ABUNDANCE AND FLIGHT HABITS OF CERTAIN ALASKAN MOSQUITOES, AS DETERMINED BY MEANS OF A ROTARY-TYPE TRAP

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A rotary-type trap (fig. 1), described elsewhere in this issue (Chamberlin, J. C., and Lawson, F. R., A mechanical trap for the sampling of aerial insect populations, page 4.) was operated almost nightly from late April until mid-September 1944 by the junior author on the grounds of the Alaska Agricultural Experiment Station at Palmer, in the northern Matanuska Valley. Although this trap was operated primarily for the purpose of collecting data on the presence and habits of night-flying cutworm moths, a quantity of other insect material was obtained and examined by him. These collections invariably included a goodly number of mosquitoes, which were segregated according to date and time of capture. By this means a sequence of

Table 1—Prevalence of Mosquito Species in Matanuska, Alaska, During 1944 As Determined from Collections in a Rotary Trap

Period		*Culiseta*					*Aedes* spp.[1]	*Culex apicalis* Adams	*Anopheles maculipennis occidentalis* D. and K.
		impatiens (Walk.)	*incidens* (Thoms.)	*alaskaensis* (Ludl.)	*morsitans* (Theob.)	Damaged			
Apr.	27-30	1	....	125	....	11	.....	....	....
May	1- 5	4	....	35	....	7	.....	....	....
	6-10	9	....	30	....	6	.....	5	....
	11-15	20	0	76	....	17	.....	1	1
	16-20	4	1	13	2	8	0	0	0
	21-25	9	1	16	0	14	97	2	1
	26-30	3	17	13	0	21	85	1	0
June	1- 5	36	2	10	0	13	635	2	2
	6-10	3	1	9	0	9	977	3	1
	11-15	4	0	21	0	10	1072	1	0
	16-20	2	3	7	0	11	404	14	0
	21-25	1	1	3	0	6	307	2	1
	26-30	3	2	0	1	16	467	0	0
July	1- 5	2	1	3	0	11	473	4	0
	6-10	4	4	5	0	17	378	1	1
	11-15	1	1	4	0	7	298	0	1
	16-20	3	2	5	1	8	465	1	0
	21-25	1	1	6	0	10	261	2	0
	26-30	1	0	5	2	7	240	0	1
Aug.	1- 5	2	....	7	0	11	306	1	0
	6-10	5	....	17	6	23	133	2	0
	11-15	6	....	49	11	20	92	1	0
	16-20	4	....	31	9	18	42	3	0
	21-25	31	....	103	20	7	30	2	0
	26-30	36	....	132	8	20	11	0	0
Sept.	1- 5	29	....	147	0	8	10	0	0
	6-14		No collections						
	15-16	9	....	23	0	0	1	0	0

[1] Because of the difficulty in separating *Aedes* of the *stimulans* group, and because many of the specimens were damaged in transit, all specimens of this genus were counted together. Besides *Aedes* of this group, *A. cinereus* Meig. and *A. pullatus* (Coq.) were present but not in large numbers.

Fig. 1. The authors examine a catch of insects in a rotary-type trap in Matanuka Valley, Alaska.

species and their relative abundance at different times in the season and under varying light intensity were obtained throughout the season. All species determinations were made by Alan Stone, of the Division of Insect Identification. The species and numbers caught are given in table 1.

The rotary-type trap has several advantages over the New Jersey light trap. During the mosquito season in the latitude of Alaska there are few hours of darkness when a light trap would effectively attract mosquitoes. Moreover, the rotary trap catches all flying mosquitoes that happen within its collecting range, and by this means one can sample an exact number of cubic feet of atmosphere. Since the trap may be operated by a small gasoline engine as well as by an electric motor, it can be used in remote places where electricity is not available. The trap as used in the Matanuska Valley captured numbers of several species of mosquitoes, although it was located several hundred feet from mosquito-breeding grounds and was operated without an attractant.

One serious disadvantage of this type of trap is that it may injure the specimens captured when unattended for long periods of time.

