PROCEEDINGS AND PAPERS

of the

TWENTY-EIGHTH ANNUAL MEETING

of the

UTAH MOSQUITO ABATEMENT ASSOCIATION

held at

Sherwood Hills
Sardine Canyon, Cache County

September 28 — 29 — 30, 1975

edited by

Bettina Rosay

and

Glen C. Collett

UTAH MOSQUITO ABATEMENT ASSOCIATION
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RESOLUTIONS

WHEREAS, The Utah Mosquito Abatement Association has held its 28th Annual Meeting at Sherwood Hills, September 28-30, 1975, and

WHEREAS, the Box Elder County Mosquito Abatement District has served as the host organization, and

WHEREAS, the arrangement and program committees have done an outstanding job,

THEREFORE, be it resolved that members of the UMAA extend sincere appreciation to the Box Elder County Abatement District and all others concerned with the preparation and arrangements for this excellent convention,

WHEREAS, the papers presented by the speakers have been of high quality with much valuable information for those in attendance, and

WHEREAS, many of the speakers came considerable distances to participate in these meetings,

THEREFORE, be it resolved that the Association extend its appreciation to all speakers and give special thanks to those who came from out of state including Dr. Harold C. Chapman, President, American Mosquito Control Association, and Dr. D. Bruce Francy, President-Elect, American Mosquito Control Association,

WHEREAS, Dr. Bettina Rosay has devoted many hours to Association activities and has been very instrumental in developing the present encephalitis surveillence program,

THEREFORE, be it resolved that the Utah Association express appreciation to Dr. Rosay for her dedication and devotion to the cause of mosquito control and public health.

WHEREAS, Sherwood Hills has provided excellent facilities and services, and

WHEREAS, the banquet was of excellent quality,

THEREFORE, be it resolved that the Utah Association express appreciation to the personnel of Sherwood Hills who contributed greatly to the success of these meetings,

WHEREAS, the Contributing Members have provided contributions and interesting displays of their products,

THEREFORE, be it resolved that the Utah Association extend its appreciation to these organizations for the support and services they have provided to further mosquito control throughout the State.

RESOLUTIONS COMMITTEE

Reed S. Roberts, Chairman
Orson Whitney Young
Evan R. Lusty

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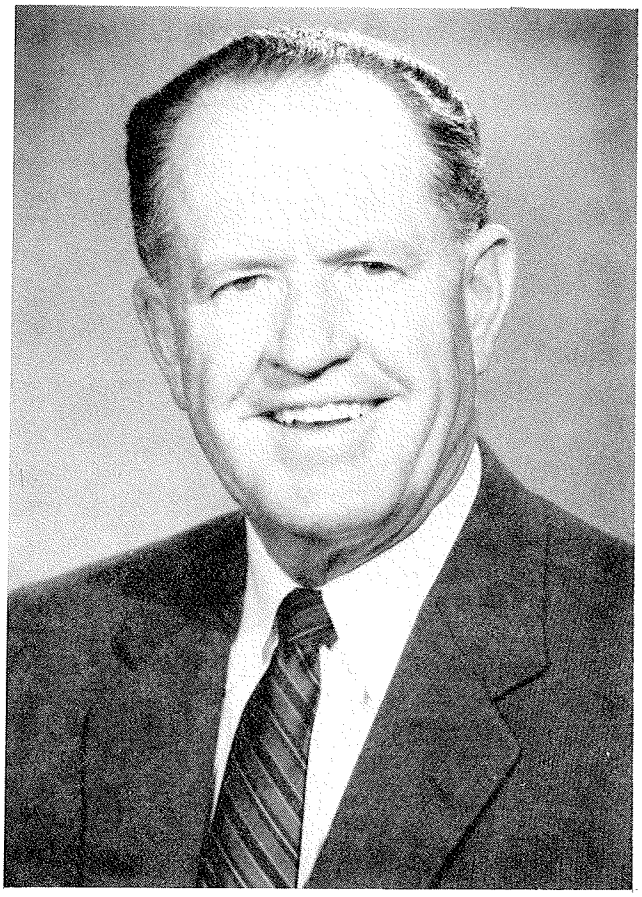

Don Merrill Rees

SEPTEMBER 9, 1901 – APRIL 5, 1976

Dr. Don M. Rees had a long and distinguished record of service to mosquito control in the United States. His contributions extended over a period of more than forty years.

He was one of the participants involved in the organization of the American Mosquito Control Association. He served on its Executive Committee during 1947-48 and as the Chairman of the Interim National Board in 1949 when the American Mosquito Control Association organized its Constitution and Bylaws. He served as President of the American Mosquito Control Association in 1952 and brought the National meetings to Salt Lake City in 1952 and 1959. He also served as Regional Director for the Northwest Central Region of the American Mosquito Control Association from 1946 to 1956. His many contributions to the cause of mosquito control were recognized when he received the coveted Medal of Honor Award from the American Mosquito Control Association in 1974.

He has rightfully been referred to as the "Father of Mosquito Abatement in Utah." He was directly responsible for the establishment of the Utah Mosquito Abatement Association in 1948 and served as its president from 1948-51, and again during 1974-75. His influence, knowledge and leadership were instrumental in maintaining the splendid cooperation between districts and other state agencies directly or indirectly concerned with the effects of mosquito control. He was elected an Honorary Member in the Utah Association in 1970.

He had been a member of the Board of Trustees of the Salt Lake City Mosquito Abatement District from 1938 to the time of his death and had served as a consultant to all of the Abatement Districts in Utah and to others outside of Utah.

He was a leader in developing and stressing means of control of mosquitoes by other than chemical methods and was a recognized national authority in the field of water management related to mosquito control. He was also an expert on mosquito-borne diseases.

In 1947, he served as a Medical Entomologist Consultant to the Surgeon General in a study of the control of viruses and rickettsial diseases in the Orient. He was a consultant to the U.S. Public Health Service from 1948-52 and in 1964 was a consultant in the Canal Zone where he was asked to evaluate and recommend improvements in mosquito control practices. He was a visiting professor of medical entomology at the University of Indonesia Medical School in Djakarta in 1957-58.

His productivity as a specialist in mosquito control is exemplified by the fact that he was the author of over 200 scientific articles, most of which dealt directly with multiple phases of mosquito control activities.

One of the greatest contributions of Don Rees, and the one of which he was perhaps most proud, was his influence on mosquito control through training imparted to his students. While a Professor at the University of Utah, he produced almost 100 graduate students with Masters or Ph.D. degrees. The great majority of these were studies in mosquito taxonomy, biology, and control. Many of his students have achieved eminence for their work and contributions on mosquitoes and mosquito control. Four of his former students have been elected to serve as President of the American Mosquito Control Association and several others have served as Regional Directors of this organization.

Don M. Rees was a remarkable man with remarkable achievements. He was also a warm, friendly, unselfish human being and a devoted husband and father. He will be greatly missed by many people.

EVAN K. JEREMY

1975
Award of Merit

Evan K. Jeremy was recipient of the 1975 award of merit from the UMAA for the many contributions he made during his many years as a worker in mosquito control. Mr. Jeremy retired on August 1, 1975 after 44 years as a field employee for the Salt Lake City Mosquito Abatement District.

During this time he participated in every phase of mosquito control conducted by the district. He worked in various aspects of water management, applied practically all materials developed for chemical control of mosquitoes from early oils to the newly developed insect growth regulators and used various types of equipment from the early developed spraying and fogging equipment to the newly developed ULV equipment.

Evan was respected by his fellow workers and earned the confidence of the property owners he worked with.

WILFORD EGBERT

1975
Award of Merit

Wilford Egbert was born in West Jordan, Utah, November 8, 1893.

During his lifetime he has distinguished himself in several fields. He served a mission for his church and has held high office in his Ward and Stake.

He was an outstanding farmer. He served as an officer in several farm organizations and has received a special commendation from former Secretary of Agriculture Orville Freeman for his work.

He was an outstanding athelete and received five letters from Brigham Young University competing on University teams while he was still in High School. The M-Men basketball team he coached won the All-Church tournament one year.

He has been active in civic affairs and a member of the West Jordan Town Council for many years making many contributions particularly in the development of the park and bowery in West Jordan.

Wilford Egbert was appointed to the Board of Trustees of the South Salt Lake County MAD in 1953 and has served with distinction ever since. He is now Secretary of the Board. He served as President of the UMAA in 1973. His contributions to mosquito control in Salt Lake County are important and are appreciated by all of those involved in the work.

PROCEEDINGS OF THE TWENTY-EIGHTH ANNUAL MEETING OF THE UTAH MOSQUITO ABATEMENT ASSOCIATION

The twenty-eighth Utah Mosquito Abatement Association meeting convened at Sherwood Hills in Sardine Canyon, Cache County, Utah, with Dr. Don M. Rees presiding at the opening session. The welcoming address was given by Dr. Peter Knudsen, Board of Trustees, Box Elder County Mosquito Abatement District and member of the Brigham City Council. The response for the Utah Mosquito Abatement Association was given by Mr. Earl Petersen, Chairman of the Board of Trustees, Box Elder County Mosquito Abatement District.

The Local Arrangements Committee was Larry Nielsen, Chairman, Harry Drew, Verl Peterson, and Gordon Wheeler. The Ladies Entertainment Committee was Joyce Nielsen, Chairman, Lorraine Peterson, Edna Stoll, and Oeleta Wheeler.

ACTIVITIES OF THE AMERICAN MOSQUITO CONTROL ASSOCIATION

Harold C. Chapman, President AMCA
U. S. Department of Agriculture, Agricultural Research Service
Gulf Coast Mosquito Research, Lake Charles, LA 70601

It is a pleasure to again appear at a meeting of the Utah Mosquito Abatement Association, particularly this time as President of AMCA. I bring you greetings from AMCA and will bring you abreast of some of the happenings in our organization since our last annual meeting in Atlantic City.

First, I would like to acknowledge the presence of our President-Elect Bruce Francy, our Vice-President Lew Nielsen, our Executive Director Tommy Mulhern, and our Secretary-Treasurer Don Murray. It is possible this is a first having these five AMCA officers together at a state or regional association meeting and certainly indicates the esteem in which AMCA holds the Utah Association.

I have both good and bad news to report with the former having priority. Our first AMCA NEWS LETTER was published in June and seemed to be well received. A great deal of credit certainly should go to Tommy Mulhern for this pioneering effort. A second AMCA NEWS LETTER is to be published in October.

The NIH grant for Helen Sollers-Riedel for the preparation of Reviews and Bibliographies for our Journal has been approved for 1975. However, this is the last year that this grant will be funded be NIH, and AMCA needs to find some other source of support if this endeavor is to continue.

Relative to the bad news, I am sorry to report that Bob Vannote, the first President of AMCA, recently died in Florida. Also Dan Manley Jobbins, another Past President of AMCA and recipient of the Medal of Honor at the AMCA meeting in Atlantic City, recently suffered a serious stroke and is still hospitalized.

To date this Country is experiencing one of the worst encephalitis outbreaks in many years with more than 900 probable cases in more than 20 States. We would expect more MAD's to be formed as an aftermath of these disease epidemics. Now is the time to inform the public that most of these cases occurred where there were no organized MAD's. If some outbreaks occurred in established MAD's it is imperative that their programs be reevaluated.

One of the most important happenings this year has been the continued encroachment into the legally granted powers of MAD's by federal, state, and private groups. More and more permits are being required by various agencies of MAD's in performace of their duties. EPA encroaches by requiring the certification of applicators and in regulating the selection and use of chemical pesticides. Also EPA has added four classes of pollution sources, previously exempt from their jurisdication, which includes storm sewers and agricultural operations.

The Corps of Engineers requires permits for most mosquito work, especially in coastal marshes. Such permits may hold up necessary control projects for long time periods. Now EPA is trying to redefine navigable waters to include everything in salt or freshwater except drainage and irrigation ditches.

Environmentalists, both groups and individuals, are becoming more vocal in their attempts to discredit or impair the functions of MAD's. An individual has brought suit against a MAD challenging their right both to enter onto private land and to clean a drainage ditch. An adverse ruling to mosquito control would most certainly have many rammifications around the country.

It is apparent to me that we in mosquito control need to present a united front to these very serious challenges to our legally granted powers. If we do not unite, we can expect a continued erosion of our rights and eventually we will find ourselves spending more time obtaining permits and worrying about our public image than in controlling mosquitoes.

Our next annual meeting is a joint meeting of AMCA and the Northeastern Mosquito Control Association in Boston, April 20-23, 1976. Utah's Lew Nielsen is AMCA's program chairman, and I am confident that he and Bob Spencer, the NEMCA program chairman, will have an excellent and well-planned event. I look forward to seeing many of you at this meeting that is being held during our bicentennial year in this very historical area.

UINTAH COUNTY MOSQUITO ABATEMENT DISTRICT

First Year Report

Steven V. Romney, Director
Uintah County MAD, Vernal, UT 84078

The Uintah County Mosquito Abatement District, having completed its first season of formal mosquito control procedures is now fully established and in the final stages of consolidating a program for the maintenance of regular county-wide integrated control. The technical, logistical and related problems common to initial organization are in the most part overcome. The remaining procedural measures still to be taken, as in long established abatements, are now more seasonal in scope. The boundaries of the district as created, inclusive of 4,472 square miles are county-wide in extent. Within those geographic limits, 18,000 citizens are served.

Due to initial financial difficulties, funding totaling $42,000 (tax levy of 1 mill) for the 1975 calendar year was not confirmed in sufficient time to allow for full control measures upon the already developing spring mosquito brood. The program director and field manager assumed duties on May 1st. Pesticides were applied to larval Uintah County mosquito populations by licensed abatement applicators for the first time on May 14th. Aerial application was begun on May 27th.

The program began with an intensive mapping and field survey of the county, including determinations of the existing primary mosquito habitat with regional summaries of commonly encountered ecological types and the relative proximity of the more extensive habitat to major human populations. This overview revealed the more important natural and agricultural sources and allowed for a projection of the dominant mosquito species to be expected, along with their most probable relative numbers and breeding potential for the duration of that first season. The county was subsequently apportioned into major, more or less naturally divided geographic regions for assignment to field operators. In ready support of those beginning efforts, quantities of equipment and supplies essential to abatement operations were offered for loan by the Salt Lake City and South Salt Lake MAD's, the University of Utah, the Ute Indian tribe and many other helpful concerns. Those materials, which were gratefully accepted included a Bissel cold fogger (USU), New Jersey and CDC light traps, invaluable taxonomic apparatus and supplies, certain pesticides, printed data, devices for ground application, etc. In addition, funds supplemental to the formal county tax levy were contributed for the remaining 8 months of 1975, including a $5,200 payment of the field manager's salary by the federal "Manpower" program in cooperation with the Uintah Basin Association of Governments, plus $9,175 in reimbursement for mosquito control on all Uintah County Ute Indian lands.

