PROCEEDINGS AND PAPERS

of the

THIRTY–FOURTH ANNUAL MEETING

of the

UTAH MOSQUITO ABATEMENT ASSOCIATION

held at

Little America Motel

Salt Lake City, Utah

September 28 - 29, 1981

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 34th Annual Meeting at Little America, September 28 – 29, 1981, and,

WHEREAS, Weber County Mosquito Abatement District, Dallas Nelson, Manager, 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 Weber County Mosquito 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. Claude Schmidt, President, American Mosquito Control Association, and Don Merritt, President, California Mosquito and Vector Control Association.

WHEREAS, Little America 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 Little America 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

Russell Snaith (Chairman)
Robert Brand
J. Larry Nielsen

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Aird Insurance Agency ..... Salt Lake City, UT
Amsel Corporation ..... Ogden, UT
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Reliable Labs ..... Sandy, UT
Rubber Supply Company, Inc. ..... Salt Lake City, UT
Sandoz, Inc. ..... San Diego, CA
Wilbur – Ellis Company ..... Twin Falls, ID

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Thomas D. Mulhern
W. Donald Murray, PhD.
Richard F. Peters

AWARDS TO PAST PRESIDENTS OF THE UTAH MOSQUITO ABATEMENT ASSOCIATION

Carl Clark	1974	Magna MAD
Glen C. Collett	1962	Salt Lake City MAD
Wilford Egbert	1973	South Salt Lake County MAD
Lewis E. Fronk	1959	Weber County MAD
Jay E. Graham	1957	South Salt Lake County MAD
Earl A. Jenne	1976	Weber County MAD
Karl Josephson	1960, 1969	Box Elder County MAD
George F. Knowlton	1963	Utah State University
J. Larry Nielsen	1967, 1977	Magna MAD, Box Elder County MAD
Lewis T. Nielsen	1958	University of Utah
Reed S. Roberts	1971	Utah State Extension Service
Kendall Sedgwick	1968	Davis County MAD
Morris Swap	1961	Davis County MAD
Howard Widdison	1955	Weber County MAD
William H. Wright	1970	Utah County MAD
O. Whitney Young	1952	Weber County MAD

IN MEMORIAM

HENRY BECKSTEAD 1894 – 1980

South Salt Lake County Mosquito Abatement District
Board of Trustees – 27 years

President Utah Mosquito Abatement Association – 1964

ORRIN BECKSTEAD 1900 – 1981

South Salt Lake County Mosquito Abatement District
Board of Trustees – 10 years

LEE P. KAY 1897 – 1980

Salt Lake City Mosquito Abatement District
Board of Trustees – 21 years

President Utah Mosquito Abatement Association – 1972

PROCEEDINGS OF THE THIRTY–FOURTH ANNUAL MEETING OF THE UTAH MOSQUITO ABATEMENT ASSOCIATION

The thirty-fourth annual meeting of the Utah Mosquito Abatement association convened at the Little America Motel in Salt Lake City with Dennis Hunter presiding at the opening session. The welcoming address was given by Dr. O. Whitney Young, President of the Board of Trustees, Weber County Mosquito Abatement District. Dallas Nelson, Manager of the Weber County Mosquito Abatement District, was in charge of the local arrangements.

MESSAGE FROM THE AMERICAN MOSQUITO CONTROL ASSOCIATION

Claude H. Schmidt, President AMCA
USDA – ARS
Fargo, ND

It is a real pleasure to be once again in beautiful Salt Lake City, my third time in as many years. Your kind invitation to participate in the 34th Annual Meeting of the Utah Mosquito Abatement Association is much appreciated as it enables me to get to know many of you better. I bring you greetings from AMCA, and you will be glad to know that it is alive and well.

Before I give you my update of what is happening in AMCA, I would like to digress a bit and tell you of my experiences with Salt Lake City. My introduction was unplanned as I was returning to the East Coast in the late summer of 1944 after spending leave in San Francisco before going overseas. As an enlisted man in the Army Signal Corps I did not have a very high priority, and I was bumped off a United DC-3 at Salt Lake City to make room for a hard-pressed colonel. Thus I had some time to discover your fair city. My second visit was under far more auspicious conditions in 1958 at the AMCA annual meeting in the Hotel Utah. By then I was a fledgling but bonifide entomologist presenting my first paper at such a meeting. Ten years later, in 1968, as Branch Chief of Insects Affecting Man and Animals, ARS, USDA, I had the good fortune to collaborate with Dr. Rees on the control of mosquitoes in the duck clubs on the east side of the Great Salt Lake. Then for the past three years I have met with your group twice at the Little America Motel and once at the Hotel Utah for a national meeting of AMCA. Each time I have gotten to know your beautiful city better as well as your picturesque canyons.

This morning I will give you a brief update of what is happening in AMCA. There is progress in some areas and less in others, for as it is said, "Rome was not built in a day," but then again neither can we sit idly by twiddling our thumbs waiting for things to happen. In a way it is too bad your meeting is not 10 days later, for the Interim Board Meeting will be held one week from today, and many things will take place. A few moments ago I told you that AMCA was alive and well, but I did not say how well. So let me discuss the membership situation. As of January 1981 we had 2252 members and subscribers. Since then we have had 125 cancellations, persons who did not renew their memberships, but by hard work and aggressive membership promotion, the count as of September 1, 1981, stood at 2177, a decrease of 75. Some of you may think that is not so bad, and perhaps that is true, but the trend is dangerous, especially with the inflation rate we are all living with these days. This has a direct bearing on AMCA's fiscal welfare. More on that in a minute. I hope that all of you are members of AMCA. If not, then I extend to you a sincere invitation to join. If you are already members, then how about becoming unofficial recruiters to try to enlist a co-worker or others who may be interested in mosquito control. Our President-Elect, Dr. Axtell, has prepared an attractive membership prospectus which is now being printed, and it will be distributed to affiliate societies shortly, and this will provide you with some good ammunition.

