could be used undiluted. If a 5 per cent solution had been necessary, 70,000 gallons, weighing about 600,000 pounds, would have been required. It is estimated that the boats traveled 1,000 miles in preparing for and dispersing the insecticide.

The cooperation and work of the numerous people involved in the program was excellent. This was an event both the operators and citizens of Lake County had been looking towards for a long time. Most of the people had complete confidence that the gnat problem was solved even before the lake was treated. The community celebrated the event as G-E (gnat eradication) Day (Knipling 1950). There apparently were some doubters, however, since it was rumored wagers were made that Clear Lake gnats would be found the next July! However, after the first few weeks no gnat larvae could be found in Clear Lake by any known means of sampling, and not a single Clear Lake gnat was observed during the summer of 1950.

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# IMPORTANT SPECIES OF MOSQUITOES AND CONTROL WORK IN WYOMING

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The purpose of this report is to present the results of our studies on the mosquitoes of Wyoming and also to give a summary of mosquito control activities in the state.

For a number of years we have been accumulating information on the species of mosquitoes found in the state, their distribution and the biology of each species. Many phases of the study are still incomplete. Much remains to be learned about the biology of many of the less common species. The total number of species recorded for Wyoming is now 42, as follows:

*AEDES: campestris, canadensis cataphylla, cinereus, communis, diantaeus, dorsalis, excrucians, fitchii, flavescens, idahoensis, impiger, increpitus, intrudens, nearcticus, nigromaculis, pionips, pullatus, punctor, riparius, schizopinax, spencerii, sticticus, stimulans, triseriatus, trivittatus, vexans.*

*ANOPHELES: franciscanus, freeborni, occidentalis, punctipennis.*

*CULEX: apicalis, pipiens, restuans, salinarius, tarsalis.*

*CULISETA: alaskaensis, impatiens, incidens, inornata.*

*MANSONIA: perturbans.*

*PSOROPHORA: signipennis.*

Twelve species were selected as the most important on the basis of numbers of individuals and distribution in the state: *AEDES: campestris, cataphylla, communis, dorsalis, excrucians, fitchii, idahoensis, increpitus, pullatus, vexans; CULEX tarsalis* and *CULISETA inornata.* Many of the other species are troublesome locally. If we were to name the most annoying mosquito to the greatest number of people I think *Aedes dorsalis* would win the honor.

*LIFE ZONES.* A discussion of the distribution and abundance of mosquitoes in a given area must take into account topography, weather conditions and a

variety of other factors, although I must emphasize that the distribution of mosquitoes is influenced only in a general way by life zones. These zones as they appear in Wyoming, are as follows:

*Upper Sonoran Zone.* This zone covers that portion of the state at an elevation below approximately 5,000 to 6,000 ft. The lowest elevation is about 3,100 ft. in the northeast corner of the state. Vegetation: Broad-leaved trees, cottonwood, juniper, yucca, grasses, saltbush.

*Transition Zone.* This zone covers approximately one-half of the state (50,000 sq. mi.). The upper limit of the transition zone is at an elevation of approximately 8,500 ft. Vegetation: sagebrush, narrow-leaved trees, cottonwood, grasses, ponderosa pine.

These two zones represent the plains area of the state.

*Canadian Zone.* This is the area of coniferous forest and has as its upper limits an elevation of about 10,000 ft. Vegetation: Aspen, lodgepole pine, Douglas fir, Engelmann spruce.

*Hudsonian Zone.* This is the zone of dwarfed forests at high altitudes and has an upper limit at an elevation of 10,500 to 11,000 ft. Vegetation: Dwarfed spruce, Alpine fir, white-barked pine.

*Arctic Alpine Zone.* This is the area above timberline. The elevation is usually above 10,000 to 11,000 ft. Vegetation: Treeless, except for willows; cinquefoil, red currant, dwarfed raspberry.