Of concern was the degree to which the citizens of Uintah County would favorably accept their new mosquito abatement—the first season especially. Accordingly, a public relations program was developed which regularly presented abatement stories and organizational progress reports in the newspaper, printed materials and in local radio broadcasts. The messages presented included the long-term goals of our organization, stories concerning members of the abatement staff, the basics of mosquito biology and behavior, and suggestions as to how individual property owners might help reduce mosquito infestations on a progressively cooperative basis. In the overall endeavor to develop a favorable working relationship with the public, special efforts were taken to assure the many participants in the local beekeeping industry (2,700 registered colonies) that a valuable service could be rendered to the citizens of the county without constituting a threat to that industry.

By early June, control efforts were expanded to the maximum of our limited first season capacity. Pesticides were applied to a total of 22,000 acres through the spring and summer of 1975. The preponderance of that acreage was treated by aerial application of larvicidal parathion emulsion and adulticidal ULV malathion. Other standard control measures extensively employed included the use of truck-mounted fogging, misting and spraying devices (John Bean, borrowed Buffalo Turbine, cold fogger) and hand application of 2% parathion granules and Flit MLO employing conventional apparatus and modes of delivery. One of our greatest handicaps was, due to our late start, having missed full access to the spring brood in the more vulnerable earlier stages of larval development—thus necessitating extensive adulticidal measures. Of those acreages treated, approximately 60% of the infestations occurred as a result of flooding due to spring overflow of several river drainages and artificially impounded waterfowl refuges and recreational waters while the remaining 40% of required applications were due primarily to habitat created as a result of extensive floodwater irrigation and secondary natural precipitation. The more prevalent mosquito species present in the areas of highest human population were found to be similar in relative numbers and density to those regularly encountered in the course of abatement procedures on the Wasatch Front. Exceptions include tremendous river drainage production of *Aedes vexans*. In addition, *Anopheles freeborni* constituted a serious pest species in certain situations. In all instances, *Aedes nigromaculis* proved wonderfully uncommon.

In the course of our 1975 activities, our first major water management and source reduction targets were recognized, and appropriate corrective measures are presently being outlined for the spring of 1976.

Funding for 1976, our first full year is inclusive of a tax levy of 1½ mills, or $77,500 plus supplemental funds in the catagories previously mentioned in the sum of approximately $14,000, yielding a total operational budget of

about $91,000. Among the immediate goals to be met for 1976 include the acquisition of a permanent building and grounds as a fully functional base of operations, and the regular use of two additional airstrips to facilitate future aerial spray operations on a more efficient, logistically economical, county-wide basis. Our seasonal and permanent staff will be increased to a total of seven, plus two additional Ute Indian employees under abatement supervision but on federal payroll.

The first season ended for the Uintah County MAD with the majority of the regions of greater human density having enjoyed significant reductions in local mosquito populations. In general, the citizens of the county have accepted the program and are in growing support of its continued role in the future.

The author wishes to acknowledge and thank those individuals instrumental in the establishment and expansion of our control program—far too many of course for adequate recognition with the limited space allowed for publication.

Among those individuals active in the creation of the abatement district and having worked in cooperation with the Uintah County Commission, and, continuing to be ardent supporters are: Mr. Wiley Stewart, president of the board of trustees, Mr. Ewell Edwards, vice-president of the board of trustees, Dr. Vaughn Hunsaker, U.S.U. extension agent, Representative Glade M. Sowards, Mr. Reed Roberts, U.S.U. extension agent and Mr. Randy Werner.

The author extends his appreciation to all the members of the Uintah County MAD board of trustees for their hard work so cooperatively, regularly, and liberally expended in the difficult first year of operation.

Thanks to the members of the Uintah County Commission for their support of the program, and to Mrs. June Stewart for her most enthusiastic and able work in our public relations program.

Thanks also to all of the members of the board of directors of the Utah Mosquito Abatement Association for their most cordial welcome of the Uintah County MAD to that organization.

A very special thank you to Glen Collett, director of the Salt Lake City MAD (who so very compassionately listened to and offered his technical assistance and help in his receipt of 1,000 telephone calls from the very new MAD director in Vernal) and to Dr. Lewis T. Nielsen, Dr. Don M. Rees, and, to Dr. Bettina Rosay, whose constant encouragement, concern and help proved so valuable through the first year of our program.

NOTE:

On October 12th of 1975, the Duchesne County Mosquito Abatement District was formally created, with legal boundaries county-wide in extent. An initial appropriation of $50,000 has been set for 1976. The initiation and lengthy follow-up of proceedings resulting in the creation of Utah's youngest MAD was accomplished in large part through the efforts of Dr. Vaughn Hunsaker. Among the many others instrumental in the establishment of the control program are Mr. Reed Roberts, Mr. Calvin Monks, current president of the first board of trustees, and Mr. Jerry Moon, secretary, board of trustees. The technical aid, time and invaluable advisory efforts of Glen Collett and Dr. Don M. Rees in the early stages of abatement formation are gratefully acknowledged, as well as the time, concern for the public interest and cooperation of the members of the Duchesne County Commission.

SOME EFFECTS OF WEATHER ON MOSQUITO LARVAL POPULATIONS IN SOUTH SALT LAKE COUNTY

Keith H. Wagstaff and Kenneth L. Minson
South Salt Lake County MAD
Midvale, UT 84047

The South Salt Lake County Mosquito Abatement District has conducted a detailed larval survey since 1956. This survey has provided the district with varied data that is evaluated in an ongoing program year after year. Part of the information has dealt with the relationship of weather data to mosquito production. Because this data is never fully complete, the conclusions derived are always difficult to state as fact. The purpose of our program has been one of modification of data to fit new sources of information as it becomes available.

Fluctuation of mosquito larval populations both total and for individual species occur from year to year and during each breeding season these fluctuations are often dramatic. Some effects of weather on mosquito larval populations in Salt Lake County have been reported elsewhere.

It was suggested by Graham et al (1960) that above normal precipitation during late spring or the presence of a heavy snowpack followed by an unusually long dry period beginning in July and extending at least into the middle of August would result in increased *Culex tarsalis* populations.

Aedes dorsalis is a floodwater species and larval populations fluctuate more dramatically for this species than for any others. Graham and Collett (1961) concluded that precipitation as melting snow or rain was responsible for the production of *A. dorsalis* from March through May and that conditions that produce constant water levels are not conducive to production of this species.

Data collected in the district in 1963 demonstrated that the average temperature of pools with larvae of *Culiseta inornata* is cooler than the average temperature of pools without larvae of this species (Graham and Bradley 1965).

The spring of 1975 was colder and wetter than in recent years (Fig.1-2) with precipitation in the form of snow falling in May and heavy rains continuing into the middle of June. This resulted in heavy flooding along valley streams due to heavy spring runoff. Three separate surges of water resulted from temperature fluctuations during late spring and early summer. The number of pools containing larvae (Fig. 3) were below normal until July except for the first part of April. The trend continued for the balance of the season. The cold, wet spring delayed the production of some species that usually become active as the weather gets warm. July through September was unusually dry, and temperatures were above normal except for August (Fig. 1-2). These factors were conducive to increased larval production as more than ample water was available for irrigation.

Larval populations of *A. dorsalis* fluctuated greatly during 1975. Production was below normal for the first part of the season and each peak followed heavier than normal precipitation, runoff, and midsummer irrigation (Fig. 4). The below normal production at the beginning of the season was due mostly to cold weather as many sources were flooded but often frozen during the first few inspection periods.

Aedes vexans larval populations were below normal for the season except for the last half of June. The peak population occurred two weeks later than normal (Fig. 5). *A. vexans* eggs hatch later in the spring than do *A. dorsalis* even though they are often flooded repeatedly. Warmer temperatures are probably needed to trigger hatching and with below normal temperatures in May and June egg hatching was suppressed and delayed. The peak population coincided with *A. dorsalis*.

Culex tarsalis was below normal most of the season except for the first half of September (Fig. 6). This species usually starts building up during May and June but cold, wet weather during this period delayed breeding activity, and the fewer than normal larvae were retarded in their development. The potential for a large *C. tarsalis* population was possible as more than ample water was available and temperatures during July were above normal but the suppressing effect of cold weather on larval production during May and June prevented *C. tarsalis* from reaching above normal populations.

Culex pipiens starts breeding later in the season than any of the other species concerned in the study so the early adverse weather did not appear to affect larval development although activity did not begin until two weeks later than normal and larval populations were slightly below normal until the first of July (Fig. 7). They again dropped below normal in August possibly because the temperature was slightly below normal.

Culiseta inornata also started breeding later than normal (Fig. 8). Larval populations were below normal during the spring except for the last half of May. *C. inornata* perfers cool temperatures and the drop in population during the first of June was probably due to cold, wet weather rather than suppressed breeding activity. The dramatic increase in population during the warm summer cannot be explained at this time.

It is apparent that weather does play some role in the appearance and production of mosquito populations in Salt Lake County. However, it is also apparent that to draw any worthwhile conclusions at this time would be premature. Further research and detailed studies are needed of a multiplicity of related factors in the environment in order to say conclusively just what role the weather does play in mosquito larval production.

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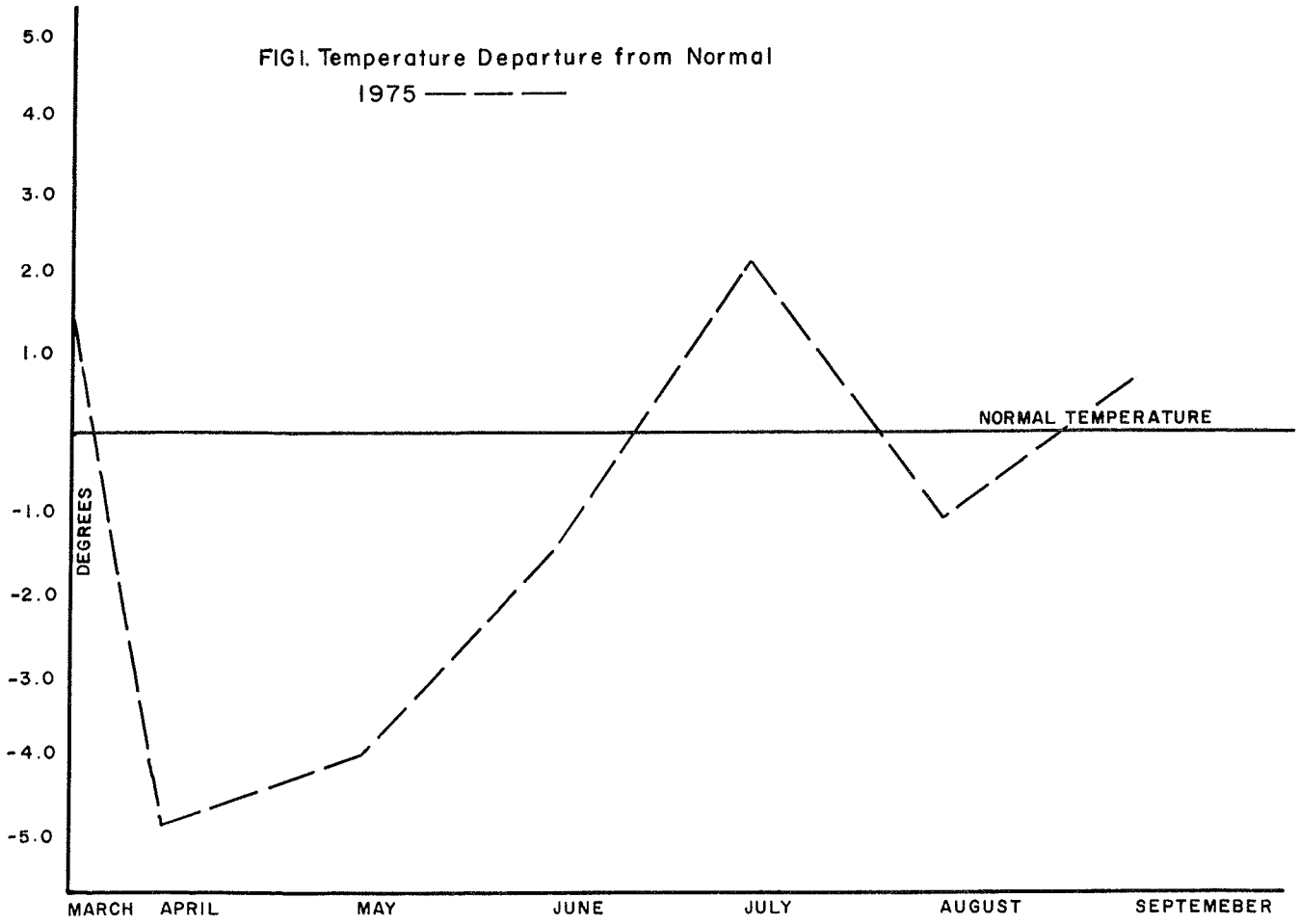