Now let us look at the financial status of AMCA. The situation for 1981 looks good, and we should finish the year in the black. The projected budget for 1982 shows a deficit of about $17,000; so the Board of Directors will have its job cut out for it next week in Medford, Oregon. Now this deficit is in spite of, or perhaps partly because of, the increase in dues passed last March in San Antonio. Membership dues will go up from $20 to $25, while subscriptions for Mosquito News to nonmembers will go up from $20 to $35, and Mosquito Systematics will go up to $15. Because of these badly-needed increases, we will undoubtedly lose members and subscriptions. This is another reason why we need to redouble our efforts to obtain new members to keep AMCA strong and healthy.

Now a few words about our publications. Even with these modest increases in prices, they are a real bargain and one of the most important services that AMCA provides to the membership. For Mosquito News this was a year in transition. Last August, Ron Ward replaced Bill Bickley as editor. Ron told me that this was a very smooth transition as both fortunately live in the Washington metropolitan area. As if this major change were not enough, we also lost the services of Hugo Jamnback, one of our two Associate Editors (Articles), who resigned this September to go into private counseling. We have been looking hard for a qualified replacement, and the Editorial Board has nominated an excellent candidate for the Board of Directors to consider next week.

I am sure that most of you have noticed that Mosquito News is getting thicker, and this is due to the increase in the number of manuscripts, from 91 per year to 112. To keep costs down as much as possible and still publish the ever-increasing load of manuscripts, Dr. Bickley started using a lighter paper with the June 1981 issue. How many of you noticed? I confess that I did not until I was told. Such innovative measures will help to keep costs down in spite of other increased publication costs and ever-rising mailing costs.

Some other good news. Yes, believe it or not, the Darsie-Ward key of Mosquitoes of North America, North of Mexico is out, and a mighty handsome and useful publication it is. We need to push sales to recoup our investment. Copies are available for your inspection at the registration desk. I would like to add that we all owe a debt of gratitude to Lew Nielsen for his untiring efforts in shepherding this publication through its tortuous birth.

There is another bit of good news on the publication front. The Directory of Mosquito Control Agencies will be in press in early October, and the first run will be 1000 copies.

We are also making some progress in another area, in providing better guidelines to our committees so that they can be more effective. Rough drafts are now circulating, and we hope to have something in place by next April. Our Bylaws Committee has started on a big project of reviewing and updating the bylaws of AMCA. This project will take at least another year, but it is something that has been really needed, and we hope the final product will enable us to streamline some of our procedures.

Now I would like to extend to each and every one of you an invitation to participate in the 1982 joint meeting of the California Mosquito and Vector Control Association and the American Mosquito Control Association, April 18-22, in Sacramento, California. This will be a special meeting because the California association is celebrating its golden anniversary--50 years of service! Sacramento is a very apt location as it is not too far from where gold was first discovered at Sutter's Mill. I certainly hope to see you there.

THE PIED PIPERS

W. Donald Murray, PhD
Manager (ret.), Delta VCD
Visalia, CA

Probably all of us heard the story of the "Pied Piper of Hamelin" when we were children. We may have forgotten details, but we should recall that there was a problem with rats and that the Pied Piper appeared and led the rats to their destruction by playing a tune on his magical pipe. When the town fathers refused to honor their agreement to pay him for his services, the Pied Piper played his pipe again and this time all the children were attracted to him and followed him into a hole in the mountain. This was a German folk story, first told about the year 1350, and later memorialized by the poet Robert Browning.

Possibly none of you has reread this story since you have become vector control specialists. I believe there is a message for all of us, and we can benefit by hearing it again:

The Pied Piper of Hamelin (excerpted)

Hamelin Town's in Brunswick
By famous Hanover City;
The river Weser, deep and wide,
Washes its wall on the southern side;
A pleasanter spot you never spied;
But, when begins my ditty,
Almost five hundred years ago,
To see the townsfolk suffer so
From vermin, was a pity.

Rats!
They fought the dogs and killed the cats,
And bit the babies in the cradles,
And ate the cheeses out of the vats,
And licked the soup from the cook's own ladles,
Split open the kegs of salted sprats,
Made nests inside men's Sunday hats,
And even spoiled the women's chats
By drowning their speaking
With shrieking and squeeking
In fifty different sharps and flats.

At last the people in a body
To the Town Hall came flocking:
" 'Tis clear", cried they, "Our Mayor's a noddy;
And as for our Corporation – shocking
To think we buy gowns lined with ermine
For dolts that can't or won't determine
What's best to rid us of our vermin!

Rouse up, Sirs! Give your brains a racking
To find the remedy we're lacking,
Or, sure as fate, we'll send you packing!"

An hour they sat in council.
At length the Mayor broke silence:
"Oh for a trap, a trap, a trap!"
Just as he said this, what should hap
At the chamber door but a gentle tap?
"Come in!" – the Mayor cried, looking bigger.
And in did come the strangest figure!

He advanced to the council-table:
And, "Please, your honours,", said he, "I'm able,
By means of a secret charm to draw
All creatures living beneath the sun,
That creep or swim or fly or run,
After me so as you never saw!
And I chiefly use my charm
On creatures that do people harm,
The mole and toad and newt and viper;
And people call me the Pied Piper.
And as for what your brain bewilders,
If I can rid your town of rats
Will you give me a thousand guilders?"
"One? Fifty thousand!" – was the exclamation
Of the astonished Mayor and Corporation.

