

## RESULTS

The survival rates for salmonellae, shigellae and cholera vibrios in eight different sources of water from Chiangmai are given in Table II. The Vibrio cholerae showed ability to live in water longer than the other two organisms. It also survived as long as ten days in water with lower bacterial contamination. Salmonella typhosa and Shigella flexneri type III exhibited very little tendency for survival. This organism could not survive longer than two days, except for the one instance in the deep well water had less contamination. Salmonella typhosa remained viable up to ten days. The role of pH appeared less significant than mentioned in the Indian literature (11) since none of organisms showed a pattern of survival linked to this factor.

Table III shows the effect of seasonal changes in concentration of Mae Ping River water on the survival of three test organisms. The samples were taken every month covering the dry, the hot season and on through the rainy season. The vibrios could not be found after two days except in November when they could survive up to seven days. Since late October and November was the time of the flood stages of Mae Nam Ping, at this time the river was highly diluted with rain water and the vibrios showed the longest viability in such water too. Salmonella typhosa and Shigella flexneri type III demonstrated equally poor viability in all seasons.

In Table IV the effect of initial concentration on survival

is given. It is interesting that the critical population of inoculum for each organism seemed to be  $10^4$  to  $10^5$  organisms. This data also shows that the organism can be detected in concentrations as low as four per milliliter thus emphasizing the sensitivity of the millipore filter/enrichment technic used in this study. The survival of vibrios in this water with the same concentration of the inoculum as used for the work shown in Table IV was four days. The survival was still long because the water was still diluted by earlier rains even though it was the early part of the cold, dry season.

Table V indicates the pH changes for 21 days during survival studies of the water from various sources.







TABLE III. (Continued)  
Survival of Salmonellae, Shigellae and Cholera Vibrios in Mae Ping River Water.

Organisms and Date Tested	mg/100 ml.		Initial Plate count	pH	Examined in triplicate Survival in days							
	Ca	Fe			0	1	2	4	7	10	20	
August, 11 <sup>th</sup>	12.8	0.055	12x10 <sup>4</sup>	7.5								
<u>Vibrio cholerae</u> El Tor-Ogawa					0/3	1/3	2/3	0/3	0/3	0/3	0/3	0/3
<u>Salmonella typhosa</u>					3/3	1/3	3/3	0/3	0/3	0/3	0/3	0/3
<u>Shigella flexneri</u> type III					3/3	1/3	0/3	0/3	0/3	0/3	0/3	0/3
September, 25 <sup>th</sup>	1.6	0.126	18x10 <sup>4</sup>	7.5								
<u>Vibrio cholerae</u> El Tor-Ogawa					0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3
<u>Salmonella typhosa</u>					3/3	0/3	1/3	0/3	0/3	0/3	0/3	0/3
<u>Shigella flexneri</u> type III					0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3
November, 1 <sup>st</sup>	1.2	0.029	6x10 <sup>4</sup>	7.1								
<u>Vibrio cholerae</u> El Tor-Ogawa					3/3	3/3	3/3	3/3	1/3	0/3	0/3	0/3
<u>Salmonella typhosa</u>					2/3	1/3	0/3	0/3	0/3	0/3	0/3	0/3
<u>Shigella flexneri</u> type III					3/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3

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TABLE IV.

Effect of Inoculum Concentration on Survival. Mae Ping River, December, 15<sup>th</sup>, 1965.

Initial pH = 7.0

Ca = 2.48 mg/100 ml.

Initial plate count =  $3 \times 10^4$ 

Fe = 0.0461 mg/100 ml.

Organisms	Conc./ml. after inoculation	Survival in days									
		0	1	2	4	7	10	13	16	19	22
<u>Vibrio cholerae</u> <u>El Tor-Ogawa</u>	4.6	+	+	-	-	-	-	-	-	-	-
	46	+	+	+	-	-	-	-	-	-	-
	$4.6 \times 10^2$	+	+	+	+	-	-	-	-	-	-
	$4.6 \times 10^3$	+	-	+	+	-	-	-	-	-	-
	$4 \times 10^4$	+	+	+	+	+	-	-	-	-	-
<u>Salmonella typhosa</u>	$4.6 \times 10^4$	+	+	+	+	+	+	+	+	-	-
	44	+	+	-	-	-	-	-	-	-	-
	$4.4 \times 10^2$	+	+	-	-	-	-	-	-	-	-
	$4.4 \times 10^3$	+	+	-	-	-	-	-	-	-	-
	$4.4 \times 10^4$	+	+	-	-	-	-	-	-	-	-
<u>Shigella flexneri</u> type III	$4.4 \times 10^5$	+	+	+	+	-	+	+	-	-	-
	$4.4 \times 10^6$	+	+	-	-	-	-	-	-	-	-
	84	-	+	-	-	-	-	-	-	-	-
	$8.4 \times 10^2$	-	-	-	-	-	-	-	-	-	-
	$8.4 \times 10^3$	-	-	-	-	-	-	-	-	-	-
<u>Shigella flexneri</u> type III	$8.4 \times 10^4$	-	+	-	-	-	-	-	-	-	-
	$8.4 \times 10^5$	-	+	-	-	-	-	-	-	-	-
	$8.4 \times 10^6$	-	+	+	-	+	-	-	-	-	-
	$8.4 \times 10^6$	-	-	+	+	+	-	-	-	-	-

TABLE V.  
pH Changes during the Survival Study.

Sources of water	1st day a.m.p.m.	2nd day a.m.p.m.	3rd day a.m.p.m.	4th day a.m.p.m.	5th day a.m.p.m.	6th day a.m.p.m.	7th day a.m.p.m.	14th day a.m.p.m.	21st day a.m.p.m.
Mae Ping River	7.0 7.0	7.0 7.2	7.0 7.2	7.0 7.2	7.0 7.2	7.0 7.0	7.0 6.7	7.0 7.0	6.7 6.7
Mae Kha River	7.5 7.0	7.2 7.2	7.2 7.6	7.2 7.6	7.2 7.2	7.2 7.6	7.6 7.0	8.0 7.0	6.4 6.4
Deep (driven) well	6.8 6.8	6.8 7.0	6.8 7.0	6.8 7.0	7.0 7.0	7.0 7.0	7.0 6.5	7.0 7.0	6.4 6.7
Klong (canal)	7.5 6.8	7.0 6.8	7.0 6.8	7.0 6.8	6.8 6.8	6.8 7.0	7.0 6.6	7.0 7.0	6.4 6.7
Shallow well (Sompetch market)	7.3 7.2	7.2 7.2	7.0 7.6	7.6 7.6	7.6 7.6	7.6 7.6	7.6 6.7	7.0 7.0	6.7 7.0
Municipal tap water	7.6 7.0	7.2 7.2	7.0 7.0	7.2 7.0	7.0 7.0	7.0 7.0	7.0 6.5	6.0 7.0	6.7 6.7
Shallow well (Chiengmai Gate market)	7.3 7.2	7.2 7.2	7.2 7.2	7.2 7.2	7.2 7.4	7.6 7.6	7.6 5.7	7.0 7.0	6.7 6.7
Chiengmai University Reservoir	7.8 7.7	7.6 7.6	6.8 7.0	7.0 7.0	7.2 6.8	7.0 7.2	7.2 6.7	8.0 7.0	7.5 7.5