FIG1. Temperature Departure from Normal
1975 — — —

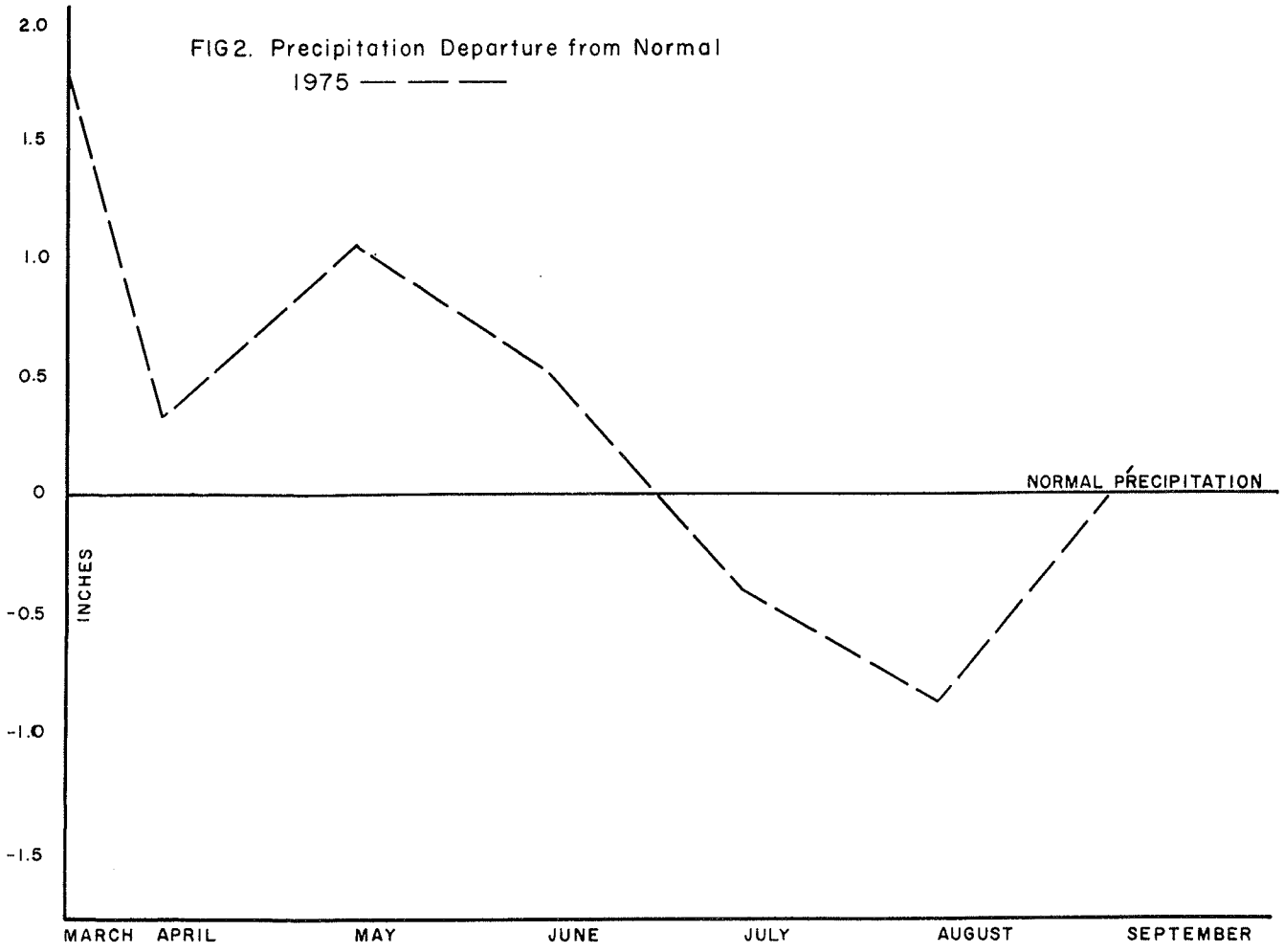

FIG2. Precipitation Departure from Normal
1975 — — —

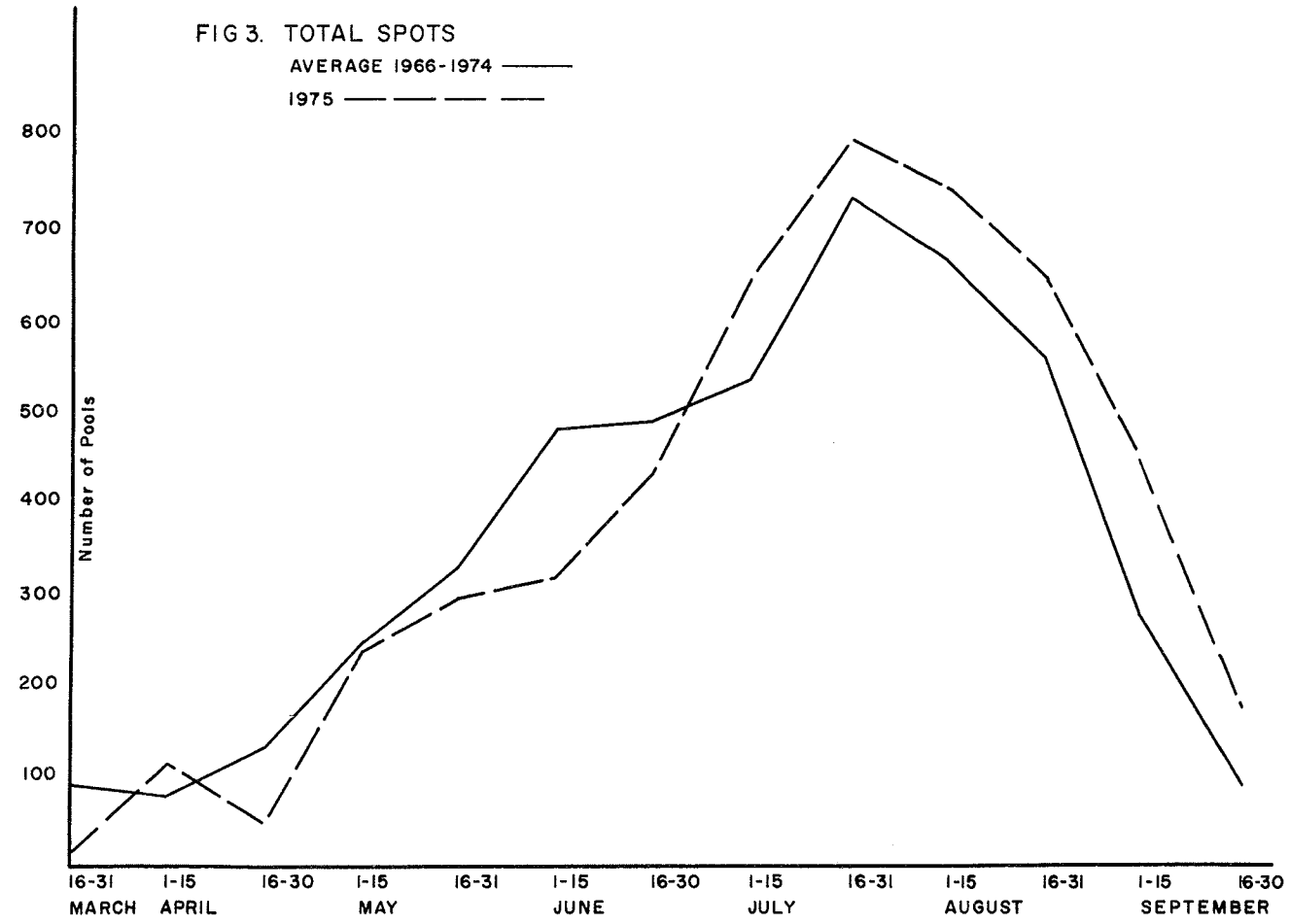
FIG 3. TOTAL SPOTS
AVERAGE 1966-1974
1975
Number of Pools
800
700
600
500
400
300
200
100
16-31 MARCH
1-15 APRIL
16-30
1-15 MAY
16-31
1-15 JUNE
16-30
1-15 JULY
16-31
1-15 AUGUST
16-31
1-15 SEPTEMBER
16-30

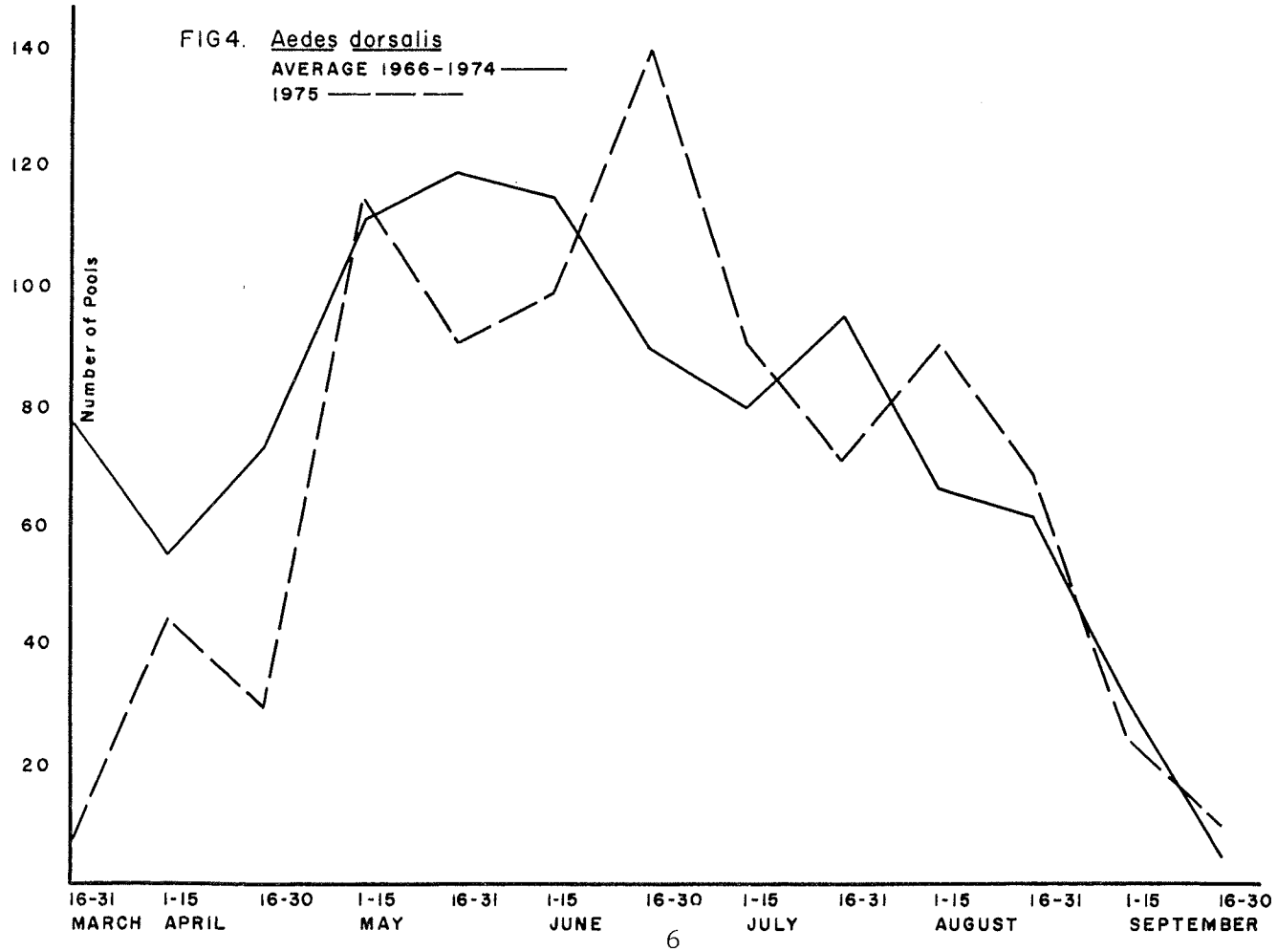
FIG 4. Aedes dorsalis
AVERAGE 1966-1974
1975
Number of Pools
140
120
100
80
60
40
20
16-31 MARCH
1-15 APRIL
16-30
1-15 MAY
16-31
1-15 JUNE
16-30
1-15 JULY
16-31
1-15 AUGUST
16-31
1-15 SEPTEMBER
16-30

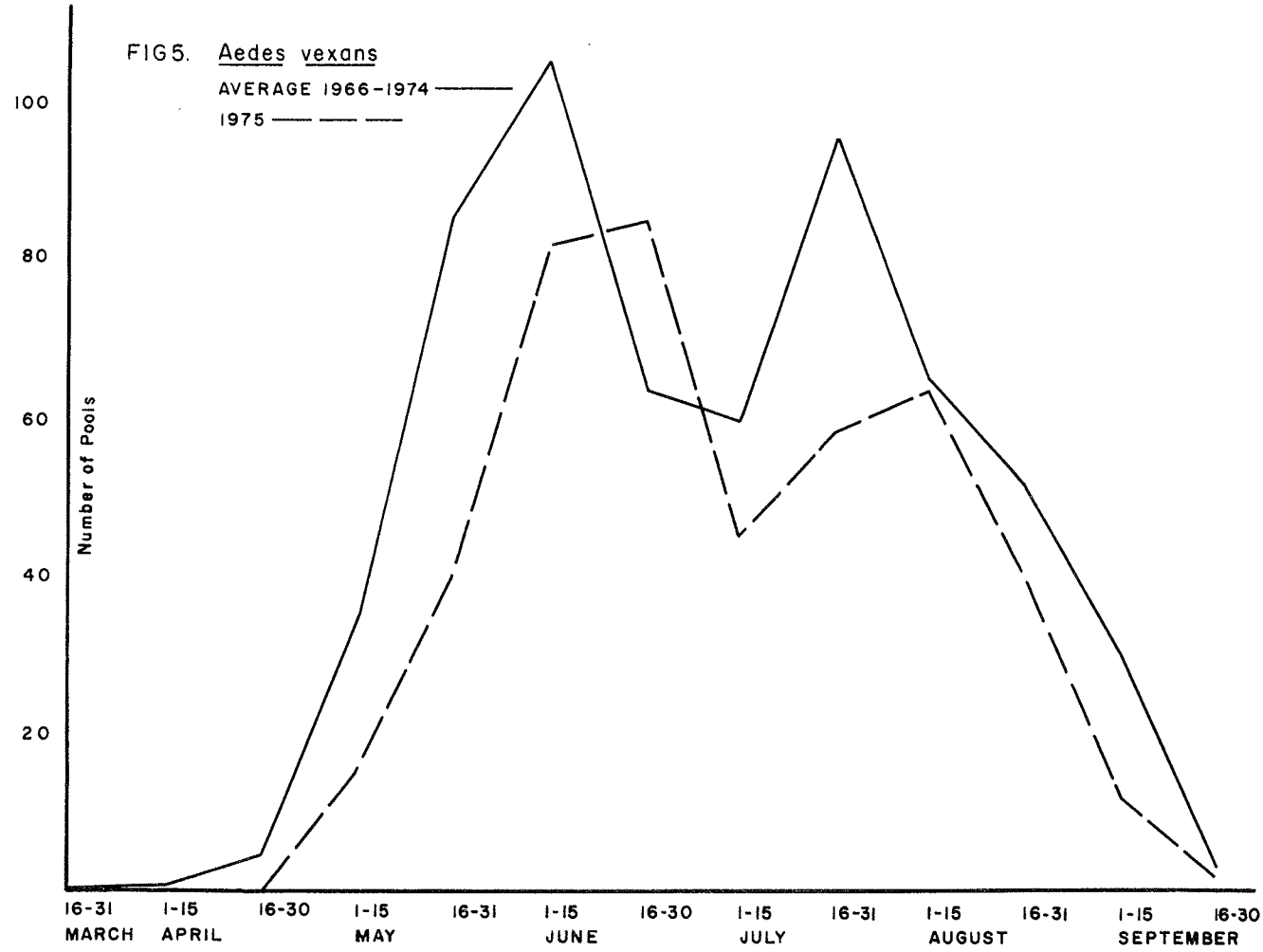
FIG 5. Aedes vexans
AVERAGE 1966-1974
1975
Number of Pools
100
80
60
40
20
16-31 MARCH
1-15 APRIL
16-30
1-15 MAY
16-31
1-15 JUNE
16-30
1-15 JULY
16-31
1-15 AUGUST
16-31
1-15 SEPTEMBER
16-30

