LIGHT TRAP INDICES OF MOSQUITO ABUNDANCE: A COMPARISON OF OPERATION FOR FOUR AND SEVEN NIGHTS A WEEK

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Many time-saving techniques have been tested and applied to the task of processing mosquitoes captured in light traps and other collecting devices. A large part of the work, however, is that of separating mosquitoes from the mass of other insects collected. This problem assumes major proportions when light traps are operated each night throughout the season. Several investigators have concluded that useful data indicating population trends of adult mosquitoes can be obtained from the operations of light traps on a limited schedule (Bradley and Travis, 1942). J. A. Mulrennen and D. M. Rees (personal communications) found that the operation of light traps for two nights a week was sufficient to follow population trends of mosquitoes in Florida and Utah, respectively. For the present study a four-night schedule was selected because it allowed the longest time for operating a light trap consistent with a five-day work week. On the fifth day, Friday, the collections were processed and results tabulated.

MATERIALS AND METHODS. Light trap collection data from mosquito control districts in two regions of the Central Valley of California were evaluated. These districts were selected because their records were kept on a daily basis. American model light traps (Mulhern, 1953), with 25 watt, white, inside-frosted bulbs, were used in all instances. Data for 1954 were obtained from seven districts; three from the northern and four from the southern regions of the Central Valley. Data from five of the seven original districts were utilized in 1955 as well as records from two traps operated by the Bureau of Vector Control in the southern region of the Valley. All data were analyzed first on a seven, then on a four trap-night per week basis. The four trap-night data utilized Monday through Thursday night collections. The analysis was limited to the numbers of female *Culex tarsalis* Coquillett collected. This species is normally the most common mosquito taken in light traps throughout the Valley during the summer months. Records for the species are tabulated separately because of its importance in transmission of arthropod-borne encephalitis. The analysis was limited to females since some districts do not record males either because of difficulty of identification or the low numbers collected. All figures are expressed as average number of female *C. tarsalis* per trap night.

The unit of measurement was the trap night. This is defined as one trap operating for one night, from 6 p.m. to 6 a.m. Light trap figures for the seven-night operation were obtained by dividing the total weekly catch for all traps operated in each district by seven times the number of traps operated; for the four-night operation the trap night figures were obtained by dividing the total catch for all traps by four (Monday through Thursday nights) times the number of traps operated.

For the comparison of indices based on trapping for four or seven nights, a standard error of the difference was calculated which took into consideration the high degree of correlation between the two sets of measurements.

RESULTS. There were 14 sets of data which were compared with respect to four or seven nights' trapping. Of these, eight sets are shown in the accompanying table and figure. It will be noticed from the figure that there was relatively little difference in the indices based on four and seven nights a week.

Figure 1 also shows four comparisons

Figure 1

NUMBER OF FEMALE CULEX TARSALIS PER TRAP-NIGHT
COLLECTED FROM SELECTED LIGHT TRAP LOCATIONS
IN THE CENTRAL VALLEY, CALIFORNIA, JUNE-SEPTEMBER, 1954-1955

