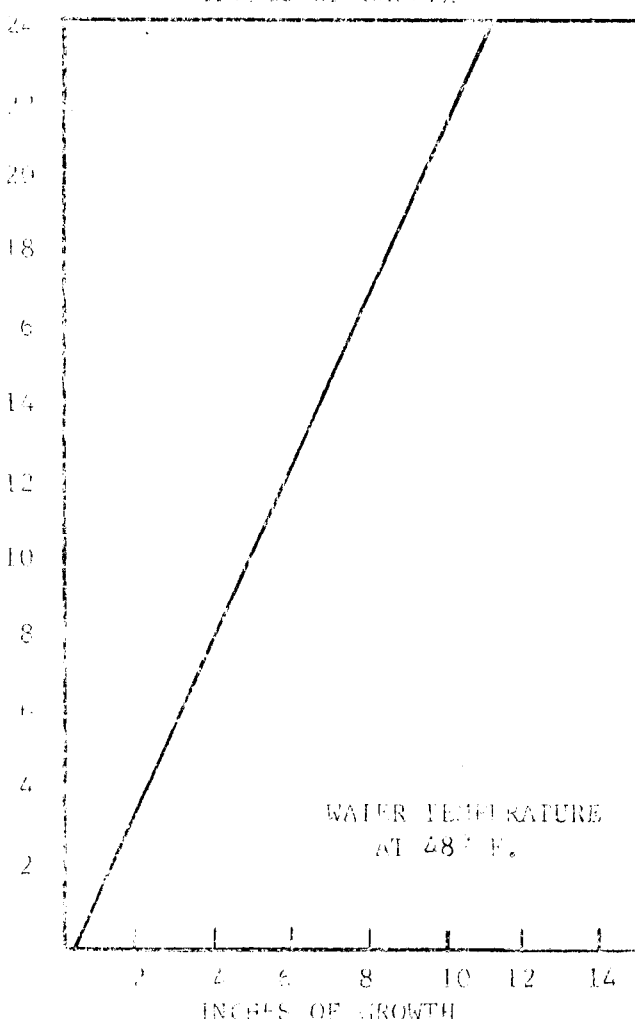
TIME IN MONTHS



TIME IN MONTHS



TIME IN MONTHS



Graph showing accumulative growth by month in brook or rainbow trout
in water temperature of 59° F.