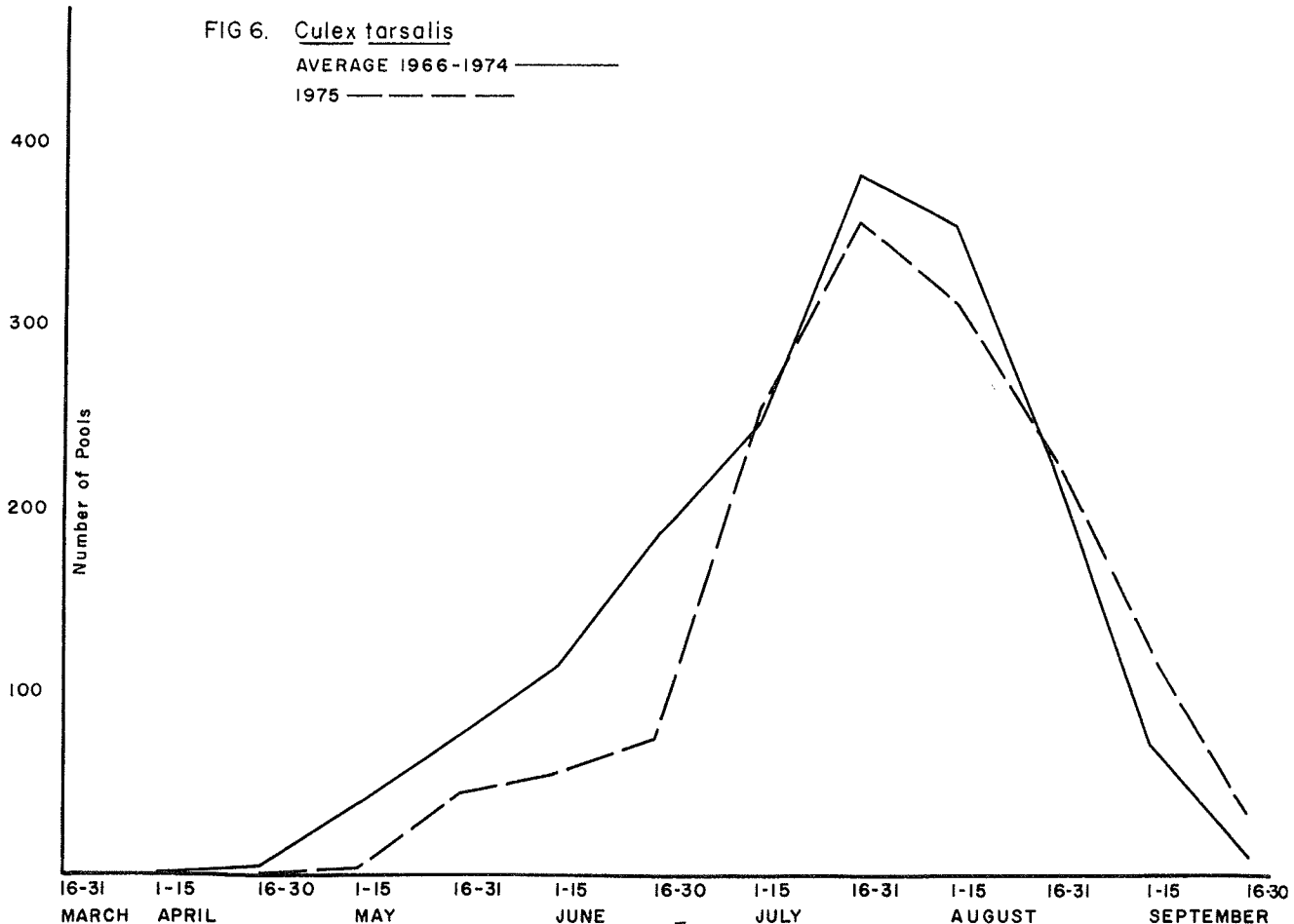
FIG 6. Culex tarsalis
AVERAGE 1966-1974
1975
Number of Pools
400
300
200
100
16-31 MARCH
1-15 APRIL
16-30
1-15 MAY
16-31
1-15 JUNE
16-30
1-15 JULY
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1-15 AUGUST
16-31
1-15 SEPTEMBER
16-30

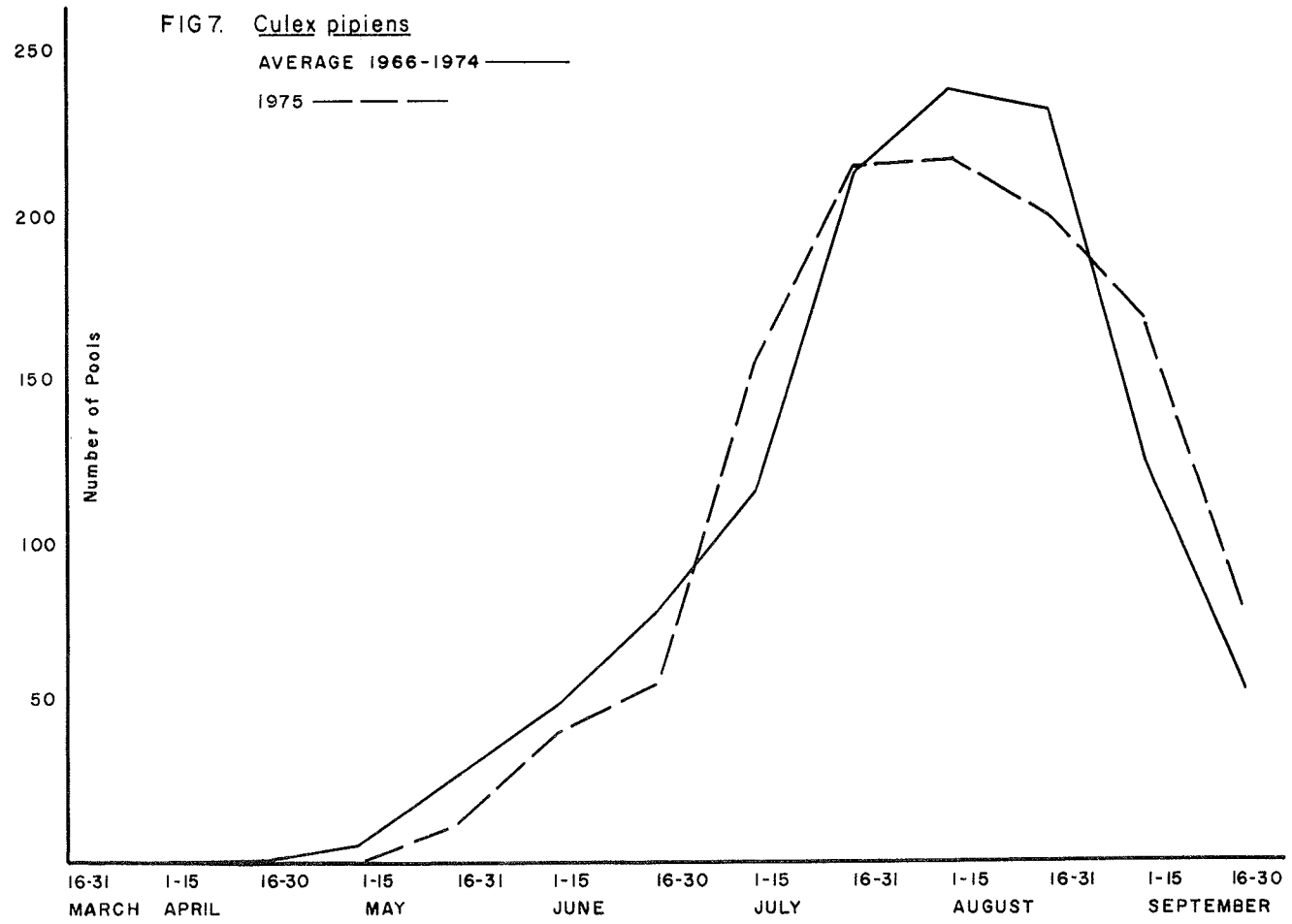
FIG 7. Culex pipiens
AVERAGE 1966-1974
1975
Number of Pools
250
200
150
100
50
16-31 MARCH
1-15 APRIL
16-30
1-15 MAY
16-31
1-15 JUNE
16-30
1-15 JULY
16-31
1-15 AUGUST
16-31
1-15 SEPTEMBER
16-30

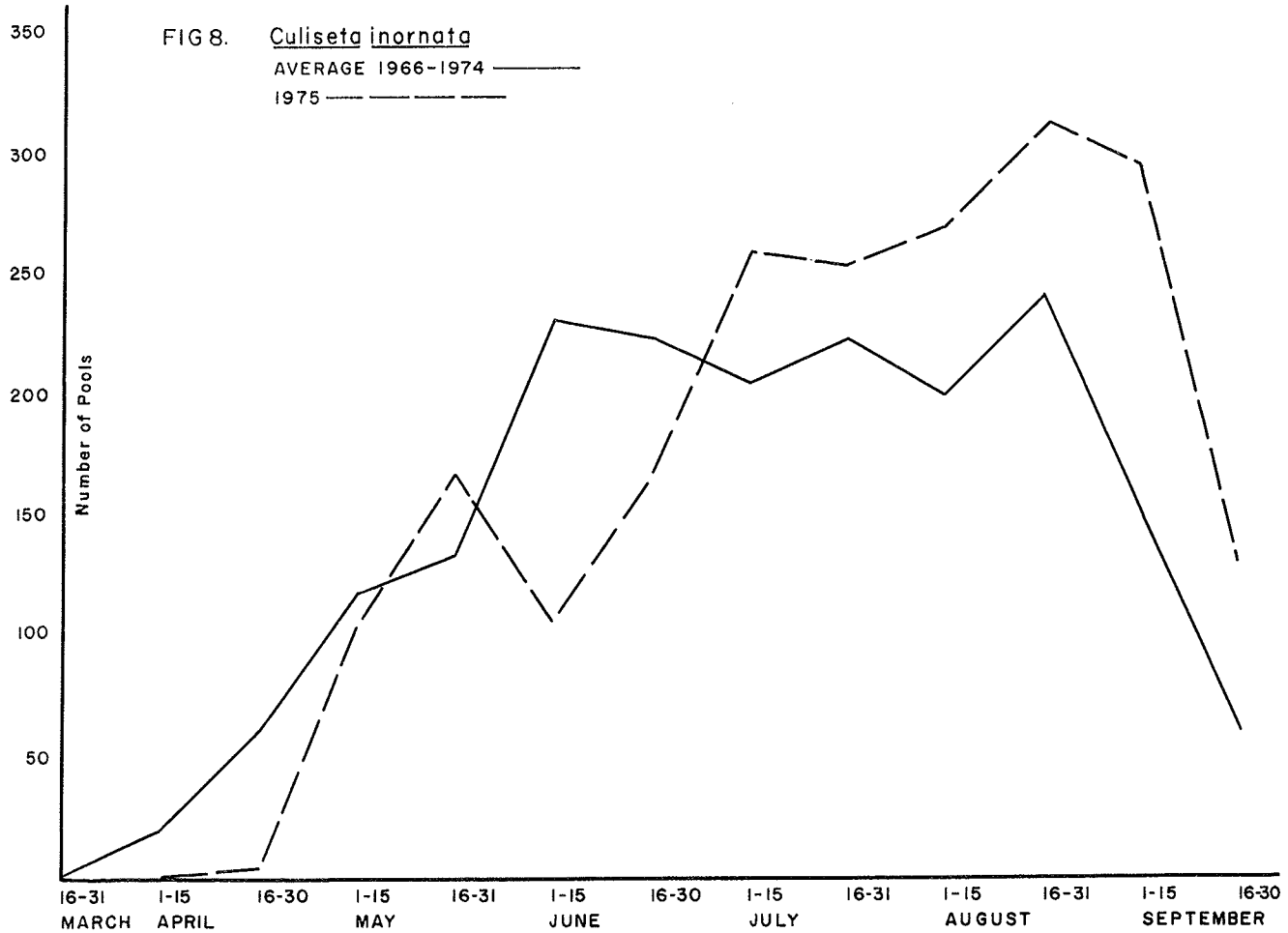
FIG 8. Culiseta inornata
AVERAGE 1966-1974
1975
Number of Pools
350
300
250
200
150
100
50
16-31 MARCH
1-15 APRIL
16-30
1-15 MAY
16-31
1-15 JUNE
16-30
1-15 JULY
16-31
1-15 AUGUST
16-31
1-15 SEPTEMBER
16-30

ENCEPHALITIS SURVEILLANCE IN UTAH, 1975

Lewis Marrott
Utah County Mosquito Abatement Department
Provo, UT 84601

In Utah, 16 species of mosquitoes are known to be vectors of encephalitis viruses. A program was initiated in 1974 to survey mosquitoes for the presence of arthropod-borne viruses of public health significance (Marrott 1975). The work was done cooperatively by the seven mosquito abatement districts along the Wasatch Front, University of Utah Department of Microbiology, the State Division of Health, and the State Department of Agriculture. The first season was primarily to establish techniques for collecting and processing mosquitoes and for testing virus recovery procedures. No virus isolations were obtained from 114 pools of mosquitoes. There had been no reported cases of encephalitis in horses or in humans.

During 1975, the program continued with the addition of mosquito collections from the Uintah Basin. The mosquito of main concern was *Culex tarsalis* but other species were submitted for virus testing when they were readily available. Species distribution by District of 122 pools is shown in Table 1. There were no virus recoveries from the mosquitoes. Although there were a number of suspected cases of encephalitis in horses, none was confimed.

Effort was made during the pooling of mosquitoes to select those that contained blood and/or eggs, or ones that appeared older, to increase the possibility of detecting virus. Samples of females from the remainder of the collections were dissected to determine physiological age. The results are given in Table 2. It was concluded that a reasonable proportion of the mosquito population was surviving long enough to transmit virus and that placement of the CDC traps was adequate for collecting older age groups.

We are certain this study is of utmost importance to the health and well-being of the public and most sincere appreciation is given to those participants who have supported the program. It is an ongoing project for assessment of virus activity in mosquitoes with continuing human and equine observations, expanding to a greater sampling area and enlisting help in reporting suspected cases of encephalitis by medical doctors and veterinarians throughout the state.