A trap equipped with two nets, as shown in fig. 1, and operated at 55 r.p.m. removes the insects from approximately 500,000 cubic feet of air per hour. By mounting one of the cones of this trap on the fender of an automobile, one can take continuous samples of mosquito populations while traveling at dusk. With a cone mounted on the right front fender of an army command car, we drove from the Matanuska Valley to Fairbanks, a distance of about

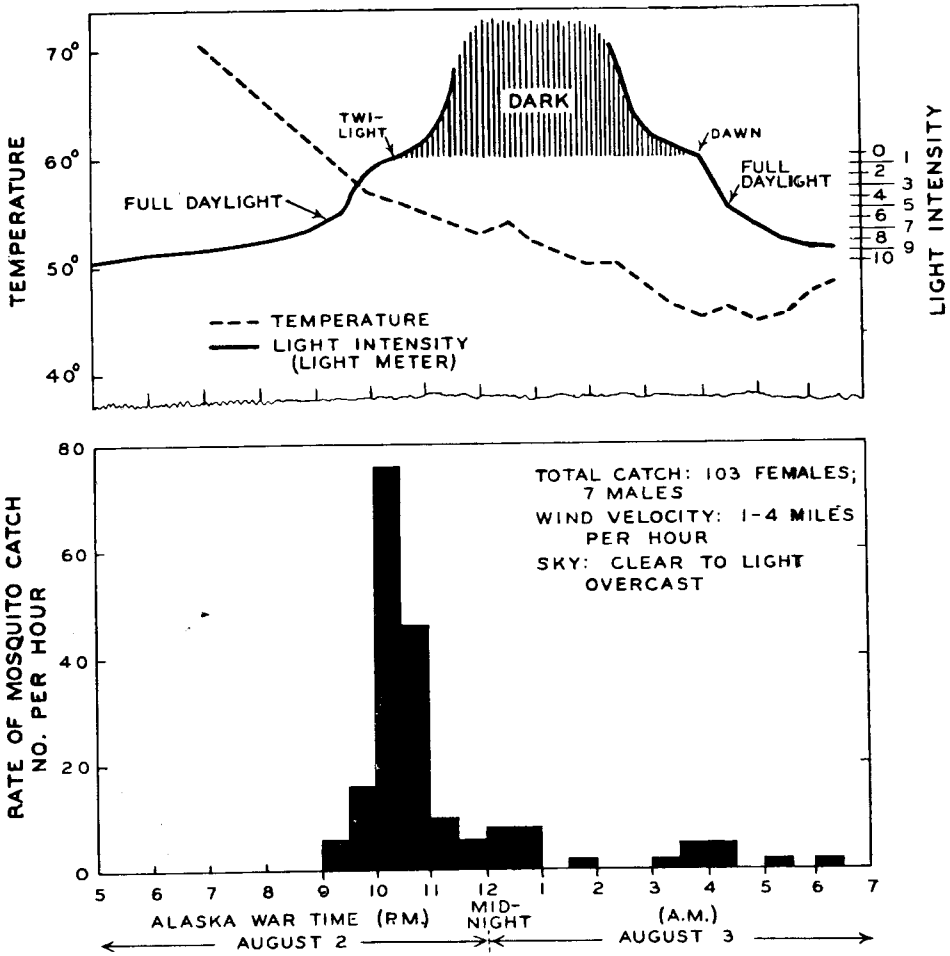

Fig. 2. Rotary trap collection at Matanuska, Alaska, Aug. 2-3,, 1944.

400 miles. About every 25 miles we inspected the catching bag and recorded the numbers of mosquitoes and certain climatic conditions. In this manner we collected a host of flying insects, a few of which were mosquitoes. Table 2 gives the results of these catches compared with 5-minute catches on one of our persons.

Table 2—Mosquitoes Caught in a Cone Trap Mounted on An Automobile Compared With Numbers Caught in 5 Minutes' Collecting by Hand, Palmer to Fairbanks, Alaska, 1944.

Alaska War Time	Temperature, °F.		Miles traveled	No. of Mosquitoes Caught: By trap on car	No. of Mosquitoes Caught: In 5 min. by hand
Palmer to Paxson, July 23					
11:45 a.m.	68°	Sunny	25	0	0
12:35 p.m.	70°	Sunny	49	0	16
2:40 p.m.	74°	Sunny	85	0	0
4:30 p.m.	70°	Sunny	111	0	18
5:15 p.m.	66°	Sunny	136	0	8
6:30 p.m.	69°	Sunny	161	3	3
7:45 p.m.	60°	Cloudy	186	1	3
9:00 p.m.	54°	Light rain	211	11	12
10:15 p.m.	52°	Light rain	236	14	11
Paxson to Fairbanks, July 24					
10:00 a.m.	52°	Light rain	261	1	8
11:15 a.m.	51°	Light rain	286	3	16
1:00 p.m.	58°	Cloudy	311	1	4
2:00 p.m.	70°	Sunny	336	0	17
3:30 p.m.	76°	Sunny	361	0	23
4:45 p.m.	76°	Sunny	386	0	16
5:30 p.m.	77°	Sunny	411	0	3