Into the street the Piper stept,
Then, like a musical adept,
To blow the pipe his lips he wrinkled,
And ere three shrill notes the pipe uttered,
You heard as if an army muttered;
And the muttering grew to a grumbling;
And the grumbling grew to a mighty rumbling;
And out of the houses the rats came tumbling.
From street to street he piped advancing,
And step for step they followed dancing,
Until they came to the river Weser,
Wherein all plunged and perished!
You should have heard the Hamelin people
Ringing the bells till they rocked the steeple.
"Go," cried the Mayor, "And get long poles,
Poke out the nests and block up the holes!
Consult with carpenters and builders,
And leave in our town not even a trace
Of the rats!" – when suddenly, up the face
Of the Piper perked in the market-place,
With a, "First, if you please, my thousand guilders!"

A thousand guilders! The Mayor looked blue;
So did the Corporation too.
For Council dinners made rare havoc
With Claret, Moselle, Vin-de-Grave, Hock;
And half the money would replenish
Their cellar's biggest butt with Rhenish.
To pay this sum to a wandering fellow
With a gipsy coat of red and yellow!
"Beside," quoth the Mayor with a knowing wink,
"Our business was done at the river's brink;
We saw with our eyes the vermin sink,
And what's dead can't come to life, I think.
So, friend, we're not the folks to shrink
From the duty of giving you something to drink,
But as for the guilders, what we spoke
Of them, as you very well know, was in joke.
Besides, our losses have made us thrifty.
A thousand guilders! Come, take fifty!"

The Piper's face fell, and he cried,
"No trifling! I can't wait, beside!
Folks who put me in a passion
May find me pipe to another fashion."
"How?" cried the Mayor, "d'ye think I brook
Being worse treated than a Cook?
Insulted by a lazy ribald

With idle pipe and vesture piebald?
You threaten us, fellow? Do your worst,
Blow your pipe there till you burst!"

Once more he stept into the street,
And to his lips again
Laid his long pipe of smooth straight cane;
And ere he blew three notes
Out came the children running.
All the little boys and girls,
With rosy cheeks and flaxen curls,
Tripping and skipping, ran merrily after
The wonderful music with shouting and laughter.

The Mayor was dumb, and the Council stood
As if they were changed into blocks of wood,
And the wretched Council's bosoms beat,
As the Piper turned from the High Street
To where the Weser rolled its waters
Right in the way of their sons and daughters!
However, he turned from South to West,
And to Koppelberg Hill his steps addressed.
When lo, as they reached the mountain-side,
A wondrous portal opened wide,
As if a cavern was suddenly hollowed;
And the Piper advanced and the children followed,
And when all were in to the very last,
The door in the mountain-side shut fast.

So, Willy, let me and you be wipers
Of scores out with all men – especially pipers!
And, whether they pipe us free from rats or from mice,
If we've promised them aught, let us keep our promise!

My baptism as Manager of the Delta Mosquito Abatement District occurred the day I arrived in June 1947. The Visalia High School was screaming: "Spray our athletic field, we have graduation there tonight and we can't even walk across the grass because we become covered by mosquitoes." Of course we sprayed, and temporarily reduced the mosquitoes, *Aedes nigromaculis*, so that the graduation could be held in reasonable comfort. Instead of rats, our public had swarms of mosquitoes, – this public wanted us to spray in order to carry out reasonable living. And they were willing to pay a reasonable price for our services.

There was no magical pipe. While the public at that time may have thought that DDT spray was just as good and was all that was needed, we knew better. There were poorly graded and poorly managed irrigated pastures producing day-biting pasture mosquitoes at the very edge of the city of Visalia. The city "sewer farm" was one mile away, but the horrendous numbers of night-biting house mosquitoes easily pressured their way into the city. Also, there were several bad dairy drains at the very edge of town producing untold numbers of house mosquitoes. And the city was surrounded by a suburban fringe of partly-to-totally open cess pools – again, house mosquitoes.

Perhaps the Pied Piper could say, "Rats today, gone tomorrow, a miracle." But we could say no such thing about our mosquitoes. There could be no miracle, just hard, dedicated work, with lots of support from public and private agencies and from the people themselves. Control would come gradually, almost insidiously. By about 1978 the dramatic results of the Pied Piper with his rat control was paralleled by the Delta MAD in its control of mosquitoes. The result was that many people no longer recognized the need for a Pied Piper – that is in this case for the MAD. So they voted for Proposition 13. We have said to ourselves that the public did not mean to emasculate the MAD's, to make it difficult or impossible for at least many of them to operate effectively. Yet I am not so sure. Perhaps we are now considered to be just another of those public agencies which has outlived its usefulness.

The Pied Piper was needed, he did his job, but the public rejected its promise to him. The MADs have been needed, they have done their job, and yet the public has rejected the belief by the MADs that they are still needed. The drastic effects of Proposition 13 are just now appearing, and the failure of the public to support us will surely come to haunt this very public. The public is consuming more claret, moselle, or other wines, and other items for their pleasure, just as the city fathers of Hamelin wished for themselves, rather than paying for their vector control.

What do we do? We cannot be vindictive, hoping that all the children will get bitten by mosquitoes, get encephalitis, or malaria. In fact, we surely will not see a reversal to the conditions of the 1940's and early 1950's. The Mayor of Hamelin knew that source correction was needed as soon as the rats were gone:

"Pole out the nests and block up the holes,
Consult with carpenters and builders."

But without our continued pressure on the mosquitoes we can expect to see some deterioration of the quality of life for the citizens.

The worldwide malaria eradication program is facing this same dilemma. Great gains were made with the single control approach of DDT or other residual insecticide spray on walls of huts and houses. The program was expensive, especially to developing countries, and some of their leaders believed that other areas of government expenditures should have higher priorities. Malaria eradication programs were reduced or even eliminated. In some countries the malaria program had been so effective that a rebound has not yet been felt. But in other countries the rebound has been fast and devastating.

