Dr. Royce

ANAYLSIS OF DATA CONCERNING THE EFFECT OF VARIOUS FACTORS UPON THE TIME REQUIRED FOR DEATH OF 90% OF POPULATION

Raw Water Experiments

The original data and averages are shown in table 1, and the summary of the analysis of variance in table 2.

Age of water

Populations in the non-aged water required a significantly greater time to be reduced 90% than those in aged water. Experiments in non-aged water averaged 2.92 days as compared to .94 days for aged water.

The analysis of variance and Fisher's F test, shown in table 2, gives an F value of 33.6, which with 1 and 18 degrees of Freedom indicates that the probability is much less than 1 chance in 100 that such a large difference in the average of these two groups of data could be attributed to chance variation in sampling from a homogeneous population.

Months

There was also a highly significant difference between "months", the experiments conducted in "August" averaging 1.13 days to reduce the population by 90%, and those in "November" averaging 2.88 days. The probability of such a large difference occurring by chance was again much less than 1 in 100. For the non-aged water, the average was 1.65 days in the "August" experiments and 4.44 days in the "November" experiments, while for the aged water the averages were 0.62 days in "August" as compared to 1.32 in "November".

Boiled and Autoclaved Water Experiments

The original data for these experiments are shown in table 3, and the summary of the analysis of variance in table 4.

Age of Water

There was no significant difference between non-aged water (6.64 days)and aged water(7.96 days).

Months

There was a highly significant difference, however, between "months"; "August" averaging 4.13 days and "November" averaging 10.98 days for all experiments. That this seasonal difference occurred in all categories of the data can be seen from the following breakdown. In the non-aged water, Boiled water averaged 3.58 days in "August" as compared to 8.76 days in "November"; Autoclaved water averaged 3.16 days in "August" as compared to 11.66 days in "November". In the Aged water, Boiled water averaged 6.58 days in "August" as compared to 9.90 days in "November", and the Autoclaved water averaged 3.02 days in "August" and 13.60 days in "November".

Boiled vs Autoclaved Water

One variable more than the number measured in the analysis of the Raw water is represented in this analysis, i.e, the difference between Boiled and Autoclaved water. The difference between Boiled (average of 7.01 days)and Autoclaved (average of 7.63 days) was found to be non-significant.

Raw Water vs Boiled or Autoclaved Experiments

Although the difference between Raw water and Boiled or between Raw water and Autoclaved was not tested by Statistical method, obviously such differences are significant. The average of all experiments done in Raw water was 1.93 days as compared to averages of 7.63 days for Autoclaved and 7.01 for Boiled water.

There is apparently some unmeasured factor operating unequally upon the performance of Boiled and Autoclaved water in the various months. The range of values in "November" is considerably greater than in the "August" experiment. This effect, as well as the significance of all differences reported in this brief summary, can best be explained by those who designed and conducted these experiments.

H. A. Schuck
U.S.Fish and Wildlife Service
Woods Hole, Massachusetts
3/16/49

RAW WATER ONLY

TABLE 1.— Days required for death of 90% Population.

	Non Aged Water	Aged Water	
August	1.9	.6	
	1.9	1.1	
	1.1	.5	
	1.7	.6	1.13
	2.0	.5	
	1.3	.4	
Av.	1.65	0.62	
November	3.4	1.4	
	5.7	1.0	
	6.6	1.0	
	3.1	1.5	2.88
	3.4	1.7	
Av.	4.44	1.32	
	2.92	.94	

TABLE 2.--

Source of Variation	D.F.	Sum of Squares	Mean Square	"F"
Total	21	55.76	. . .	. . .
Water Types	1	21.60	21.60	33.6**Highly Sig.
Months	1	16.64	16.64	25.9** " "
Subclass Discrepancy	1	5.94	5.94	9.1** " "
Within Subclasses (error)	18	11.58	.643	

	"F" with 1 and 18 degrees of freedom at:
Table of "F" from	5% level of significance is 4.41
Snedecor, Geo W. "Statistical Methods"	1% " " " " 8.28

Mean = 1.93 days

Std. dev. = .80187 days

Std. error = .18396 days

BOILED AND AUTOCLAVED WATER

TABLE 3.--Days Required for death of 90% of Population

		Non Aged Water	Aged Water		
AUGUST	Boiled	5.8	4.0	AV. 5.08	4.13
		6.1	27.0		
		3.0	1.8		
		2.2	2.5		
		2.2	2.0		
		2.2	2.2		
		Av. 3.58	AV. 6.58		
	Autoclaved	3.3	3.0	AV. 3.08	
		4.3	5.5		
		2.6	2.8		
		3.4	2.0		
		2.2	2.9		
		--	1.9		
		AV. 3.16	AV 3.02		
NOVEMBER	Boiled	11.0	20.0	AV. 9.33	10.98
		5.2	1.4		
		9.8	20.0		
		10.0	2.6		
		7.8	5.5		
		--	& --		
		AV. 8.76	AV. 9.90		
	Autoclaved	8.5	20.0	AV. 12.63	
		13.0	6.3		
		20.0	20.0		
		7.1	14.0		
		9.7	7.7		
		--	--		
		AV. 11.66	AV.13.60		
		AV. 6.64	AV. 7.96		

TABLE 4.--

Source of Variation	D.F.	Sum of Square	Mean Square	"F"
Total	42	1,797.73	18.75	.56
Water Types	1	18.75	518.75	14.9356
Months	1	502.53	502.53	14.93
Treatments	1	4.06	4.06	.1206
Subclass Discrepance	4	94.35	23.59	.7010
Within Subclasses (error)	35	1,178.04	33.66	

"F" with 1 and 36 degrees of freedom at:

5% level of significance is 4.11

1% " " " " 7.39

With 4 and 36 degrees of freedom at:

5% level of significance is 2.63

1% " " " " 3.89

Mean - 7.31 days

Std. Dev. - 5.80172 days

Std. Error - .96695 days