It is to be particularly noted that mosquitoes were caught in the automobile trap only toward evening and in the morning. The following species were taken in these collections: *Aedes* spp. of the *stimulans* group; *Aedes cinereus, A. pullatus, Culiseta incidens,* and *Culex apicalis.* A few males were taken in the car trap; none of course were captured in the 5-minute collections.

The trap on the car was also used on two consecutive nights on what is known as the Farm Loop Road between Fairbanks and the University of Alaska. Table 3 summarizes these data.

Table 3—Mosquitoes Caught by Means of a Cone Trap Mounted on the Fender of an Automobile While Traveling Along Farm Loop Road, Fairbanks, Alaska, 1944.

Alaska War Time	Light conditions (no wind)	Temperature, °F.	Miles traveled	No. of mosquitoes
July 25-26				
11:00 p.m.	Dusk, cloudy	56°	10	22
12:00 m.	Dusk, cloudy	53°	11	46
1:00 a.m.	Lighter Cloudy	53°	12	22
2:00 a.m.	Early dawn, cloudy	54°	10	21
2:30 a.m.	Daylight, cloudy	54°	11	19
July 26-27				
10:00 p.m.	Sunset, clear	44° ±	10	1
10:30 p.m.	Early twilight, clear	44° ±	12	0
11:15 p.m.	Dusk, clear	44° ±	11	0
12:00 m.	Dusk, clear	44° ±	10	4
1:00 a.m.	Dark, clear	44° ±	11	2

Since the front opening of the cone trap measured exactly 2 square feet and since the exact mileage was known, each 10-mile trip screened about 105,600 cubic feet of air.

The mosquitoes collected on the Farm Loop Road were *Aedes* species of the *stimulans* group, *Culex apicalis, Culiseta impatiens,* and rarely *Anopheles maculipennis* var, *occidentalis* D and K. Although these collections were made somewhat late in the mosquito season ,a few *Aedes* males were taken. Males of the other species were fairly numerous.

From the data presented in tables 2 and 3 it will be seen that, provided climatic conditions and light intensity are suitable, the cone trap when mounted on the fender of an automobile will catch representative samples of the mosquito population. Furthermore, this method lends itself well to