Agreements had been made to work for malaria eradication, and these agreements have been broken by government authorities. The people are the ones who suffer, especially the very young children who are most susceptible to malaria. True, the government authorities, like those of Hamelin, are concerned about the priority of funds. Also the 1-method approach to malaria control by WHO was not condoned by many medical entomologists. But certainly the public – the children especially – should not be sent through a hole in the mountain for the sake of a keg of wine – or other desires of the authorities.

We, the vector control specialists, together with the governmental authorities who should be aware of the dilemma of the authorities of Hamelin, should join hands and see that needed programs are provided for and that the funds provided are properly spent. There certainly is no need to banish our children and future generations to disease and a poor quality of life just because some politicians and some of the public want more wine for their feasts.

DISTRICT GOVERNMENT

Lynn M. Thatcher
Member, Board of Trustees
Salt Lake City MAD
Salt Lake City, UT

When asked to present this discussion on "districts", I accepted gladly because of the interest I developed in various forms of district government during my career with the Utah Department of Health. Now, after attempting to develop some broader viewpoints on the subject by reading readily-available publications, I am aware that the title is too imposing for my meager knowledge, and I will admit, therefore, that I am going to talk mostly about my experience as a trustee of the Salt Lake City Mosquito Abatement District in terms of a few concepts gleaned from my reading.

I approach this task essentially as a citizen and taxpayer interested in good government at lowest possible cost. Much of what I have read has a familiar ring when viewed in the light of my experience. The big surprise was learning that I have less time for this type of activity now than I did before I retired.

I, like many of you, became aware of a growing anti-district sentiment many years ago. I didn't know what it all meant at the time, but I found it easy to embrace the popular logic that fragmentation (in the sense of many districts) was bad and that consolidation (meaning big, centralized government) was good. On reflection, it is clear to me that hardly anyone ever paused in their daily chores to wonder if big was really good or if centralization of authority could ever be bad.

Now, I've had some years dealing with a big federal government having many areas of centralized power, and my complacency has changed to skepticism. Today, I've got to be convinced that big is good just because some authority said so.

I would never claim that our present methods of doing things are as good as they need to be. It seems quite obvious that we need to search continually for better methods, or we'll get into a rut. And none of us want to be in a rut because the only differences between ruts and graves are the dimensions.

But I keep reflecting on an old Chinese proverb which says "If it ain't broke, don't fix it".

Applying this philosophy to the subject at hand, I interpret it to mean that changing our present mode of operation just for the sake of change doesn't make sense. Unless a proposed change is based on good evidence that an improvement will result, it shouldn't be embraced.

Over the years I have found no evidence that there is any basic defect in Utah's Mosquito Abatement District Law. There have been differences in performance of different districts, as would be expected, but no dissatisfaction with the results being achieved under the statute.

As for districts generally, the negativism toward them that I encountered in my reading can be summarized in the following points. I have added my immediate reaction to each point parenthetically.

1. Districts frequently provide uneconomical service. (I'm sure some districts do, just like many other governmental entities. Switching to another form of government would only transfer the diseconomy to another location.)

2. Districts create serious intergovernmental problems. (I recall from my career in government that any time two or more units are created in multipurpose government, there will be intergovernmental problems. The statement is true of any type of government, and certainly not the exclusive property of districts. In fact, my observations of mosquito abatement districts in action would lead me to believe they are adept at solving intergovernmental problems. How the problems are solved, after all, is the only point to be made here.)

3. Districts lack visibility and therefore may get away with charging too much for their services. (Districts certainly lack visibility, just like many functions buried deep in multipurpose government. But there are times when mosquito abatement districts suddenly become very visible. Examples are when the mosquitoes start biting or when there is evidence of a bee kill. I've never known people to have trouble finding the district at times like that.)

4. Districts may "empire-build" without consideration of area-wide priorities. (I can't imagine any worse examples of empire building than I observed during my career in goverment – all in multipurpose governmental units. It could happen in districts too, but it should be recognized as a problem of government rather than just districts.)

5. Districts compete for scarce tax dollars. (This is true, just as it is true for every governmental unit ever invented. Any group of intelligent people assigned the responsibility of performing a function supported by tax dollars will compete for those dollars or they will fail in their responsibility.)

6. Districts, because of multiplicity, prevent most citizens from understanding them and controlling them. (I recall the exercises we had in state government each time a reorganization was decreed. We spent weeks establishing organizational structure and trying to put it on paper in the form of an organizational chart. I still look back with horror on the final charts, depicting the lines of authority and the various functions from the governor down. Depicting district lines of authority and functions in an understandable fashion is child's play by comparison.)

7. Districts usually outlive their usefulness. (I've never known about any districts that have outlived their usefulness, but I feel sure it has happened. It occurs to me that dissolving a district in such a situation would be a very simple matter in contrast to what might happen if a unit of multipurpose government became useless. In fact, I know a lot that have, but they're still in operation.)

Though I got the impression that most of the literature is negative on districts, I did find a few expressions of support, as follows:

1. Districts must be performing a worthwhile service or there wouldn't be so many of them and they wouldn't be increasing in number.

2. Districts have the advantage of a single purpose, which they can pursue intently and without the distracting influences of dozens of other jobs.

3. The policy-management teams of single-purpose districts can develop an expertise for a specific task that doesn't exist for multipurpose government.

There are probably a lot more arguments on both sides of the question which I could have reported if I had read more reports. One thing I can guarantee is the availibility of a vast quantity of reading material on districts, much of it downright boring but nevertheless educational.

Observing our own district, and others like it, over a period of years has prompted some concepts I'd like to share with you now.

I have seldom seen a governmental activity where the purse strings are so closely watched. Over a 10-year period, the Salt Lake City Mosquito Abatement District budget has grown at an average rate of about 4%, while inflation generally moved well into double digits. And we aren't anywhere near the tax limit allowed by the law, and never have been.