*HIGH ALTITUDE SPECIES.* This group includes those species found in the Arctic Alpine, Hudsonian and most of the Canadian zones. The dominant species are as follows: *Aedes communis, A. cataphylla* (transition upward), *A. pullatus* (transition upward), *A. punctor* (in some areas). Larval habitats of these species are pools fed by the melting of snow. We may describe them as forest pools and pools found in the alpine meadows.

The alpine species are of interest because of the increasing popularity and utilization of recreational areas at high altitudes. These mosquitoes are extremely abundant for a short period in mid-summer.

*PLAINS SPECIES.* This group of mosquitoes is found over the entire plains areas, their range extending into the Canadian Zone at lower elevations. The dominant species are as follows: *Aedes dorsalis, A. campestris, A. excrucians, A. fitchii, A. idahoensis, A. increpitus, A. vexans, Culex tarsalis, Culiseta inornata.* Larval habitats of these species are flood waters, water in irrigated meadows, temporary ponds filled with rain or melting snow and permanent ponds.

The highest populations of mosquitoes found in the state are in many of the river valleys. Spring floods fill the natural depressions along the streams and at the same time water for irrigation is diverted into the meadows. This irrigation water is permitted to stand on the hay meadows for several weeks. To quote one rancher, "We turn the water on the meadows as soon as possible and keep it there as long as possible." A single large flight of these species appears in the early spring. The peak of abundance is reached in late June and by the middle of August the "mosquito season" is over. A second brood of species like *Aedes dorsalis* is seldom of importance.

Some cities in the state have no trouble with mosquitoes; other cities are located on rivers where conditions are favorable for production of large numbers of mosquitoes.

*MOSQUITO CONTROL.* Mosquito control has been carried on in Wyoming since 1934. The work is organized on a community basis and financed by the cities and public subscription. We have no state organization or central coordinating agency. Furthermore, Wyoming has no mosquito control law or enabling act which permits the establishment of tax-supported abatement districts. One of the control projects has received limited funds from a local Pest Control District. The law permitting the establishment of Pest Control Districts is not well adapted to mosquito control.

The first mosquito abatement project

was established at Thermopolis in 1934. The State Entomologists planned the work, the local County Extension Agent supervised the project and labor was furnished by the Emergency Relief Administration. My contribution was the identification of a group of mosquitoes collected by the Supervisor.

The second control project was started at Greybull in 1939. The State Entomologists took an active part in planning this project and again I made identifications of the mosquitoes collected in the area. This work was supported in part by WPA and NYA.

Thermopolis and Greybull were the only two cities engaged in mosquito control prior to the war. Within the last few years additional cities have initiated control work. Some of these are limited to mosquitoes while others are considered combined housefly and mosquito control activities.

I have compiled information on mosquito abatement for the season of 1950. The data are not as complete as desired, but are sufficient to give an overall picture of what is being accomplished.

## SUMMARY OF CONTROL ACTIVITIES, BY CITIES

*DOUGLAS.* The work was financed by the city treasury and supervised by the city sanitarian. Douglas is located on the Platte River. The control area included flood waters and irrigated meadows adjacent to the city. Wettable DDT powder was the insecticide used. The entire city and adjacent areas were treated twice during the summer with an airplane. The number of times the alleys and garbage cans were sprayed with power sprayer were not reported. Cost of the program, $50.00 for insecticide.

*SARATOGA.* Saratoga is located on the Platte River and attracts many tourists. This project was started in 1950 and was financed by the city treasury and public subscription. The State Department of Public Health provided technical assistance and supervision for the work. Waters serving as a source of mosquitoes were ponds, flood-water and irrigated meadows.

Larvicide used was 3.5 per cent DDT in diesel oil No. 2. This material was applied by hand sprayers and an airplane at bi-weekly intervals during July and August. Cost of the program, $2,000.00 for the season.