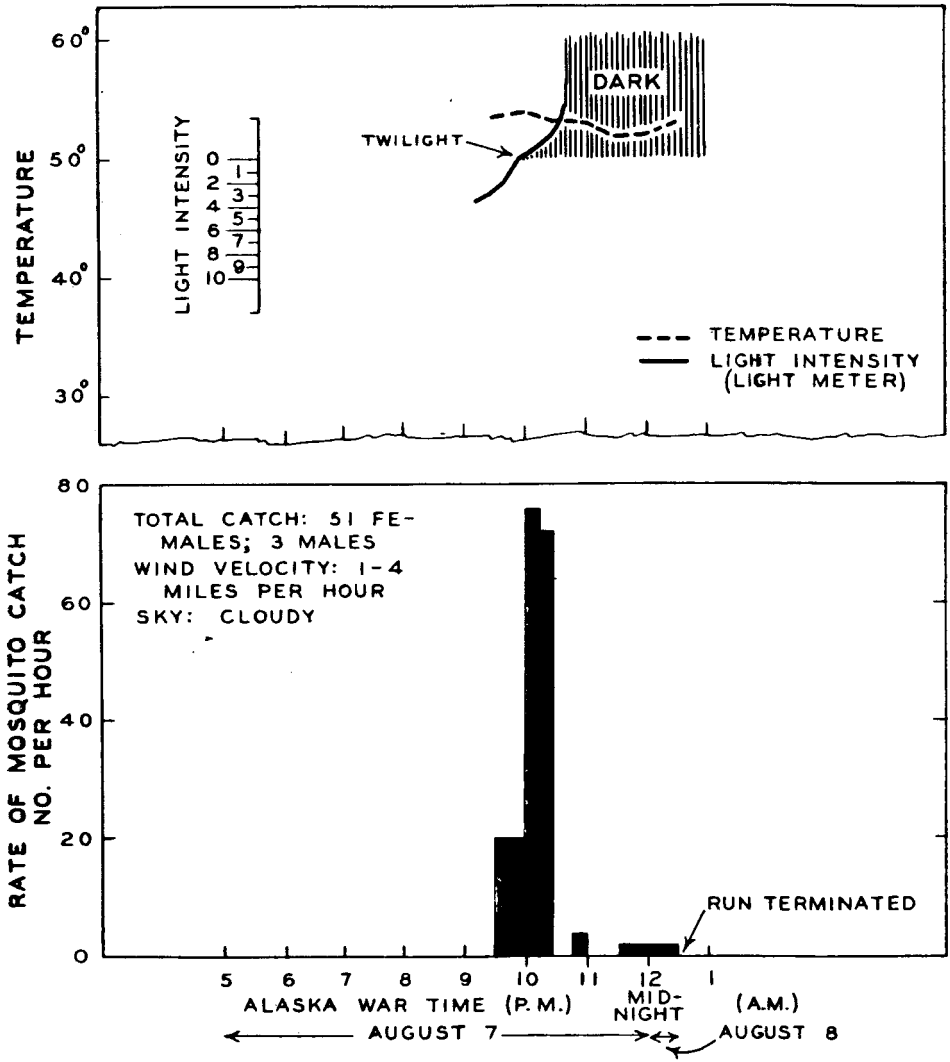

Fig. 3. Rotary trap collection at Matanuska, Alaska, Aug. 7-8, 1944.

gathering species data hastily, if one is reconciled to securing his data from early dusk to total darkness.

Late July, when these data were recorded, is well past the peak of the mosquito season. A much greater number of individuals, although not of species, would probably have been taken at the height of the season, some 30 days earlier. For a complete list of the mosquito species occurring in Alaska the reader is referred to table 4.

During August a special effort was made to determine, for a representative series of dates, something of the flight activity of the general mosquito population relative to various factors, particularly temperature, light, precipitation, wind velocity, and time. Collections were removed at more or less definite intervals, and the total mosquito catch for the various periods was recorded coincident with observations on the meteorological conditions.

These data are shown in graphic form in figures 2-6. The diurnal catches consisted largely of *Aedes* females, with occasional *Aedes* males and *Culiseta alaskaensis, C. morsitans,* and *C. impatiens,* males or females. As far as could be noted at the time from superficial observation, there were no marked differences in the flight behavior of the species caught (for example, the flight of *Aedes* spp. as compared to that of *Culiseta* spp.).

Examination of these charts clearly shows that the mosquito flight at Matanuska, where it was not affected or influenced by the presence of prey, light, or other attractant, was a true crepuscular phenomenon, the peak of flight occurring only during twilight periods. Very few mosquitoes were taken during hours of full daylight or complete darkness, either during these special observations or at any other time during the season.

The diurnal flight pattern of mosquitoes in the Matanuska Valley may be generalized by the following statements: Flight is at a minimum during the hours of full daylight but increases greatly with the coming of twilight. Flight activity starts rather gradually about sunset, and reaches

Table 4—Alaskan Mosquito Records, As Obtained *by Various Collectors*

Species	Alaska in general[1]	Fairbanks 1931[2]	Fairbanks 1944[3]	Matanuska 1944[4]
Anopheles maculipennis occidentalis D and K.....	105*	x	x	x
Culex apicalis Adams[5]	14	x	x	x
Culiseta				
alaskaensis (Ludl.)	26*	x	..	x
incidens (Thoms.)	27*	..	..	x
impatiens (Walk.)	28*	x	x	x
morsitans (Theob.) syn. *dyari* Coq.....	25	..	..	x
Aedes				
pullatus (Coq.)	53*	..	..	x!
diantaeus H. D. and K,	54	x	..	..
punctodes Dyar	55*	!	..	!
punctor (Kby.)	56	X	x	x[7]
leuconotips Dyar	57*	x	..	..
cyclocerculus Dyar	58*	x	..	..
aboriginis Dyar	58*	x	..	..
aldrichi Dyar	63	X	..	..
impiger (Walk.)	63*	x	..	..
cataphylla Dyar	64*	x	..	..
communis (Deg.), *syn. communis* Felt *lazarensis* Young	65*	X	x	x[7]
pionips Dyar	68*	..	..	..
prolixus Dyar	69*	..	..	..!
campestris D. and K.....	70*	..	..	..
excrucians (Walk.)	72*	..	x	x
flavescens (Müll.)	74*	..	..	!
stimulans (Walk.), syn. *mercurator* Dyar	75*,76	X	x[6]	x[6]
fitchii (Felt and Young)	78	x	..	..
palustris Dyar	80*	..	..	..
alpinus (L.)	84*	..	..	..
nearcticus Dyar	84*	..	..	..
cinereus Meig.	93	..	..	..