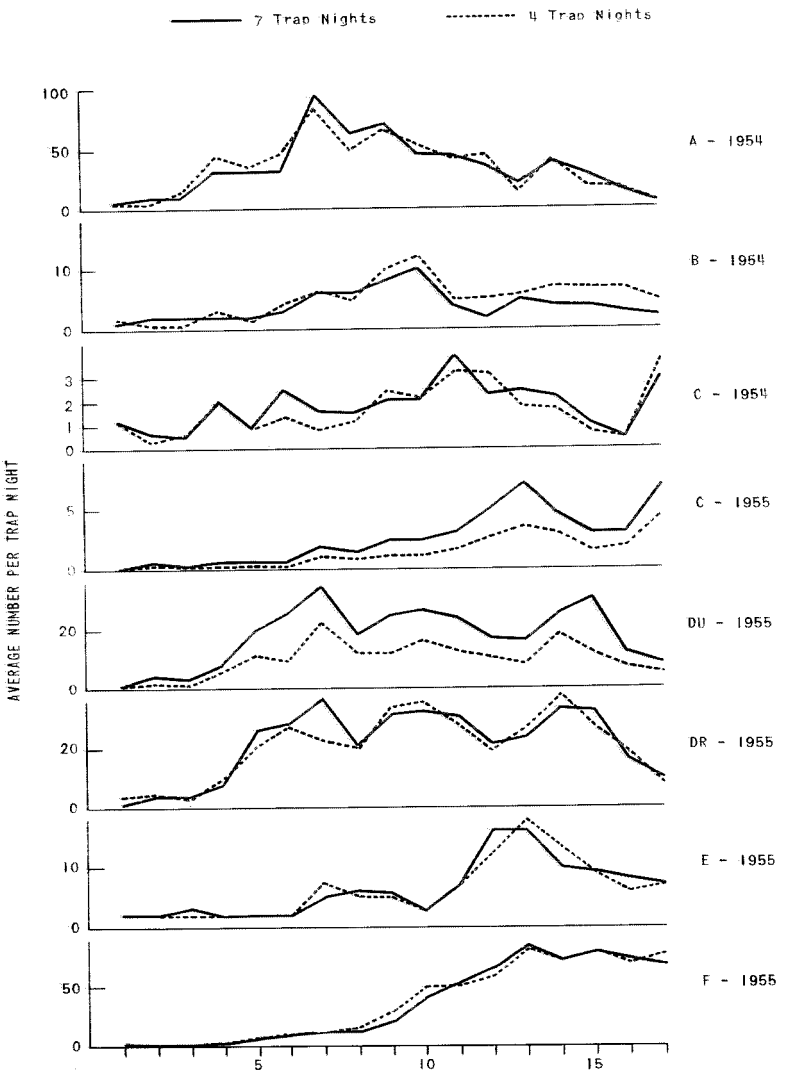

TABLE 1

NUMBER OF FEMALE CULEX TARSALIS PER TRAP NIGHT
COLLECTED FROM SELECTED LIGHT TRAP LOCATIONS
IN THE CENTRAL VALLEY, CALIFORNIA, JUNE-SEPTEMBER, 1954-1955

DATE	LOCATION															
	A		B		C-54		C-55		DU		DR		E		F	
	NUMBER OF TRAPS															
	1		8		5		5		6		6		1		1	
	NUMBER OF NIGHTS															
	7	4	7	4	7	4	7	4	7	4	7	4	7	4	7	4
June 5	1.8	2.0	0.9	1.7	1.3	1.2			0.7	0.4	0.9		1.5	2.3	1.5	1.7
12	6.5	3.7	1.4	1.3	0.7	0.3	0.6	0.4	3.7	2.1	4.4	4.6	2.0	2.5	0.3	0.2
19	9.3	13.2	1.3	1.3	0.5	0.6	0.3	0.2	2.8	1.0	4.4	3.4	2.7	2.5	1.3	1.3
26	31.3	43.0	2.2	2.6	2.0	2.0	0.7	0.3	8.0	5.7	7.9	9.2	2.3	2.2	1.3	1.0
July 3	32.0	34.2	2.2	2.1	0.8	0.8	0.7	0.4	19.2	11.0	25.9	21.2	1.6	2.0	6.3	7.5
10	32.5	44.0	3.9	4.3	2.5	1.3	0.6	0.3	24.9	9.3	28.0	27.1	1.5	1.7	8.1	10.0
17	93.5	84.0	5.7	6.2	1.6	0.8	1.8	1.1	34.3	22.2	37.5	32.6	5.1	7.2	6.1	9.8
24	62.1	45.7	6.4	5.2	1.5	1.1	1.5	0.9	18.5	11.8	20.7	20.5	6.4	5.2	12.0	14.0
31	70.2	65.0	9.2	10.0	2.1	2.3	2.5	1.2	24.2	11.8	31.2	33.6	6.0	4.8	21.0	28.2
August 7	47.0	52.0	9.7	13.6	2.0	2.1	2.4	1.2	26.2	16.1	32.4	35.0	3.1	3.2	41.0	49.7
14	45.7	43.0	4.6	5.0	3.8	3.2	3.1	1.7	23.6	12.4	29.9	28.3	7.1	7.1	53.7	52.7
21	36.5	44.0	4.0	5.1	2.3	3.1	5.0	2.6	17.4	10.0	21.3	19.3	16.0	11.5	64.0	57.5
28	21.1	14.0	3.9	5.0	2.4	1.8	7.2	3.4	16.7	8.2	22.9	26.1	16.0	17.5	82.7	81.0
September 4	37.8	39.0	5.0	5.6	2.2	1.6	4.7	2.9	25.5	17.6	32.9	38.3	10.0	12.8	71.9	72.7
11	28.2	18.5	5.2	6.8	0.9	0.7	3.0	1.5	29.8	11.7	32.1	27.5	9.0	9.0	78.0	78.0
18	15.7	17.0	5.2	6.7	0.5	0.5	3.0	1.8	11.6	6.8	16.0	18.1	7.6	8.0	72.4	70.2
25	3.8	4.0	3.0	4.6	2.8	3.6	6.7	4.4	7.7	4.9	9.0	8.8	6.9	7.0	67.1	78.5
Total	575.0	566.3	73.8	87.1	29.9	27.0	43.8	24.3	294.8	163.0	356.5	353.6	104.8	104.5	588.7	612.0
Mean	33.8	33.3	4.3	5.1	1.8	1.6	2.7	1.5	17.3	9.6	22.3	22.1	6.2	6.1	34.6	36.0
Correlation Coefficient	0.952		0.952		0.854		.973		.929		.962		.936		.993	
Standard Error of Difference	1.84		0.197		0.118		0.251		1.23		0.781		0.396		1.443	