As for intergovernmental problems. I can't say how many we cause, but I know of a few that we solve. For example, we work closely and continuously on mutually beneficial drainage activities with the county.

We are in frequent contact with the state on many fronts. One of the most productive results of such contacts is the prevention of new breeding areas through study of highway plans, followed by negotiations to achieve modest design modifications.

Then there is the cooperative effort with other mosquito abatement districts to get the most for our airplane-spraying dollar by jointly contracting with the spraying companies.

But to me the most impressive thing about my experience as a member of the board of trustees is the recognition of a reservoir of competent, able citizens who are anxious to perform a service for their government at the ridiculously low price of "free". I've met these people not only in my own district but from districts around the land. And they are all impressive. Good, honest, competent citizens, anxious to help.

I can't escape the conviction that sprinkling boards of such citizens throughout government can do nothing but make government better.

I want to close with two thoughts which sum up my current feeling about the district government controversy.

1. Don't be too quick to embrace the arguments that districts have to go. The subject is so complex that I doubt if anyone has enough information to justify a strong recommendation on the matter. There are still arguments on both sides.

2. If it ain't broke, don't fix it.

MOSQUITOES AND THEIR CONTROL -- ILLUSTRATED

Reed Roberts
Extension Entomologist, Department of Biology
Utah State University
Logan, UT

Sets of a comprehensive series of slides on topics of mosquito biology and control were assembled for use in Utah mosquito abatement public relations and educational programs. The 131 slides in the sets were prepared for rapid presentation with a printed narrative.

Some generic identifying characteristics were shown for several species of mosquito adults and larvae. The public health aspects of annoyance from mosquito bites to disease transmission were stressed. Reference was made to economic losses to dairy cows, livestock, and wildlife resulting from mosquito harassment and blood loss. Potential mosquito breeding sites were well-illustrated. Domestic and area-wide mosquito control methods included slides of source reduction procedures, chemical application equipment, and biological control agents.

PROGRESS OF MOSQUITO CONTROL IN TOOELE COUNTY

Robert J Brand, Manager
Tooele Valley MAD
Lake Point, UT

This past summer marked the fifth year that the Tooele Valley Mosquito Abatement District has been in existence. It is impossible to report on all progress that has occurred in the district during the last five years, so I have limited this account to two general areas – public relations and field operations.

Contingent to any successful mosquito control program is the need to have the support of the people you serve. Our policy has always been, from the start, to be open with the public. In 1977, our first year, we started by meeting with prominent officials of the county, the cities, and principal land owners. Articles in the local newspaper were placed to announce the beginning of mosquito control in the district. As many people as possible were contacted and enlightened to the concept that mosquito control is principally water control, source control, and working, for the most part, away from the populace. We gained trust from those property owners that had mosquito sources on their land and thus gained access on their lands. Once people understand the nature of mosquito control they generally support it.

During the first four years of our organization we had no facilities to work from. The work was directed from my residence with much inconvenience to the public. For this reason the Board of Trustees recommended that we yearly participate in the Landmark Days County Fair to reach those unaware of the program. In 1979 we set up a booth at the fair and explained the aspects of mosquito control. This time we gave the public the opportunity to voice complaint. We also participated in the fair in 1980 and 1981. Our mosquito abatement has been more successful this year and fewer people complained.

This past June we had the pleasure of moving into our permanent home at Lake Point. Until then the equipment, pesticides, and supplies were scattered throughout the district. This situation was not desirable in the least, but money was being saved so that we could build our own facilities. An open house is being planned in the spring of 1982, and once again we will explain our program to the public.

Our field operations have been changed little from those established in 1977, albeit they are better managed and refined. In our first year we began a very limited control covering approximately 25 sq. miles out of the district's 630 sq. mile total. This area was inspected every nine days and sites within the area were selected as to pool type. In 1978 we doubled our field personnel and extended control to approximately 75 sq. miles and returned inspection every seven days. Sites within this area were also selective to pool types. In 1979 and 1980 we decreased our field force while still maintaining conditions set up in 1978. In our first year we had two field workers covering 25 sq. miles; in 1980 we had two field workers covering 75 sq. miles; and in 1981 we increased our field labor to three and extended coverage to about 100 sq. miles. There are still areas within the district that are yet to be controlled, but due to a stagnate economy it is impossible to reach out any farther. Presently we are taxing at full capacity and the tax base has not expanded. Much of this uncontrolled area is desolate but does contain habitats conducive to *Aedes* species, so we are continually vulnerable to repeated migrations and dispersals of *Aedes dorsalis,* especially in the spring and early summer when pools are large and help is scant.

This past year we completed an extensive mapping program which began in 1977. Each year we improved our existing maps and completed others. Those areas now completed need very little revision and future mapping will be in updating places that change due to development. Sixty-four scaled maps covering more than 100 sq. miles have been prepared. These maps aid the inspectors in locating the known larval sources and also provide a record of work performed.

Our district is unique in that we experience our greatest problems in late spring and early summer. As summer progresses our pools diminish in number and size. Because of the scarcity of water, irrigation runoff does not present a great problem. Irrigation practices, for the most part, are generally very good in the district. In one area we may find 50 large mosquito-bearing pools in May and only one in August. We estimate that 15% of our pools escape control in the springtime. Our first species of importance is *Ae. niphadopsis* which occurs in large numbers by early February. The control of this species begins in early March. *Ae. dorsalis, Ae. campestris, Ae. fitchii,* and *Ae. increpitus* begin to show up in the pools by the end of March.

Until this past summer we did some aerial spraying, but because of the high cost of this, we have tried to find other answers through ground crews and equipment. In 1976, before the district was created, private interests used aerial spraying exclusively on adult mosquitoes. Based on this, the Board of Trustees concluded that aerial spraying would be needed in much of the district. In 1978 I began to test our limits for covering the problem with ground crews. Aerial spraying was discontinued this past summer. Indeed, some aerial spraying would still be used if we could affort the cost. On occasion we will still use this method but only when all else fails.