* Alaskan records are positively indicated.

[1] Dyar, H. G. Mosquitoes of the United States. U. S. Natl. Mus. Proc. 62, art. 1, 119 pp. 1923. Numbers refer to pages in the reference.

[2] Tulloch, G. S. Mosquito investigations in Alaska. Psyche 41: 201-210, illus. 1934. The four commonest species are indicated by large crosses. An exclamation mark (!) indicates a Fairbanks record in Dyar's report (*loc. cit.*).

[3] Collections in 1944 by Stage and Chamberlin.

[4] Collections in 1944 by Stage and Chamberlin. An exclamation point (!) indicates a positive specific record for Anchorage, Alaska, by Dyar (*loc. cit.*).

[5] Listed as a synonym of *Culex testaceaus* Van der Wulp in Dyar (*loc. cit.*).

[6] Indeterminte identification; of *stimulans* group.

[7] Indeterminate identification; of *communis-punctor* type.

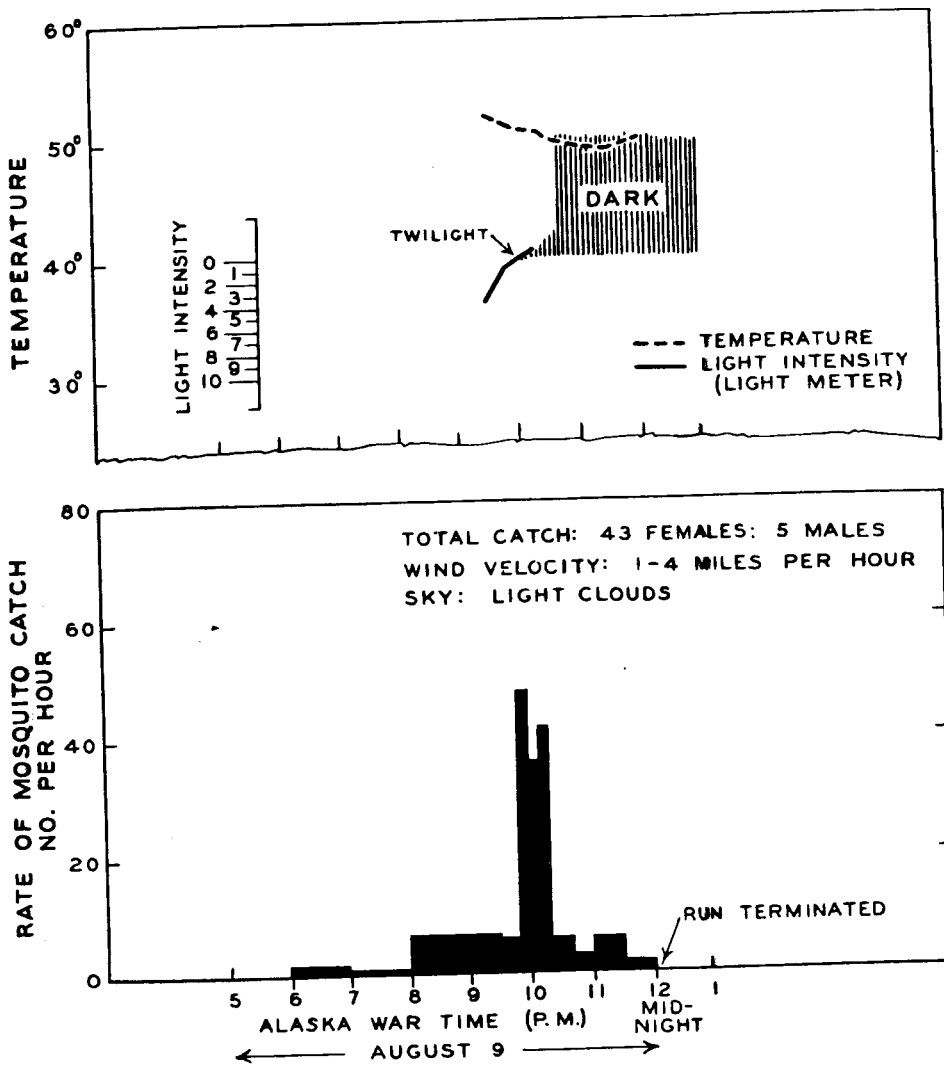

Fig. 4. Rotary trap collection at Matanuska, Alaska, Aug. 9, 1944.