Source: State of California, Department of Public Health, Bureau of Vector Control Records.

which indicate that the four-night index is satisfactory under a variety of conditions. Areas A and B represent districts in the northern and southern regions, respectively, of the Central Valley in 1954. Seasonal trends in 1954 and 1955 are shown by District C located in the Southern Central (San Joaquin) Valley. Trends in urban (DU) and rural (DR) areas are shown from a district in the northern Central (Sacramento) Valley in 1955. Examples E and F show trends of *C. tarsalis* populations in areas of the San Joaquin Valley in 1955 where mosquito control measures were or were not practiced, respectively. Comparable results were obtained from the other six sets of data which are not included for the sake of brevity.

Table 1 shows the the average number of mosquitoes per trap night for eight trap locations for seventeen weeks, on a four- and a seven-night basis. The means, the correlation coefficients, and standard error of the difference of the means are shown in the lower part of the table. For many individual weeks the number of mosquitoes per trap night for a given location are very similar for both four and seven nights. The mean number of mosquitoes per trap night for the entire season differed significantly in three of the eight sets of data (B, C—55, DU). The difference in a fourth location (C-54) approaches significance at the 95 percent level. Thus it can not be concluded that there is no difference between indices based on collecting for four or seven nights. The high degree of correlation between these schedules of operation, however, shows that for most purposes the four-night schedule is satisfactory.

DISCUSSION. These results closely parallel those of Bradley and Travis (1942) who found that "the mean daily catches, obtained from trap operations made every second and third day, approximate closely to the mean catch from traps operated every day." These workers found that the magnitude of the standard error increased as the interval between sampling increased; the standard error for an index based on catches made every third day was approximately twice the standard error of the index based on daily catches.

In view of the many factors that may affect light-trap catches, such as temperature, humidity, wind direction and velocity and the relative effectiveness of mosquito control in surrounding areas, the authors believe that these results justify the use of *C. tarsalis* indices based on operation of traps for four nights a week in the Central Valley of California.

SUMMARY. Operation of light traps on either a four- or seven-trap night a week schedule was shown to give acceptable seasonal population trends of adult *Culex tarsalis* in the Central Valley of California. The two schedules of operation gave similar results under a variety of conditions and in different locations during a two-year period. Light traps used four consecutive nights, Monday through Thursday, rather than seven nights may insure a better schedule of operations within mosquito control agencies.

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