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Table 1. Pools of mosquitoes processed for attempted virus recovery.

	A. dorsalis	*A. nigromaculis*	*A. vexans*	*A. increpitus*	*C. pipiens*	*C. tarsalis*	*C. inornata*	TOTALS
Box Elder						6		6
Weber	1		1			16	1	19
Davis	3		1		2	17	3	26
S. L. City	5	1				17		23
S. L. County						1		1
Magna						4		4
Utah	2		5	1	2	12	8	30
Uintah	1					11	1	13
TOTALS	12	1	7	1	4	84	13	122

Table 2. Results of dissections of female mosquitoes for evidence of having had at least one blood meal.

SPECIES	NUMBER DISSECTED	PERCENT HAVING FED
C. tarsalis	420	29
C. pipiens	18	6
C. inornata	197	22
A. dorsalis	74	58
A. vexans	57	9
A. increpitus	10	10
An. freeborni	3	0

ARBOVIRUS ISOLATIONS FROM BLUE LAKE, CALLAO AND FISH SPRINGS, UTAH, 1974

George T. Crane, Robert E. Elbel and Keith L. Smart
Environmental and Ecology Branch,
Dugway Proving Ground, Dugway, UT 84022

During July, August and September 1974, insects were collected by light traps at Blue Lake, Callao and Fish Springs in western Utah. Specimens totaling 25,471 were segregated into 274 pools and assayed for arboviruses and identified in suckling mouse neutralization tests. There were 47 isolations: 46 California group (CAL) viruses of which 45 were from *Aedes dorsalis* and 1 from *Culex tarsalis,* and 1 Lokern virus which was from *Culicoides variipennis.* Blue Lake accounted for 42, Callao for 3, and Fish Springs for 2 of the isolates. Below normal precipitation apparently reduced the number of viruses from Callao and Fish Springs, but the number of CAL viruses from Blue Lake was comparable to that of other years which may, in part, be attributed to the large number of *A. dorsalis* from that area. The lack of fluctuation in the number of virus isolations from year to year at Blue Lake suggests that the maintenance mechanism is different than in other areas.

Support for this project was provided, in part, by DA Project No. 1-T-1-61101-A-91A, In-House Independent Research.

ARBOVIRUS ISOLATIONS FROM BEAVER DAM WASH, ARIZONA, 1974

Robert E. Elbel, George T. Crane, and Keith L. Smart
Environmental and Ecology Branch,
Dugway Proving Ground, Dugway, UT 84022

ABSTRACT

In 1972 and 1973 western encephalitis (WE) virus was isolated from *Culex tarsalis* collected at Bloomington, south of St. George, Utah, and in 1973 three unidentified isolates were obtained (Elbel et al. 1975). Subsequent identification showed these to be one Main Drain (MD) virus from *Culicoides variipennis* collected at Middleton, northeast of St. George, one Jamestown Canyon (JC) virus from *Culiseta inornata* and one St. Louis encephalitis (SLE) virus from *C. tarsalis*. Both JC and SLE were collected at Beaver Dam Wash, Arizona, near the Utah-Nevada border.

The dominant vegetation at these sites was described by Elbel et al. (1975). Collections were made with CDC Miniature Light Traps supplemented with paperwrapped dry ice. Insects were frozen on dry ice and transported to Dugway where they were pooled by species on a CDC chill table prior to intracerebral inoculation into suckling mice. Viruses were identified by the suckling mouse neutralization test using specific antisera as explained by Crane et al. (1970). Selected specimens were identified by Dr. C. H. Calisher at the Center for Disease Control, Fort Collins, Colorado. No viruses were isolated from Bloomington in 1974 although more *C. tarsalis* were collected than in 1972 or 1973. In the St. George area, although there was normal precipitation in July, 1974 was the only year of the three year study with below normal precipitation during both May and June. Therefore, the absence of WE is not unexpected since Graham et al. (1960) showed that *C. tarsalis* abundance and WE in horses in Utah were associated with above normal precipitation in the spring and an unusually dry July and early August.

In 1974 from Beaver Dam Wash, one unidentified and two MD viruses were isolated from 340 *Anopheles freeborni* collected in September which was the only month from May to October with above normal precipitation. These isolations suggest the importance of Beaver Dam Wash as a pathway for viruses into Utah. This is suggested further by the 1973 isolation from *C. tarsalis* of SLE virus which has not been found in Utah but has been isolated in areas to the south.

From 3689 insects collected in 207 trap nights the highest trap night average was 31 at Beaver Dam Wash and the lowest 9 at Middleton. Most of the *Anopheles franciscanus* and *A. freeborni* were from these two areas, and most of the *Culex thriambus* and *C. tarsalis* were from Bloomington and Beaver Dam Wash.

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POTENTIAL ROLE OF CLIFF SWALLOW BUGS *(OECIACUS VICARIUS)* IN THE ECOLOGY OF WESTERN ENCEPHALITIS VIRUS

D.B. Francy, W.A. Rush, R.O. Hayes, G.C. Smith, and J.S. Lazuick
Vector-Borne Diseases Division, DHEW
Fort Collins, CO 80522

Because of a proposed impoundment of the South Platte River in Morgan County, Colorado, studies were initiated in 1972 to survey for vectors and selected vector-borne pathogens of public health importance in this region. Results of these studies demonstrated an unusually high level of WEE virus activity in mosquitoes in this area which rivalled or exceeded that previously found in hyper-endemic areas of west Texas with a history of human encephalitis cases due to WEE virus. Transmission of virus was substantiated by serologic conversions of sentinel chickens located at five sites along a 70-mile region of the South Platte River. WEE virus antibody prevalence ratios in the sentinel chickens ranged from 43% to 86%, with three of the flocks having conversion ratios $\geq$70%. Among mammals collected in the area, two species, *Lepus californicus* and *Procyon lotor,* had WEE virus antibody prevalence rates of 56% and 16%, respectively.

As a result of the previously established importance of nestling *Passer domesticus* in the amplification of WEE virus in west Texas, the role of this species in WEE virus amplification in eastern Colorado was investigated. In 1973 emphasis was placed on collecting mosquitoes and bleeding nestling house sparrows for virus isolation. There were no strains of WEE virus recovered from mosquitoes collected in 1973, although one St. Louis encephalitis, one Turlock and five Hart Park virus isolations were made. During the interval of mosquito collections, 271 nestling house sparrows from two sites were bled, and 23 virus strains were recovered from 148 nestlings sampled from one of the sites, the Bijou Bridge. House sparrows at the cliff swallows. It was also noted that these nests were heavily infested with the cliff swallow bedbug, *Oeciacus vicarius.* In September, a sample of 518 of these bugs in 20 pools was tested for virus, and a single virus strain was recovered.

Although all of the virus strains recovered during 1973 from nestlings and the single swallow bug strain appeared to be WEE virus, the following significant differences in characteristics were noted in laboratory hosts and tests. In contrast to classical WEE virus strains, these virus strains failed to kill or had a low degree of pathogenicity for suckling mice inoculated intracranially. Additionally, log neutralization indices were only $10^{1.0}$ to $10^{1.5}$ when a high titered WEE immune serum was used in identification tests. Virus strains did yield an extractable hemagglutinin from the agar-overlayed cell culture bottles which was specifically inhibited by WEE virus immune serum.

Studies in 1974 documented the continuing occurrence of these WEE virus strains in nestling house sparrows and cliff swallows and bugs. WEE virus was also recovered from pools of swallow bugs collected from cliff swallow nests each month throughout the winter of 1974-75.

Experimental studies with the cliff swallow bug have shown that representative WEE field isolates replicate in the bugs, which become infected by feeding on viremic chicks or house sparrows. Virus is transmitted to chicks or nestling house sparrows when the infected bugs refeed after an extrinsic incubation period. The infection and transmission efficiency is much higher in swallow bugs fed on viremic nestling house sparrows than in those fed on white leghorn chicks.

Field and laboratory results suggest that *O. vicarius* serves as a vector for amplification of WEE virus in nestling house sparrows and may also serve as an overwintering host for WEE virus in northeastern Colorado.

THE STATUS OF PESTICIDE LEGISLATION

Ray. J. Downs, Director
Division of Plant Industry, Utah Department of Agriculture
Salt Lake City, UT 84114

Use of Pesticides in Utah.

Generally, the usage of pesticides in the State of Utah is relatively light. Population is sparse over much of the state and a high percentage of the land is non-tillable. A survey conducted in 1971 indicated that only about 1.1 million lbs. of active ingredient of pesticides were applied that year; of that amount, nearly 60% was in the form of herbicides and about 70% of all pesticides was used for agricultural purposes. The amount used in Utah represented only about 0.2% of the total pesticides used in the United States.

To date, monitoring of agricultural products in Utah has revealed very few pesticide levels of a serious magnitude. Public concern for the use of pesticides is minimal and there have been no real efforts by emotional groups to bring about more restrictive legislation. Of course, there is concern for proper use of pesticides and efforts are being made to prevent high residue levels in Utah. Legislation presently in effect in Utah does provide considerable protection to the environment, as well as providing for safe and effective use of pesticides.

Present Pesticide Legislation in Utah.

Currently, Utah has three laws pertaining to pesticides.

1. *The Utah Insecticide, Fungicide and Rodenticide Act* was enacted in 1951. This law provides that every pesticide which is distributed, sold, or offered for sale within the state shall be officially registered at the office of the State Chemist and such registration shall be renewed annually. Other provisions of this law deal chiefly with requirements for proper packaging, branding, and labeling of pesticides offered for sale in the State of Utah. This law closely parallels the Federal Insecticide, Fungicide, and Rodenticide Act prior to the recent amendments by EPA.

2. The 1967 State Legislature amended the *Utah Economic Poison Application Act of 1951* in an attempt to protect the public from misuse of pesticides by unqualified applicators and to protect the interests of those persons legitimately engaged in the business of pest control. This law provides that any person engaged in the custom application of pesticides in excess of $50.00 per year must be officially licensed by the Utah State Department of Agriculture. He must exhibit adequate knowledge of safe application of pesticides by successfully passing a written examination. It shall be unlawful for any person applying pesticides for hire to use a pesticide for any purpose not specified on the label, nor used in a manner contrary to such label.

It is believed that administration of the applicator law has materially reduced the incidence of misuse or indiscriminant use of pesticides and has resulted in more intelligent use by more qualified applicators. Basically, this law satisfies most of the requirements of the new federal pesticide act pertaining to certification of custom applicators, but does not provide for certification of private applicators (i.e., farmers).

3. Utah's third pesticide law, the *Utah Pesticide Control Act*, was enacted in 1971 and it is felt that this is a very significant step forward in pesticide legislation. This law provides for the establishment of an 8-member State Pesticide Committee which is to evaluate pesticide problems in the state, and, where necessary, to make recommendations for corrective measures. The Commissioner of Agriculture is to give consideration to the findings and recommendations of this committee and obtain committee approval in promulgating regulations concerning pesticides. With the broad authority provided by this act and the vast experience represented by members of the Pesticide Committee, it is now possible to administer laws and regulations which may be necessary for safe and effective use of pesticides in Utah.

Future Pesticide Legislation.

No new pesticide legislation has been enacted in Utah since the Federal Insecticide, Fungicide, and Rodenticide Act was amended in 1972. There has been so much indecision and frustration in EPA's attempts to establish regulations by which to implement the amended Federal Act that most states have delayed taking any additional legislative action until the situation has improved. All too often EPA has issued orders with no consideration whatever to the economic effect and, in some cases, in direct conflict with the suggestions of scientists as well as economists. Currently, congressional committees are proposing to amend the Federal Pesticide Bill to require EPA to consider all factors and to be more responsive to agricultural needs and interests. One proposed amendment would require the Administrator of EPA to file an agricultural impact statement with the Secretary of Agriculture, thus allowing the Secretary ample time to review any actions against a pesticide *before* the registration of that pesticide is suspended or cancelled.

It will be necessary to enact a new pesticide law in Utah in order to implement the amended Federal pesticide law. A new law will be presented to the 1977 State Legislature for this purpose. Such a law will be patterned after suggested model laws being developed by state regulatory people over the nation and it must be compatible with regulations which EPA ultimately promulgates.

Certification of Pesticide Applicators.

The Utah State Department of Agriculture, which has been designated the lead agency responsible for pesticide use in the State, has recently prepared a State Plan for Certification of Pesticide Applicators. Upon approval by EPA, this plan will be the official guideline for certifying

and licensing both commercial and private applicators in Utah. This plan will only cover the area of procedures for certification and licensing, while regulations which are to be established will govern the overall pesticide program. Present laws and regulations will be in effect until such time that a new law is enacted by the Utah Legislature.

The Federal pesticide law provides that any person who wishes to apply "restricted type" pesticides must be certified as a "private applicator" or a "commercial applicator". A "private applicator" is defined as a certified applicator who uses or supervises the use of any pesticide which is classified for restricted use for purposes of producing any agricultural commodity on property owned or rented by him or his employer or (if applied without compensation other than trading of personal services between producers of agricultural commodities) on the property of another person. The term "commercial applicator" means a certified applicator who uses or supervises the use of any pesticide which is classified for restricted use for any purpose or on any property other than as provided by the definition of "private applicator". Accordingly, persons applying pesticides for mosquito control would be classified as commercial applicators.

Federal regulations have established ten categories of commercial applicators:

(1) Agricultural Pest Control
(2) Forest Pest Control
(3) Ornamental and Turf Pest Control
(4) Seed Treatment
(5) Aquatic Pest Control
(6) Right-of-way Pest Control
(7) Industrial, Institutional, Structural and Health Related Pest Control
(8) Public Health Pest Control
(9) Regulatory Pest Control
(10) Demonstration and Research Pest Control

Generally, mosquito abatement applicators will be included in Category 8, Public Health Pest Control. Applicators in this category shall demonstrate by examination, practical knowledge of vector-disease transmission as it relates to and influences application programs. A wide variety of pests is involved, and it is essential that they be known and recognized, and appropriate life cycles and habitats be understood as a basis for control strategy. These applicators shall have practical knowledge of a great variety of environments ranging from streams to those conditions found in buildings. They should also have a practical knowledge of the importance and employment of such non-chemical control methods as sanitation, waste disposal and drainage.

Each applicant for a license will be required to take a written examination as a means of evaluating his competency regarding general use of pesticides, as well as specific uses within the category or categories for which he applies. Examinations for certification in additional categories may be taken upon application for such. Upon successfully passing the appropriate written examination, the applicant will be issued a license by the Department of Agriculture. Governmental agency employees shall not be required to pay a license fee in performing the official duties of the agency.