a peak just before complete darkness, and then decreases to a very low rate, if it continues at all, during periods of maximum darkness. Dawn brings another increase in flight activity whicih reaches a maximum well before full daylight, and then again decreases, generally to the vanishing point.

The dawn flight is always of lower magnitude than the evening flight. This is almost certainly the result of less than optimum flight temperatures, which tend to reduce flight activity in spite of favorable light conditions.

The bimodal character of the flight is indicated in figure 2, and to a greater degree in figure 6.

It is of interest to note that light rain during periods otherwise favorable does not markedly inhibit flights (figs. 5 and 6).

The air velocity did not vary sufficiently

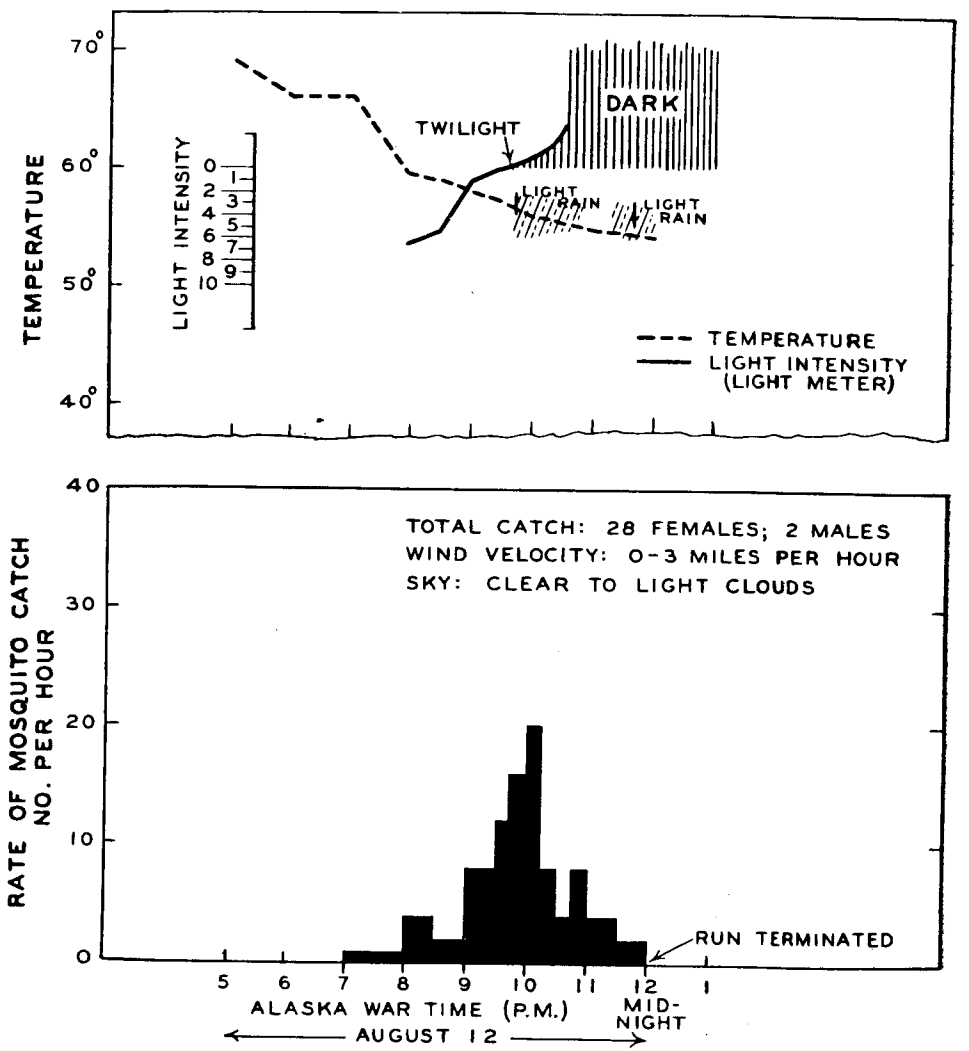

Fig. 5. Rotary trap collection at Matanuska, Alaska, Aug. 12, 1944.

during these tests so that the influence of wind on flight could be ascertained. It is probable, however, that high wind velocities tend to inhibit flight, although they apparently must be in excess of 5 to 6 miles per hour to be effective in this regard.