Right now, people within the district have noticed a great difference. In 1977 no one complained unless hundreds of mosquitoes were about. Now, people complain when a few are seen. Another indication of success is that people notice that mosquito problems are periodic during times of migration or dispersal. Before, mosquitoes were found throughout the district all summer long.

Our greatest challenge ahead is financial. For us to perform this service more funds need to become available. Our operating budget cannot exceed $56,000 because that is all that can be generated with our tax base.

A YEAR OF MOSQUITO CONTROL

E. James Nielsen, Supervisor
Emery County Mosquito & Weed Control Department
Castle Dale, UT

Emery County, with an area of 4,439 square miles is the seventh largest county in the state of Utah. Federal land in the county consists of 81.5%, 10.49% is state land, .01% is city and county land, and 8% is private land. The county is bordered on the west by the Manti-LaSal mountain range and on the east by the Green River. This gives the county a general northwest to southeast slope with the elevation changing in a series of descending terraces from over 10,700 feet down to around 4,000 feet where the Green River exits the county. The county is located in what is called the canyonland part of the Colorado Plateau and is referred to as Castle Valley. This area is an arid region with an average annual precipitation of seven to eight inches.

Mosquitoes and mosquito-related problems have always been problems in the county. Although mosquito control has always been desired, the problems had to be lived with as not much could be done since the area was so large and the population so small.

Radical changes in the complexion of the county in the last ten years has made it possible to have a mosquito control program. The energy crisis and the county's enormous coal reserves have moved Emery County from economic depression to economic prosperity. The population, rather than declining 7.4% as it did from 1960 to 1970, increased 123% from 1970 to 1980, making a total population of 11,451 and an overall density of 2.5 people per square mile. The assessed value of all property in the county in 1970 was a little over $10,000,000, by 1981 it had leaped to $220,000,000.

As a result of such great changes, a mosquito control program, as well as many other county programs, became feasible. In 1979 Commissioner Donald R. Curtis initiated the groundwork and in 1980 money was budgeted for a combined mosquito and weed control program. In April of that year I was hired to supervise the program.

With a combined budget of over $111,000 for 1980, chemicals and equipment were purchased. The equipment consisted of a one-ton GMC pickup, a three-quarter ton GMC pickup, a 300-gallon Bean sprayer, a Leco fogger, a Ford 5600 tractor with a Tiger rotary mower and an Arps backhoe. Some equipment, already owned by the county and used for weed control by the county road department, was turned over to us. This included a 300-gallon Myers spray tank with booms and a 1966 three-quarter ton Ford pickup. A Ford 3600 tractor and a Woods mower were also turned over to the department but were traded in on the new models. In 1981 with a combined budget of $129,000 another one-ton pickup was purchased as well as a variable flow Leco fogger. Needless to say, we feel fortunate to start a new program in this manner.

The biggest problem that we face at this point is locating the mosquito breeding areas. This is a labor-intensive job as it is all footwork with hundreds of square miles to be checked. To make matters worse, we realize the intermittent nature of many mosquito breeding areas, so we try to look at each area as it is and as it could be.

As a larval source is discovered it is outlined on a map. Temperature, pH, water source, larval count, vegetation, and ideas on how to reduce or eliminate the source are all recorded. Usually a treatment with Dursban-2 is given at the initial visit.

The mosquito fish, *Gambusia affinis,* is new to the county but has already proven to be of enormous benefit. The fish were introduced into many ponds in 1980. Some of these ponds have turned out to be excellent supply ponds and are now furnishing all the fish we need. The fish have now been distributed to every stock watering pond that we can locate and to many of the washes that drain the county farmlands.

In other efforts to control mosquitoes, we have used the backhoe to reduce and eliminate some larval source areas. We will also be using ditching powder this fall for the same purpose.

In spite of all that we have done, there are still so many source areas that we have not yet located that we must rely quite heavily on our foggers to give many of the county residents relief from the mosquitoes. In the summer of 1980 the towns were fogged every eighteen days. This summer we fogged the towns and the outlying areas every ten days. This schedule of fogging has been quite effective in keeping these areas free of mosquitoes.

We have made an attempt to keep the public informed on what we are doing. Over the past year we have made personal contact with almost all landowners and have been in touch with many others through our educational booth at the county fair. In both situations we informed the public about what we were doing and how they could help. The public is very much appreciative of the mosquito control program. Some people have even given the program credit for their having better gardens and prettier yards as they can now get out in the evening and work in them.

During this season we have participated in the Utah Mosquito Abatement Association's encephalitis surveillance program by maintaining a sentinel chicken flock and by sending adult mosquitoes to the University of Utah virus laboratory on a weekly basis. No viral activity has been detected in this area.

We are pleased by the enthusiastic help and support we have received from the various departments, agencies, and associations. The Department of Agricultural Stabilization and Conservation (ASCS) has especially been helpful by making maps and technical aid available to us. The Utah State University Extension Service and the Utah Mosquito Abatement Association as well as many others have given us much valuable direction and advice.

We are pleased with our mosquito program to this point because Emery County has become a better place to live, but we know we have a long way to go to change the conditions so they are not so conducive to the production of mosquitoes.

MOSQUITO PROGRAMS OF WYOMING

Everett W. Spackman
Extension Entomologist
University of Wyoming
Laramie, WY

The mosquito control programs of Wyoming are not, I think, the traditional ones that function in other states. That is, under authority of an enabling act passed by the Legislature, providing for a source of revenue, personnel, equipment and enforcement. We, in Wyoming, do not have the enabling legislation to establish a mosquito abatement district.