It is anticipated that all commercial applicators will be required to pass new written examinations to become licensed for 1976. Training courses will be offered by the Extension Services within each county during the winter months (1975-76) to provide information necessary for certification. Handbooks and supplemental training materials will also be made available to those who desire them. Categorical handbooks will be especially helpful in increasing the competency in specialized areas of pest control. Each license will expire on December 31st of the year of its issuance, but it can be renewed each year upon request, until such time that a re-examination is required.

Classification of Pesticides.

All pesticides are to be classified by EPA for "general" or "restricted" use. Those classified for "general" use may be applied by the general public without further restrictions other than those on the label. Those pesticides classified for "restricted" use, on the basis that they may have unreasonable adverse effects on the environment or cause injury to the applicator, will be available only to certified applicators. Many aspects of the implementation of the Federal Act will be influenced by the classification of pesticides.

Because of the magnitude of re-registering and classifying the thousands of pesticides on the market, EPA is considerably behind schedule. The most recent information received regarding classification showed that about 10% of the active ingredients used in insecticides,, 4% used in rodenticides, 2% used in herbicides, and 11% used in fungicides may be restricted to some extent. It appears that the number of pesticides which will ultimately be classified for restricted use may be considerably smaller than initially believed—we certainly hope this is the case.

Mosquito Control Programs in Utah.

Generally, mosquito control in Utah is accomplished through community- or county-sponsored mosquito control programs. In recent years mosquitoes have been effectively controlled in most areas of concern with a minimum of problems associated with the use of pesticides. The various abatement districts have cooperated very well with the State Department of Agriculture in complying with the pesticide applicator law and regulations. Whenever complaints have been received concerning application of pesticides for mosquito control, the Department of Agriculture has received excellent cooperation in the investigations of the problems and in the employment of corrective measures. As a representative of the Department, I commend you for your success to date and solicit your continued diligence and cooperation in obtaining safe and effective control of mosquitoes in accordance with both State and Federal laws which pertain to your activities.

PESTICIDE RESIDUE DYNAMICS

Stanley D. Allen, DVM
Utah Biomedical Test Laboratory
Salt Lake City, UT 84108

Introduction

I am pleased to have the opportunity to visit with you relative to the pesticide research work currently underway at the University of Utah Research Institute. The area of research which I would like to present is that of pesticide residue dynamics. This work is currently underway at the Utah Biomedical Test Laboratory, or UBTL, which is a part of the University of Utah Research Institute.

In 1974, UBTL responded to a solicitation or request for proposal from the National Institute for Occupational Safety and Health, more commonly referred to as NIOSH, to develop a national program in agricultural worker safety and health. NIOSH is that portion of the National Institutes of Health which does research relative to occupational diseases. NIOSH is sometimes confused with OSHA which is a part of the Department of Labor.

After careful NIOSH review of our proposal; we were awarded a contract, which began July 1, 1974, or approximately 15 months ago. A major part of our contract with NIOSH is focused on occupational health problems of farm workers related to pesticide use.

Background

Most of you are probably aware of the fact that over the past two decades there have been a number of cases reported primarily from the State of California where farm workers, usually migrants, have gone into organic phosphate pesticide-treated fields to harvest crops and have become intoxicated. These cases have not been frequent, but when they have occurred, political repercussions have been enormous. The Government's response to these situations has been the development of reentry standards or reentry times. The term "reentry time" refers to that period of time between pesticide application to a crop and when workers are permitted to go back into the treated field. The whole concept of establishing reentry times emerged as an effort to prevent intoxication incidents. National reentry regulations which were proposed, changed, and eventually adopted by the Environmental Protection Agency were based on very fragmentary scientific data. Pesticide residue dynamic curves were simply not available except for parathion on citrus in California and a very limited number of other cases.

Variables

A portion of our contract effort has been directed towards filling this void of knowledge. The magnitude of the problem of generating data from which national reentry policies can be made is astounding. Ideally, we would like to study all pesticides on all crops in all locations, at all application rates and with all formulations. This, of course, isn't possible. The following variables seem to be of prime importance as we consider those factors which influence how long residual organic phosphates persist on foliage which could present a health hazard to farm workers:

1. Type of Pesticide. Inherent in the type of pesticide is its toxicity. To give an example; if parathion and malathion were applied on adjacent fields under identical conditions, the malathion field would be safe to enter before the parathion field simply because malathion is less toxic to humans than parathion.

2. Application Rate. Four lbs. of active ingredient per acre would produce a less dangerous field than 8 lbs. of an active ingredient per acre if all other variables were held constant.

Formulation. Wettable powders, emulsifiable concentrates, encapsulated forms, ultra low volume applications all influence persistence.

Type of Crop. Is there less hazard to a worker entering a lettuce field than one entering a peach orchard because there is less contact with foliage? If so, how much difference?

Weather and Locality. The hot and dry climate of California's Central Valley seems to cause these agents to persist longer than the damp, humid climate of Florida, but why this is so and to what degree needs to be resolved.

Worker Practice of the Laborer. An orchard of peaches may be very unsafe after X number of days after spraying for a "picker" or "thinner" but could be safe for an "irrigator" simply because the irrigator will have less contact with sprayed foliage.

Ground Cover. Some would argue about the above example of irrigation saying the most important source of exposure is the soil and dust on the ground cover. Does the dust and dirt which collects around a worker's socks as he walks through a field which has been sprayed represent a significant source of exposure? We really don't know.

Dust. Does the amount and type of dust on the leaves and cover crops represent a significant source of exposure? As a picker goes into the orange groves in the Central Valley of California, a cloud of dust envelops him. These pesticide laden dusts must represent a significant source of respiratory exposure.

Clothing. Is it best to wear a shirt which helps keep some dust from contacting the skin and yet traps some dust against the body. Ideally, we would like workers to wear impervious clothing but in most work situations this is totally impractical. What is the best type of clothing for a worker to wear?

All of these variables relate to the occupational hazard of a worker entering a pesticide treated field and should be considered in reentry regulations. We have started a series of studies in which we hope to generate some original data which will serve to define more adequately some of those variables which seem to be important in

determining the level of pesticides on crops which is available for worker exposure.

Study Plan

We are in the process of investigating the influence of pesticide type, application rate, crop type, locality and formulation as they effect residue decay dynamics. Specifically, we are looking at parathion, guthion, ethion and methyl parathion applied at 8 lbs. of active ingredient per acre on citrus in California. Each are wettable powder preparations. In the area of application rate we intend to look at parathion wettable powder on citrus in California applied at 4, 6, 8 and 10 lbs. of active ingredient per acre. In crop type, we are looking at parathion wettable powder applied at 8 lbs. of active ingredient per acre in California on citrus, grapes and apples. For locality, we are looking at parathion wettable powder at 8 lbs. of active ingredient per acre on citrus in California, Florida, Arizona and Texas. To study formulation, we are planning to look at parathion on citrus at 8 lbs. of active ingredient per acre in California as encapsulated, wettable powder and emulsifiable concentrate formulations. (See Figure 1.)

Data Collection Plan

The following data information is collected in each study.

Weather Data. Parathion is converted to paraoxon, which is the toxic form of the compound, by heat, water and light. We are measuring each of these. Heat is measured by recording temperature, water by measurements of precipitation and humidity, and light by taking periodic solar radiation measures.

History of the Field. This data includes previous spray history, type and variety of crop, size of trees, ground cover, soil type, insect population, shape of leaves and size of fruit.

Application Information. We carefully calculate the actual application rate, record the type of sprayer used, the agent, its source and lot number.

Measurement of Residues. Two methods are used to measure residues. First, the Gunther leaf punch technique. In this technique, a disc the size of a nickel is punched from leaves. Forty to sixty of these leaf punches are taken into a bottle as a composite sample. In the laboratory these leaf punches are washed and washings analyzed for pesticide to determine "dislodgable residue." A vacuum sampling technique is also being used. The technique was developed by Spear and Poppindorf of the University of California research group at Berkeley. This determination is called "available residue." A number of leaves are vacuumed in such a way as to approximate the amount of pesticide and dust that dislodges and is available to a worker as he picks the crop. In this technique, the dust and pesticide is collected onto a millipore filter. The filter is then weighed for total dust and analyzed for residue. In the "dislodgable" or leaf punch technique, we report pesticide residue in ug/cm² of leaf surface. In the "available" residue or the vacuum technique, we report pesticide as ug/cm² of leaf surface and ug/g of dust. The fields are sampled before spraying and at increasing intervals for up to about 45 days after spraying. Both filter and the leaf punches are analyzed for parent compound and oxone metabolite. In the case of parathion, this would mean parathion, the parent compound, and paraoxone the metabolite. The residue levels are plotted on a log scale vs. days.

Summary

The University of Utah Research Institute is currently conducting research for NIOSH in the area of pesticide residue dynamics. Variables under investigation include pesticide type, location, formulation, application rate and crop type. Residue decay curves are generated for both parent compound and oxone metabolite over a period of about 45 days. Results of these studies will be available by July or August 1976.

Figure I.

INSECTICIDE FOLIAR RESIDUE STUDIES 1975 - 1976

STUDY VARIABLES	COMPARISON STUDY I	COMPARISON STUDY II	COMPARISON STUDY III	COMPARISON STUDY IV	COMPARISON STUDY V
PESTICIDE	PARATHION	PARATHION	PARATHION	PARATHION, GUTHION, ETHION, METHYL PARATHION	PARATHION
APPLICATION RATE	8 lb. AIA	8 lb. AIA	8 lb. AIA	8 lb. AIA	4,6,8,10 lbs. AIA
FORMULATION	WETTABLE POWDER	WP, EC, ENCAP	WETTABLE POWDER	WETTABLE POWDER	WETTABLE POWDER
CROP	CITRUS	CITRUS	CITRUS, APPLE, GRAPE	CITRUS	CITRUS
LOCATION	CALIF., FLA., ARIZ., TEX.	CALIFORNIA	CALIFORNIA	CALIFORNIA	CALIFORNIA

RECYCLING OF THE NEMATODE *REESIMERMIS NIELSENI* DURING 1975 IN *ANOPHELES CRUCIANS* IN LOUISIANA[1]

James J. Petersen
Gulf Coast Mosquito Research Laboratory, Agricultural Research Service
U. S. Department of Agriculture, Lake Charles, LA 70601

Reesimermis nielseni Tsai and Grundmann, a parasitic nematode of larval mosquitoes, was recently shown to be effective in controlling mosquitoes in semipermanent and permanent water environments (Petersen et al. 1972, Petersen and Willis 1972, 1974). Releases of *R. nielseni to* control *Anopheles crucians* Wiedemann in 23 sites during 1971 and 1973 resulted in recycling of this nematode in most of the sites during 1974 (Petersen and Willis, 1975). This paper summarizes *R. nielseni* activity in populations of mosquito larvae from ten of these sites during 1975. The ten sites were selected because of their accessibility, host production, and nematode activity during 1974. Descriptions of the sites were given previously (Petersen and Willis, 1975). Nine of the sites were sampled weekly whenever possible from March through October and one site (L-1) was sampled weekly from January through October; the individual sites were sampled 13 to 33 times. Methods and procedures were the same as those described in the earlier study (Petersen and Willis, 1975). A total of 3951 *A. crucians* from 223 samples were examined for nematodes.

The results are summarized in Table 1. Two sites that were treated in 1971 continued to produce parasitized mosquitoes through 1975. The M-2 site, an open pond with low populations of mosquito larvae, produced only low levels of nematode activity (0-14%) until 1975. Then parasitism rose to a mean of 24% and exceeded 34% in third and fourth instar hosts during 5 of the 7 months from April to October. The M-3 area, a heavily vegetated site had shown a marked increase in *R. nielseni* activity during 1974 over previous years; this increased activity continued through 1975 with parasitism averaging 87% in third and fourth instar *A. crucians* from June through October.

Four sites that were treated in 1971 and again in 1973 showed continued parasite activity through 1975 though one (R-2) showed a marked decrease over the previous two years and never exceeded 20% for a given month. The other three showed activity that was similar to or more than the 1974 levels, and all three (G-1, G-2, and C-1) exhibited similar monthly activity with parasitism ranging from 15 to 70% and averaging 35 to 45%.

All four sites treated only in 1973 showed increased parasite activity in 1975 over that in 1974. At the G-5 site, it increased steadily to 100% in July, but samplings through October produced only 9 larvae of which only one was parasitized; the G-6 site, an area that often dried, showed a noticeable increase in parasite activity from July to October when parasitism averaged 84%. The H-1 site, a freshwater swamp, continued to show a very high level of parasite activity through 1975, ranging from 88 to 100% from June through October, despite periods of heavy rain and flooding. Also, the L-1 site, a heavily vegetated drainage ditch kept wet by a leaking water main, was essentially unproductive of adult *A. crucians* for a second year because of *R. nielseni* parasitism. The mean monthly levels of parasitism never dropped below 90% from February through October, and hosts were generally multiply infected; only five uninfected third and fourth instar *A. crucians* were collected after March.

Parasitism was always as high or higher in older larvae (Table 1), as would be expected because of their longer period of exposure to the infective stage of *R. nielseni.* Thus, as in previous studies (Petersen and Willis 1972, 1974), parasitism was actually higher than reported because no attempts were made to determine the levels of parasitism for each instar.

The data show that *R. nielseni* has a strong propensity for establishment and recycling for an indefinite period in habitats of *Anopheles* mosquitoes. Eight of the sites produced significant levels of parasitism for over two years, and two of the sites showed continued activity for over four years after introduction.

Reesimermis nielseni can be an effective control agent for *A. crucians* and presumably many other *Anopheles* species (Petersen 1975). However, the effectiveness of this parasite against other permanent and floodwater species remains to be determined.

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Petersen, J. J. and O. R. Willis. 1975. Establishment and recycling of a mermithid nematode for the control of mosquito larvae. Mosq. News 35: 526-32.