*EVANSTON.* This project was started in 1950. The State Department of Public Health provided technical assistance and supervision. The work was financed by the City Treasury. Evanston is located on the Bear River. The mosquito-producing waters were ponds, flood waters and irrigated meadows. The larvicide used was 3.5 per cent DDT in diesel oil No. 2. This material was applied with a hand sprayer and a power sprayer at bi-weekly intervals for a period of 6 weeks.

The cost was $1,000.00 for larvicidal work. Evanston also had a fly control program in which DDT as well as chlordane was used. Exact formulation, timing and rate of application not reported. Cost of fly control given as $257.50.

*THERMOPOLIS.* This is the oldest control project in the state and is now supervised by the City Sanitarian and the County Extension Agent. Financial support is as follows:

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|---|---|
| City treasury | $500.00 |
| Public Subscription | 125.00 |
| County Pest Control | 50.00 |
| | $675.00 |

Thermopolis is on the Big Horn River. The mosquito-producing waters are a series of ponds adjacent to the river which are flooded each spring. Larvicides used were chlordane and a combination of chlordane and DDT. These agents were dissolved in diesel oil No. 2 and combined with sawdust. The sawdust was saturated with the oil and suspended in the water in burlap bags. The bags were replaced twice during the summer.

Formulations: (1) 100 lbs. sawdust, 2 lbs. chlordane, diesel oil to saturate; (2)

100 lbs. sawdust, 4 lbs. DDT (50 per cent); 1 lb. chlordane, No. 2 diesel oil to saturate. Both formulations gave satisfactory results.

A fly control program was carried on within the city. DDT was the insecticide used. Application was by airplane and a power sprayer. The city was treated three times. Details not reported.

*BASIN AND GREYBULL.* The abatement programs in these two cities were similar in nature. They were financed by the cities and supervised by the City Sanitarian. The Big Horn River is the source of the mosquito-producing waters. Larval habitats were flood waters, ponds and marshes.

The chemical formulation used was 35 per cent DDT emulsion concentrate diluted with water to a strength of 1.5 per cent. Application was by airplane and power sprayer at the rate of 3½ gallons per acre.

The same formulation was used for fly and mosquito control. Alleys and garbage pails were sprayed weekly. Entire city and adjacent area sprayed monthly for a total of three applications. Combined cost—$1,200.00.

ADULT FLY AND MOSQUITO CONTROL

*TORRINGTON.* Program was financed by the city. Formulation used was wettable DDT powder and applied with a power sprayer. Alleys and garbage pails sprayed every ten days during the summer. Strength and rate of application not given.

*LANDER, RIVERTON AND SHOSHONI.* The program was financed by the cities. The entire cities were sprayed with two applications of wettable DDT powder in water. The strength used was apparently 1 per cent applied at the rate of 10 pounds per acre.

(In the summers of 1947 and 1948, larval control was carried on in these areas. The larvicide used was a 2 per cent DDT in No. 2 diesel oil. This program was abandoned because of expense.)

*WORLAND.* This program has been in progress since 1943 and was financed by the following agencies:

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|---|---|
| Local residents | $750.00 |
| Jr. Chamber of Com. | 500.00 |
| City Treasury | 75.00 |

Supervision was by the county Pest Control Operator. Formulations used were 50 per cent DDT emulsion; .25 per cent–.50 per cent chlordane. Power sprayer was used for alleys, shrubbery and garbage pails, and the entire city was sprayed with an airplane. The control program extends from April 1 to September 15. Total cost, $1,425.00.

**AAAS PHILADELPHIA MEETING, DECEMBER 26–31, 1951. The 118th Meeting of the American Association for the Advancement of Science, the annual meeting for 1951, will include programs of all 18 of the Association's sections and about 45 participating societies. Focus of the approximately 225 sessions will be Convention Hall, adjacent to the University of Pennsylvania's School of Medicine and its associated hospitals; there will be some meetings in the downtown hotels, especially the Bellevue-Stratford (headquarters) and the Benjamin Franklin (zoologists).**