It should be of considerable interest to obtain similar data for other species and in other localities. This technique should be of value in ascertaining the seasonal sequence of species in particular localities, interspecific associations, and distances of dispersal from breeding grounds. More especially it offers an accurate method of sampling flight activity for very short periods in correlation with any of a large number of physical factors, particularly light intensity and temperature.

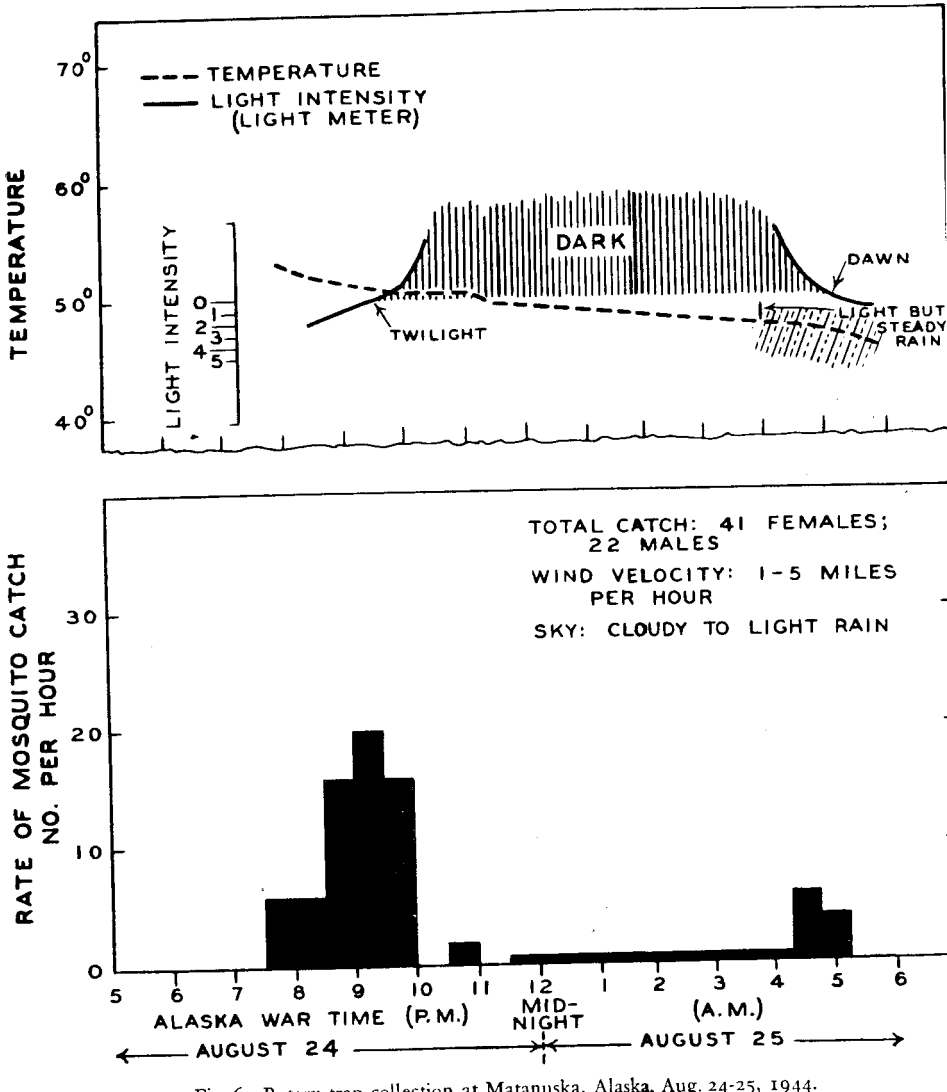

Fig. 6. Rotary trap collection at Matanuska, Alaska, Aug. 24-25, 1944.