In 1979, I sent out a questionnaire to all known towns and cities of Wyoming trying to find out those that consider they do have a mosquito pest problem and whether they have a control program. Ninety questionnaires were mailed out and we had a 77% return. Of those responding, 80% considered they had a mosquito problem, and 57% were trying to do something in the way of control.

Because of our relatively small population in a number of our cities and towns, there is a small tax base. These areas have resorted to an adulticiding program instead of the more effective larval control effort as we have emphasized. Most of the towns doing adult control have purchased a mist-type applicator such as the Leco, London Aire or Microgen. With these they apply technical malathion (ULV). There are some who also depend on the aircraft operator to do the application of technical malathion at 3 to 4 oz/acre. There are still a few remaining adulticiding programs that have the old thermal foggers. Most of the towns doing adulticiding by ground equipment only report they made one or two applications per week. Those with a combination of larvicide and adulticide usually supplement by misting for adults as needed.

The larvicides being used are Baytex, Flit MLO, Altosid, Dursban, diesel fuel, Tossits and Abate.

The really serious mosquito problems in Wyoming are in those areas associated with some of our high mountain irrigated meadows. In these areas our main mosquito problems are *Aedes melanimon, Ae. dorsalis, Ae. compestris, Culiseta inornata,* and *Culex tarsalis.* Some of these affected areas have developed some very effective programs, namely: Albany County (Laramie City, Big Laramie Community) and Little Laramie Community, Teton County (City of Jackson and vicinity), Baggs (Snake River area), Jeffrey City, Nowood River Community (Ten Sleep and community), Elk Mountain and Medicine Bow.

The above-mentioned communities have used the Albany County program as a guide. They have worked with the Agriculture Extension Service, established a mosquito committee and then have presented a thorough plan to their people. This included training of volunteers to do survey work with the dipper, preparing bid invitations to prospective aerial applicators and letting bids to the successful low bidder. The larvicide in most cases (except one) has been 1 oz Baytex in 1 qt of diesel fuel per wet acre. In most years, because of irrigation schedules, it has been necessary to make two applications, one in late May to early June and the second, late June to early July. The Albany County ranch program has been going on since 1976, each year doing over 100,000 acres at a cost of from 75 cents to $1.90/A.

There have been many benefits according to those living within these ranching community programs; for example, heavier calves, heavier lambs, no longer a split calf crop, higher percentage of pregnant cows, cows no longer bunching, more grazing time, better job of irrigation (more hay), human comfort, fisherman comfort, and improved hay quality.

The programs in Wyoming are financed in various ways: some towns and cities levy a tax on each water meter or each household and some have it within their general budget. The ranching communities have received some assistance from the County Commissioners, the Weed and Pest Districts and donations. Then they have assessed each rancher on the basis of his wet acreage included in the program. I think the main reason for the success of this program to date is the rancher interest and, of course, the good results that have been received.

Whenever there is a problem as complex as mosquito control is, there are always concerns such as: How do you continue to keep up the interest and enthusiasm of those in a voluntary program, water management (irrigation schedules) and what chemicals are available at a very reasonable cost and are compatible with the environment?

POTENTIAL FOR INCREASED MOSQUITO PROBLEMS WITH PROPOSED DIKING OF UTAH LAKE

Dennis Hunter, Manager
Utah County Mosquito Abatement District
Provo, UT

Utah Lake is a remnant of Lake Bonneville which occupied most of western Utah until about 10,000 years ago. As time passed, drier and warmer conditions prevailed and evaporation rates began to exceed the inflow rates, resulting in a decrease in size and eventually a separation into at least two distinct lakes. What is now Utah Lake remained as a temporary catchment basin for freshwater entering the larger Great Salt Lake via the Jordan river. As you look at a satellite photo of Utah you can see several lakes and reservoirs which comprise a portion of the Bonneville Unit Storage System that was authorized as part of the Central Utah Project by the Colorado River Storage Project Act of April 11, 1956.

Utah Lake is the largest natural freshwater lake in the intermountain west. The lake occupies over 25% of the Utah Valley floor, and even though it covers about 150 square miles and contains approximately 900,000 acre-feet of water, its average depth is only 9.2 feet. The major perennial streams that feed the lake, have their headwaters in the Wasatch and Uinta Mountains to the east. The Bonneville Unit includes facilities to collect water from the streams of the Weber River, Strawberry River, and the Duchesne River in the Uinta Basin. This project is to store and regulate the water and to release it as needed through diversion canals and tunnels from Strawberry Reservoir to the Bonneville Basin and deliver it to diversified areas of use. The Utah Lake features of the Bonneville Unit would be part of the Irrigation and Drainage System.

Three sources of additional project water supply would be from reducing evapotranspiration losses from Utah Lake, recovering return flows and saving spills, and importing water from the Uinta Basin through the Strawberry Collection System. The Irrigation and Drainage System water supply will be used for irrigation in southern Utah County, Juab County, and the Sevier River Basin, and for municipal and industrial purposes. Of the total 178,000 acre-feet of Irrigation and Drainage System supply, about 105,000 acre-feet would be developed by diking Utah Lake which will reduce the surface area by about 35% and thereby reduce losses resulting from evapotranspiration.

Some physical features of the Utah Lake plan are in the proposed Provo Bay development. Provo Bay would be separated from the main body of the lake by a 7.2 mile-long dike beginning near the Provo River, north of the Municipal Airport and extending southward across the bay to the Spanish Fork River. The bay would then be drained with pumping plants constructed to transfer water to and from Utah Lake and the land used for agriculture. The drainage system would include about 65 miles of closed subsurface drains, 22 miles of unlined open lateral drains and 11 miles of open unlined collector drains. About 9,500 acres of land in the Provo Bay area would be reclaimed or improved by the drainage program and provided with irrigation facilities and project water.