1. In cooperation with McNeese State University, Lake Charles, Louisiana 70601.

Table 1. Recycling of *Reesimermis nielseni* in *Anopheles crucians*

Site	Percentage Parasitism				
	1971	1972	1973	1974	1975
			Sites Treated in 1971		
M-2	5	14	0	10	24 (31)[2]
M-3	19	19	9	65	73 (81)
			Sites Treated in 1971 and 1973		
R-2	8	4	31	21	5 (5)
G-1	13	4	7	26	35 (36)
G-2	<1	0	–	33	45 (48)
C-1	21	26	5	51	45 (52)
			Sites Treated in 1973		
G-5				11	34 (39)
G-6				23	47 (58)
H-1				47	84 (85)
L-1				85 (94)	85 (97)

2. Mean parasitism of third and fourth instar larvae in parentheses.

MOSQUITO CONTROL TECHNIQUES IN A SUBURBAN AREA OF NEW JERSEY

Robert W. Helm, Superintendent
Union County Mosquito Extermination Commission
Westfield, NJ 07090

My employer is the Union County Mosquito Extermination Commission. We are one of the original mosquito control units, established in 1912. When we came into being, Union County was considered rural. Now we are somewhere between urban and suburban. We are quite fortunate to have a good solid core of experienced workers. Fourteen of our employees have been with us for over 15 years. Despite all the changes that have occurred demographically from 1912 until 1975, we still follow the same basic control methods.

1. We try to manage the water;
2. We inspect the remaining water-holding areas; and
3. If we find breeding, we coat the breeding area with a light application of larvicidal oil.

Our success has been phenomenal. Fortunately we have lost half of our salt marsh area to development and the other half is accessible and under fairly good drainage. There are about five or six other poorly drained areas capable of breeding huge populations of *Aedes vexans* after heavy rainfall and flooding. We do our best to keep these areas well-drained and free of debris. This activity constitutes our major thrust throughout the year and covers approximately 260 miles of drainage facilities.

Our only big problem is backyard breeding. We can not possibly inspect every backyard in 21 municipalities every 2 weeks. Our adjustments, to fit the changing population patterns, are the subject of my paper today.

Our personnel has evolved from a basic hand labor crew, to a highly skilled group of machinery operators. Hand labor is too expensive except in a few relatively special problem situations. Our equipment has changed from the basic shovel, hook, fork and machete, to an array of highly mobile earth-moving machinery. We still keep the basic hand tools, but we limit their use, and the employees are grateful.

We have always been ultraconservative with insecticide. We do not practice or encourage wholesale applications of either adulticides or larvicides. Fuel oil #2 is used as a larvicide in rough, polluted areas, such as garbage dumps and sanitary landfill sites. Flit MLO is used as a larvicide in all other situations. We have two mist blowers that carry a water solution of Pyrenone for general adulticiding. Our adulticiding actually is a concession to public relations. We kill more miscellaneous flying insects than mosquitoes. We mist-blow recreation areas, concert and other open-air performances and celebrations. Our total effort in the insecticide field consists of fuel oil #2, Flit MLO and Pyrenone. We have followed this procedure religiously for the past three successful mosquito seasons. Our program requires expertise, finesse and full confidence in our total water management program.

In 1973 our average summertime population was considered high at 15.0 mosquitoes per night per trap. In 1974 we came through with a more normal average of 4.0 mosquitoes per night per trap. This year, despite heavy rainfall and flooding in mid-July, our average was 6.0. These averages are all well within the records established since the year 1949 when we started to use residual chemicals. Our 27-year average count stands at 7.0 per night per trap.

Our surveillance program is set up to avoid duplication of effort and wasted time. We maintain complete records of sampling, and our entire county is sampled in at least 200 areas every two weeks. This task is performed by two young ladies, personally trained by me to be nosey, snoopy and thorough in their search for breeding locations. All known permanent or semipermanent breeding areas are recorded on municipal or township maps. Our spray crew leaders check at each location for active or potential breeding before actual treatment with larvicide.

All telephone complaints about mosquitoes are checked and acted upon within a twenty-four hour period. In many cases, we can have someone on the scene within ten minutes after receiving the complaint. During the later half of July and the first half of August when our peak season develops this becomes quite a challenge but it does wonders for public relations and county prestige. Bear in mind that we have one of the heaviest people populations per square mile in the entire metropolitan area and that theoretically one mosquito can annoy many people. Therefore, when someone is sufficiently annoyed to telephone our office asking for help, and when, within half a day or less, a pretty young lady is at the front door ready to track down the source of annoyance and eliminate it, these people are actually overwhelmed with gratitude, admiration and respect for our organization. We always leave some literature and a sincere invitation to call us again if they experience any further problems. Sometimes we also send our mist blower into nearby wooded areas, if we think it will abate any of the nuisance.

We now have all of our vehicles equipped with two-way radios. This will make our program even better and much more flexible.

We measure our efforts comparatively by the standard New Jersey mosquito light trap. We have 30 traps randomly located throughout the county during June, July and August. Each weekday the catch is counted and identified. Here, again, we have two serious-minded, efficient young ladies engaged in this program.

In addition, we also obtain a measure of performance by the number of complaints. When mosquitoes are rampant in many areas, we may receive as many as 30 to 35 calls per day. This falls back rapidly to one or two calls per day as a normal summertime happening.

We also observe people reactions as we drive around our county. Such things as people playing tennis or waiting for a tennis court, nursery playgrounds, construction sites, community swim clubs, and people waiting at bus stops. It is quite easy to spot local annoyance whenever these observations can be made. Some of the most prolific breeding areas are localized, difficult to find and once found, there is usually little that can be done to prevent recurrence of the annoyance. We regularly find breeding in old, discarded automobile tires, pails, abandoned swimming pools, old barbeque grills, wheel ruts, new construction sites, birdbaths, old discarded plastic garbage pails, old-55 gallon drums and old automobile wrecks. We also find breeding frequently in containers where someone has been trying to root some plantings.

We have approximately 20,000 storm sewer catch basins within the county. Many of these are capable of holding water after a rain for more than two weeks or even permanently. We try seriously to cover many of these basins on a two-week cycle. This has always proven quite difficult because of rainy weather. Therefore, we have to place some reliance on emergency inspection and treatment of these breeding basins whenever we locate them while investigating a complaint.

We have two major sources of annoyance that we call borderline problems and for which we have no solution. Our eastern county limit borders on Staten Island. This is one of the boroughs of New York City. The area in question is salt marsh and no active mosquito control is practiced by New York City. Therefore, whenever the prevailing wind blows from Staten Island, our local residents are plagued with hungry mosquitoes. Fortunately these invaders generally do not come too far inland. No adulticiding is effective except for a few hours duration. Our other major borderline area is where our northwest border meets neighboring Morris County. Several years ago, in a successful attempt to stop the Port of New York Authority from building a huge jetport in southeastern Morris County, the local residents succeeded in having the area declared a "wilderness area" by the Department of Interior. However, one of the strict rulings that must be followed is that no activity can be allowed inside the wilderness area if it tends to disturb the natural wilderness. Therefore, no mosquito control measures can be employed. Since the wilderness is within one mile of our heavily populated county, whenever the wind is right, our residents have to suffer. We have managed to live with both problems for many years now, but they do get frustrating at times, when people are begging for relief.

We have not used any thermal fog in our county since 1956. We have not used any ULV treatment procedures in our county, and we will not until more experimental work shows that it is really a worthwhile tool.

Since we began our operations as a rural county and have progressed through the years to a situation of high residential density, we feel that we have many answers that can be profitably used by other mosquito commissions. We always stand ready to offer our expertise and suggestions for better control.

GROUND APPLICATION OF ULV

Robert Hollar
Environmental Management Services
Great Falls, MT 59403

ULV refers to quantity of application per acre and is the correct term to use concerning outdoor application. ULV is not new. In fact the principle itself received a gold medal at the Paris Exposition in the year 1894, but the lack of efficient and lightweight engines and adequate air source held back development, and it wasn't until the ineffective spray programs of the '50's and '60's that called attention to the need, that serious research was undertaken. Much of this research was done commercially, and efficient and economical ULV machines were developed.

Federal interest in the potential benefits of ULV has led to joint research projects. The complexities of properly planned and executed research studies are many.

There are various ranges of droplet sizes produced by different types of equipment. For ULV work the ideal droplet size is between 5 and 20 microns in diameter. A micron is one millionth of a meter. Imagine tossing a basketball into a crowd. You would hit only one target. On the other hand, take the same volume as the basketball in ping-pong balls and throw them into a crowd. You would hit many members of the crowd because the volume of the basketball equals the volume of 234 ping-pong balls. However, if those ping-pong balls were reduced in size until they were so light, such as smoke, that the air movements around the crowd caused them to just float, then very few, if any, targets would be hit. The volume of 234 ping-pong balls equals the volume of 217,400 BB shots, and the diameter of one BB shot is 3937 microns. This means that if you could break up the BB into over 2 million pieces each of those pieces would be the same size as the largest droplets produced by ULV equipment. Therefore, the key to efficient use of each insecticide droplet is to control the size range: no size so small it will not impinge or come in contact with insects' bodies, and no size so large that contact is unlikely. Realize that it takes 63 million of the size one micron diameter droplets to make only one of the 400 micron diameter size. If that 400 micron diameter droplet misses its target, it is wasted because contact sprays which do not actually hit or impinge on the insect do no good. On the other hand, how much do the chances improve when we have changed that one 400 micron diameter droplet for 63 million size one or even 63 thousand size ten? The chances for contact are immensely improved. This is why ULV is so much more effective than other methods. ULV uses every droplet to its maximum efficiency.

There are many different kinds of fogging sprayers, one of which is thermal. Thermal fogs are smoke produced by introducing oil-base insecticides into hot exhaust gasses from pulse jet engines. They are used mainly outdoors because of the inherent fire hazard. Besides, they impinge poorly or not at all and are carried away from target insects by air currents. Most mechanical foggers produce a very wide range of particle sizes from 1 to 500 microns in diameter and could be considered inefficient because so many of these droplets are not in the desirable size range.

To calculate ULV dispersion of one fluid ounce per acre, we need to know the settling rates of various sized particles and the number of particles per square inch. If we break up a 100 micron particle in 10 micron particles, what will we have? Not 10, but 1,000 because we are dealing with volume. A large particle of 100 microns in diameter will fall at a rate of 59 feet per minute, whereas a 10 micron-sized particle will fall at .59 feet or 7.1 inches per minute. Each square inch of surface will have 9000 particles of 10 micron size. If we want to know how many 10 micron particles will be produced from one fluid ounce, we multiply 9000 by the number of square inches in a square foot, 144, then multiply this number by the square feet in an acre, 43,560. The answer is 56,453,760,000 particles, each one of which will have the probability of being carried to the insect while remaining ideal for impingement.

To obtain the best results from ULV application the following points must be observed: Rate of flow, area, time, route planning, and careful compliance with label directions. Careful compliance with all label directions is mandatory. Application of pesticides not in conformance with label directions is a federal offense and subject to a heavy fine or imprisonment upon conviction.

Perhaps for the first time we have the capability of treating vast areas in a very short time with low volumes of concentrated insecticides. This is both a blessing and a possible hazard. When used according to label directions ULV methods make possible effective control with a real savings in insecticide costs and application time. When used incorrectly or not in accordance with label directions, problems may occur in the form of product contamination or employee injury. Be sure that all label directions are followed regarding application rate. When prudently used by competent, knowledgeable personnel, ULV is one of the most effective tools for control of pests ever developed.

BAYGON 1 MOS — NEW FORMULATION OF PROPOXUR FOR MOSQUITO AND FLY CONTROL

Jack W. Warren, Field Research Representative
Chemagro Agricultural Division, Mobay Chemical Corporation
Portland, OR 97201

BAYGON is an insecticide that has been registered for a number of years for a number of uses including control of mosquitoes, flies, cockroaches, and other pests of public health importance. The currently available formulations, 70% W.P. and 1.5 lb./gal. E.C., are not entirely suitable for certain types of application such as ground or aerial ULV applications and cold-fogger use. Chemagro has developed a new formulation, BAYGON 1 MOS, which has proved to be very suitable for these methods of application, either undiluted or mixed with any of the commonly used oils.

Several tests in the Northwest this past summer have confirmed its efficacy against adult mosquitoes and various species of flies, including house flies, horn flies, face flies, and stable flies. Brief summaries of these tests are as follows:

1. Cascade County MAD, Great Falls, Montana; ground ULV application by truck-mounted LECO at 0.47 oz. a.i./acre on a 44-acre fairgrounds plot; excellent control of a light population of mosquitoes and heavy population of flies.
2. Estacada, Oregon; aerial ULV applications at 0.5, 1.0, and 2.0 oz. a.i./acre diluted in Supreme Oil for 1-2 pints/acre total spray volume; excellent and very quick kill of horn flies and a very light population of adult mosquitoes; in addition, both the 1.0 and 2.0 oz. rates resulted in virtually complete and very rapid kill of first and second instar larvae of *Culex* spp., *Culiseta* spp., and *Anopheles freeborni*.
3. To confirm the observed control of larvae, a test was arranged in cooperation with Mr. John Beard, Clackamas County Vector Control, Oregon City, Oregon; 1.75 oz. a.i./acre in 1 gal. Flit MLO was applied by hand-sprayer to a one-acre log pond; evaluations made over a 24-hour period indicated 92% larval and 94% pupal mortality of *Culex pipiens* and *Culex peus*; only minimal control had been obtained with previous treatments of 3 gal. Flit MLO at this site.

Enough research data has been accumulated to submit to EPA for adult mosquito control by ground ULV and mist blower for use in urban and open areas, and an EPA label may be available as soon as early 1976. Aerial ULV, ground ULV, or mistblower use in forested or brushy areas will require more research, as will fly control. The promising larval control will also be investigated more fully.

1975 REPORT OF THE UTAH MOSQUITO CONTROL—FISH AND WILDLIFE MANAGEMENT COORDINATING COMMITTEE

J. B. Low, Chairman,[1] Don M. Rees,[2] and Albert Regenthal[3]
(Ed. note: This report was prepared by Dr. Rees)

This Committee continued to function in 1975 in the capacity of coordinator between mosquito control and fish and wildlife programs in Utah. The Committee is always available but renders this service only by request of participants engaged in these activities.

In Uintah and Duchesne Counties, mosquito abatement districts were organized and started abatement programs. Late in the season Dr. Steven V. Romney, Manager of the districts, asked the committee members to examine some of the mosquito producing areas in these counties, especially those owned and managed by the State Division of Wildlife Resources and others under private ownership and management.

Some of the problems were discussed with Dr. Romney but an on-sight visit to these areas could not be arranged. This will receive priority on the agenda of the Committee in 1976.

No other major requests were made for the services of the Committee during the year.

1 Leader, Utah Cooperative Wildlife Research Unit, Utah State University, Logan, UT 84322

2 UMAA and Professor Emeritus, Department of Biology, University of Utah, Salt Lake City, UT 84112

3 Supervisor of Waterfowl and Furbearers, State Division of Wildlife Resources, Salt Lake City, UT 84116

FLY CONTROL IN THE DELTA VECTOR CONTROL DISTRICT

W. Donald Murray, Manager
1737 West Houston Avenue
Visalia, CA 93277

The Delta Vector Control District (Delta VCD or the District) began investigating fly problems in 1962. At that time the President of the California Farm Bureau, Allan Grant, who was also a dairyman in the Delta VCD, urged this District to make a study of fly production on dairies. He noted that people were moving from urban homes into suburban and rural homes, frequently into areas already occupied by dairies. Since dairies were noted for producing flies and odors, the first reaction of many people was to demand that the dairies move away or go out of business. Allan Grant hoped that the Delta VCD could develop fly control measures which would help the dairies to stay in business.

The Delta VCD Board of Trustees agreed to help, and authorized the summer employment of a university-trained biologist to make inspections of fly breeding sources on a number of local dairies. This biologist quickly discovered that significant fly sources were usually restricted in area and were usually amenable to physical control measures for reduction or elimination of the breeding. As a result of these studies, a research control program was carried out in 1973 on the Allan Grant dairy and, using harrowing and precision cleanup of moist organic matter, production of flies was reduced to a non-nuisance level. Unfortunately, dairymen over the District were not yet ready to understand and accept this program, and the dairy work was dropped.

At the very beginning of the fly studies in 1962 it was quickly discovered that the fly species causing the greatest discontent among residents of the city of Visalia was not the house fly, *Musca domestica,* from the dairies, but rather the copper blow fly, *Phaenicia cuprina,* which was breeding in a high percent of the garbage cans in the city itself. The District made studies of this blow fly and garbage collection procedures. Most residents had a once per week collection of their garbage, a few had twice per week, but 20% had no pickup at all. As many as 20,000 maggots were collected emerging from a garbage can in the latter part of the week following collection. The District believed that a mandatory twice per week collection plus a routine inspection of cans and bins to assure acceptable cleanliness should provide good control. The city of Visalia adopted an ordinance which provided a twice per week pickup for all residents, and the District provided several summer students to make inspections. The local newspaper provided good publicity, especially relative to the need for each resident to keep the garbage containers clean and free from residue. This program is still in effect with excellent results.

No significant additional development occurred in the District's fly control program until 1970, when the County Health Officer together with one of the County Supervisors (Commissioners) requested that the District study fly production on chicken ranches. There had been much public demand for fly control on chicken ranches, but the only public agency answering complaints was the County Health Department, and its only lever was to issue a written citation to clean up all manure on a twice per week schedule. Most chicken growers found it physically impossible to comply with such a requirement. The District studied this problem during the summer of 1970 and determined that manure per se was not normally the problem, rather that the breeding medium resulted when water from leaky and overflowing water troughs and coolers mixed with the manure. In 1971 a major effort was made to obtain corrections of what were essentially plumbing problems. The Board of Trustees, however, was expressing concern about the program's extension into fly control without a major mandate from the people. This was supplied during the summer when over 30 residents adjacent to several heavy-producing chicken ranches attended a Board meeting and described vividly the extreme need for an organized fly control program. As a result of this meeting and continued urging from the Health Officer, a permanent year-round Fly Control Supervisor was hired.

The Delta VCD in 1972 found that disposal of fruit wastes was responsible for heavy fly production over a large part of the District. Plums, peaches and nectarines are subject to 20 to 30% culling as a result of hail and wind scarring, split pits, green or overripe fruit, and other defects. Without organized planning, growers and packers had been disposing of culls by dumping them in deep piles or by spreading them in layers on dirt lanes. Production of house flies was fantastically heavy. When the District investigated the many unauthorized dump sites, it discovered that many such sites had also become repositories for many kinds of miscellaneous wastes, including dead animals and cans and jars of highly toxic insecticides such as guthion and parathion. The County Supervisors have a legal responsibility to control all dump sites and, through the County Health Department and the County Public Works Department, they cooperated with the District by stopping illegal dumping and by providing acceptable sites for fruit dumping. The District in turn developed a program of crushing culled fruit and then harrowing it, thereby drying it out within two or three days and thus preventing fly breeding. The work by the District was performed at a reasonable charge to growers and packers. This program has been very successful in controlling fly problems and also has helped control unsightly and dangerous unauthorized dumping.

Walnuts may be thought to be a dry product which could not produce flies, but the District found that walnut production was creating one of the worst late-season — September to December — fly sources. Nuts are shaken

from the trees before many of them have separated from the husks, and the moist husks are broken free in dehydrator plants. In previous years the moist organic material has been piled by the dehydrator plants or on nearby idle ground, frequently adjacent to populated communities. Residents and restaurants have been overwhelmed by the resultant flies. The District met with the managers of all the dehydrators in the area together with the County Farm Advisor and plans were made to handle the wastes in such a way that a fly source would not be produced, primarily by scattering the material thinly. In 1975, for the first time, no significant fly production has occurred from the walnut industry.

After 13 years of study and control of various fly sources, the District is now prepared to return to the first problem it studied, the dairies, and to make recommendations to dairymen which should be accepted without much challenge. During these years most dairies have improved dramatically in their general sanitation, with better drainage of corrals, better control of water troughs, cleaner mangers, and greater recognition of the need for fly control.

Throughout the development of the fly control program, the District has not believed it necessary to become involved in the use of insecticides. Control in almost all cases can be accomplished by good organic waste management. The District has emphasized education and the development of understanding among the many persons and agencies which manage organic wastes. Social pressures have been applied, but to date no legal pressures have been necessary. Especially important, the fly control program has included the support of many other governmental agencies: the County Supervisors, the County Health Department, the County Public Works Department, the County Planning Department, the County Schools Office, the Farm Advisors Office, several departments of city Governments, and several state offices.

People have asked "Why did the District get involved in fly control – was not mosquito control a sufficient challenge?" The answer, involving several parts, is rather simple:

First, the public requested the District to develop a fly control program.

Second, the entomological background of the District staff provided reasonable assurance that flies could be successfully controlled.

Third, the parallels in the mosquito and fly control efforts have proven to be dramatically close. Control of both requires a knowledge of species, of biology, and of an educational and progressive operational program. The District had already developed the concepts for an outstanding mosquito control program – the addition of the domestic fly control program has proven to be a "natural" for the District and its staff.

It is firmly believed that other mosquito abatement districts would enhance their position and respect from their communities and would provide a needed service if they would move into programs of this type.

REVISED CONSTITUTION OF THE UTAH MOSQUITO ABATEMENT ASSOCIATION

Adopted at the 8th Annual Meeting of the Association
Revised at the 13th Annual Meeting
Revised at the 25th Annual Meeting
Revised at the 28th Annual Meeting

ARTICLE I. NAME

The name of the organization, an unincorporated association, shall be "UTAH MOSQUITO ABATEMENT ASSOCIATION".

ARTICLE II. OBJECTIVES

The objectives and purposes of the Association shall be to promote close cooperation among those concerned with, or interested in, mosquito control and related work, to increase the knowledge and advance the cause of mosquito abatement in an efficient and effective manner compatible with the goals of a sound environment. The Association may also encourage and undertake such other insect control problems as the Association may determine.

ARTICLE III. MEMBERSHIP

Section A. The membership of the Association shall consist of three classes: Members, Contributing Members, and Honorary Members.

Section B. Members shall consist of two categories: Agency Members and Individual Members.

1. Agency members shall be any active mosquito abatement program supported with an annual budget from public funds.

2. Individual members shall be any person interested in or concerned with mosquito abatement who desires affiliation with the Association.

Section C. Contributing Members shall be any commercial or other organization which desires affiliation with the Association.

Section D. Honorary Members. Honorary Members shall be any individual who has performed outstanding service in the interest of mosquito abatement and who has been elected to honorary membership for life by two-thirds majority vote of voting members present at the time of voting.

Section E. Approval of Membership. All applications for membership shall be subject to approval by a majority of the Board of Directors at any meeting of the Board of Directors at which a quorum is present.

Section F. Voting. All trustees, commissioners and designated permanent employees of agency members shall have one vote at Association meetings. All individual and honorary members shall have one vote. Contributing members shall have no vote.

ARTICLE IV. REVENUES

Section A. The revenue of the Association will be derived from dues paid by members, from the sale of publications, from donations and contributions and from such other sources as may be approved by the Board of Directors.

Section B. The dues for members and date of payment shall be established annually by the Board of Directors of the Association. All mosquito abatement districts and organizations sponsoring members shall be notified one month prior to the annual meeting of the Association of any changes in the amount of dues from those assessed the previous year and approved by the Board of Directors.

ARTICLE V. OFFICERS

Section A. The elective officers of the Association shall be a President, President-Elect, and a Secretary-Treasurer. The officers shall be elected at the annual business meeting by a majority vote. A director shall be appointed by the governing body of each unit in Utah engaged in mosquito control and which is a member of the Association. The elective officers and the duly appointed directors shall constitute the Board of Directors.

ARTICLE VI. DUTIES OF OFFICERS

Section A. The President shall preside at all meetings of the Association, annual and special, and at all meetings of the Board of Directors. He shall maintain and exercise general supervision over the affairs of the Association, subject to the authority of the Board of Directors, and shall discharge such other duties as usually pertain to the office of President. In the absence of the Secretary-Treasurer, the President may sign checks to pay for bills approved by the Board of Directors.

Section B. The President-Elect shall exercise the powers and perform the duties of the President in the absence or disability of the President. In case of a vacancy in the office of the President, the President-Elect becomes President for the balance of the term of the office. The Board of Directors shall appoint by a majority vote an Acting President-Elect, when the office becomes vacant, to serve until the next election of officers by the Association.

Section C. The Secretary-Treasurer shall keep full and correct minutes of all meetings of the Association and of the Board of Directors. He shall be responsible for the maintenance of all membership records, conduct the correspondence of the Association, and issue all notices of meetings. He shall collect and receipt for all dues, assessments and other income. He shall deposit promptly all funds of the Association in such depositories as shall be approved and designated by the Board of Directors. Checks in payment of obligations of the Association shall be signed by the Secretary-Treasurer. He shall, under the direction of the Board of Directors, pay all bills of the Association and make such other disbursements as are necessary and incidental to the operations of the Association. He shall, at the annual meeting of the Association, and if directed by the Board of Directors at special

meetings, make full and true report of the financial condition of the Association. He shall perform such other duties as are usually incident to the office of Secretary-Treasurer and as may be assigned to him by the Board of Directors. The Secretary-Treasurer with the approval of the Board of Directors and with the assistance of the Publications Committee, shall publish and distribute the Proceedings and other publications of the Association. In the absence or disability of the Secretary-Treasurer, the Board of Directors shall appoint a member of the Association to serve in this capacity as required or until the next election of officers by the Association.

Section D. The Board of Directors shall meet upon the call of the President, or upon the request of three (3) or more members of the Board of Directors directed in writing to the Secretary-Treasurer. At least five (5) days prior notice in writing shall be given by the Secretary-Treasurer to all members of the Board of Directors as to any meetings of the Board of Directors: the time and place of such meetings shall be designated by the President. A majority of the members of the Board of Directors shall constitute a quorum for the transaction of business, and action by the Board of Directors shall be upon the vote of a majority of those members present at any meeting of the Board of Directors at which a quorum is present. The Board of Directors shall manage the affairs of the Association and shall have power:

(a) to fill any vacancy among the elected officers of the Association,

(b) to appoint the following standing committees each to consist of not less than three (3) members: Publications, Auditing, Program, and Nominating. Special procedures for the Nominating Committee are included in Article VII. The Secretary-Treasurer shall be an ex officio member of all committees,

(c) to appoint such other committees as it may deem to be necessary or useful in conducting the business of the Association,

(d) to prescribe the duties of officers of the Association not otherwise prescribed in the By laws of the Association,

(e) to prescribe rules and regulations for the conduct of the affairs of the Association, as are not inconsistent with the provisions of the Constitution of the Association,

(f) to determine the number and price of each publication which shall be distributed to the various members of the Association, and to others; to approve lists of nonmembers who may receive publications without charge,

(g) to accept or reject applications for memberships in the Association, except Honorary Membership, and to prescibe rules and procedure in relation thereto.

ARTICLE VII. NOMINATION AND ELECTION OF OFFICERS

Section A. At least 15 days prior to the annual meeting of the Association, the President shall appoint, subject to approval of the Board of Directors, a nominating committee consisting of five (5) members of the Association naming one of the five to serve as Chairman.

Section B. The Nominating Committee shall determine its nominees for elective officers of the Association. It shall present the names of the nominees selected in the opening session of the annual meeting of the Association. It shall also present at this time, on request, any nominations made in writing and signed by three or more members of the Association. Election of officers will be conducted in a business meeting where nomination for officers may be made from the floor.

Section C. Officers of the Association shall be elected by majority vote at the annual meeting of the Association, and shall serve until the next annual meeting.

ARTICLE VIII. MEETINGS

Section A. There shall be an annual meeting of the Association, for the election of officers, the presentation of papers and discussions on mosquito abatement and related subjects, and such other business as may be properly considered. Such meetings shall be held at such times and places as the Board of Directors shall prescribe. At least 7 days prior notice shall be given to all members as to the time and place of the annual meeting.

Section B. Special meeting of the Association may be held whenever the Board of Directors deems such meetings necessary, or whenever ten or more Members shall make a written request thereof, presented to the Secretary-Treasurer. Such request shall be presented to the Board of Directors, which shall designate a time and place for such special meeting. The Secretary-Treasurer shall give written notice of all special meetings of the Association to all members at least seven (7) days prior to the date of such special meeting.

Section C. A simple majority of Members of this Association shall constitute a quorum for the transaction of business at any annual or special meeting and any actions taken at such meetings shall be by majority vote.

ARTICLE IX. REPORTS AND PUBLICATIONS

Section A. The Association shall publish an annual report. The report may contain the proceedings, papers, and business transacted at the annual meeting. It may also include any other matter deemed by the Board of Directors to be essential to the general welfare.

ARTICLE X. PARLIAMENTARY PROCEDURE

In the absence of rules in this Constitution of the Association the proceedings of the Board of Directors' meetings, as well as the Association meetings shall be conducted in accordance with established parliamentary procedure.

ARTICLE XI. AMENDMENTS

This Constitution may be amended at any regular business meeting of the Association at which there is a quorum, by a two-thirds vote of the members present, provided the Board of Directors has previously considered the merits of the amendment.

ARTICLE XII. FINANCIAL RESPONSIBILITY

Except by the specific direction of the Board of Directors under their personal individual financial responsibility, no debt or other financial obligation of this Association shall be incurred by this Association beyond the amount of funds (over and above all liabilities) then in the hands of the Secretary-Treasurer.