The Goshen Bay-Mosida irrigation area is part of the Bonneville Unit. The proposed Goshen Bay Dike would separate the bay from the main body of Utah Lake. This dike would extend 5.4 miles across Goshen Bay from Lincoln Point to the Knolls, north of the Mosida area. An emergency outlet structure would be constructed to permit lake water to spill into Goshen Bay under extreme flood conditions. Approximately 5,000 acres of land in the Mosida area would receive project irrigation water.

There are potential areas of mosquito-breeding habitat created by this project along with the challenges of proper management of these areas. To mitigate the loss of wildlife habitat in Goshen and Provo Bays, the Goshen Bay Wildlife Management Area would be established and developed as part of the Bonneville Unit Plan.

Three potential recreation sites have been identified on project lands adjacent to the dike abutment. Day-use and overnight camping facilities would be built. The facilities would include roads, parking areas, access trails, boat-launching ramps, marinas, docks, picnic areas and water and sanitary facilities to accommodate up to 70,000 visitor-days annually. There are also potential alternative uses of the Provo Bay lands including the following: 1. Lands used for agricultural purposes. 2. Lands could be used for mixed industrial development. 3. Lands could be developed to enhance the existing wildlife habitat in the bays. With these alternatives in mind along with proposed recreational areas, additional mosquito control must be initiated. While most of the important mosquito species do breed to some extent throughout the county, there is an exception around the lake. Around the perimeter of the lake, there is a wide range of habitat which is generally semipermanent or permanent water providing a good environment for *Culex tarsalis* and *Culiseta inornata*. As we move away from the lake, the agricultural area is the principal source of floodwater species such as *Aedes dorsalis, Aedes vexans* and *Aedes nigromaculis.*

We have estimated that with the completion of the Provo Bay project, it would require an additional $12-15,000 per year for chemical cost, aerial application and equipment required for one additional inspector plus $3,000 to $5,000 wages for other seasonal employees. At present, the Goshen area isn't under 100% mosquito control because of low human population levels. However, with the completion of the Goshen Bay project, we estimate population and industrial increases which definitely would require a stepped-up control program in this area. Without the project, we would need $50-70,000 in funding depending on population increases. With the project, we estimate $90-115,000 at 1981 budget levels to initiate a control program.

In closing, it seems appropriate to note that a wealth of renewable natural resources occur in and around Utah Lake. Not only can these resources be utilized now but with proper management they will be available indefinitely.

THE UTAH SOIL CONSERVATION COMMISSION – WHAT IS THE RELATIONSHIP WITH MOSQUITO CONTROL?

Kenneth B. Creer, DVM
Commissioner
Utah State Department of Agriculture/Chairman, Soil Conservation Commission
Salt Lake City, UT

The Soil Conservation Commission (SCC) is the organization of the state that has the responsibility of developing goals and objectives directed to the conservation of our water and our soil. This responsibility alone is tremendous but sandwiched with this responsibility of developing goals they are challenged with:

1. Developing projects throughout the state which will be meaningful to their objectives and be helpful in the ultimate goal of conserving our natural resources.

2. Prioritizing these many projects which generate throughout the state and determining those projects which will reap the greatest cost-benefit ratio.

3. Taking those projects of highest priority and trying to fund the planning of them with a limited amount of funds.

4. If the planning is funded and completed, then the responsibility of acquiring money for the construction of the project is up to the Soil Conservation District (SCD), ASCS, Federal SCS, the irrigation company, county or city government, etc.

I might add that the commission has a much greater need for funds than years ago. The budget cutting, inflation, high interest syndrome has caused many good projects to be scrapped. The types of projects we look at range from water storage, flood control, sprinkling systems, ditch lining, land leveling, and draining of wet areas.

The activities which I have described are the end results of many people and organizations functioning together and they are from federal, state, county, city, SCDs and water conservancy district officials. Let me give you the members of the team which I feel is impressive:

1. USDA Soil Conservation Service

2. USDA Agricultural Stabilization and Conservation Service

3. Other federal technical and financial supportive agencies

4. USCC and Utah Dept. of Agriculture

5. Utah Department of Natural Resources and Energy
   a. Water Resources
   b. Wildlife Resources
   c. Parks and Recreation
   d. State Lands and Forestry

6. Utah Department of Environmental Health

7. Soil Conservation Society of America

8. Utah State Association of Soil Conservation Districts

9. Local soil conservation districts.

10. Local county and city officials

11. Other environmentally oriented groups

12. Upon occasion, other related state agencies and private organizations

Representation of all these organizations could become involved in our planning and project construction.

I would like to give you a background as to how the State SCC was started and also what it consists of. There is a state statute which gives the authority to the people of the state to organize the SCC. These are the public servants assigned by law:

1. Director of the State Extension Service

2. Director of the State Natural Resources

3. The State Commissioner of Agriculture – this person is designated Chairman of the Commission

4. The President of the Utah Association of SCDs.

These are four of the ten members on the Commission. The other six are members of the Board of Directors of the Multi-County Zones which we have in the state. The Zone recommends to the Commission and the Governor appoints to the Commission.

The local SCD leaders are elected by landowners of their districts and they serve to represent their people. At present we have 39 of these local districts. Each of these 39 districts are required to develop a program plan at the first of the year, and they also report at the end of the year what they have accomplished. From these local plans and requests for help and funding from the district organization for such assistance, the districts present their programs to the State Commission which makes the determination as to what funding and assistance is given.

The major functions of the Commission are:

1. To support local districts by helping to coordinate activities from various districts.

2. To help disseminate information to various districts of the State's district programs by newsletters and informative correspondence.

3. To encourage the formation and reorganization of the districts as deemed necessary.

4. To prescribe uniform accounting and record keeping procedures.

5. To provide administration for the Utah Range Development.

6. To secure cooperation and assistance through other state agencies, local farming units, other state and federal agencies.

7. To plan watershed flood control projects.

8. To direct the elections and train the district supervisors in the 39 districts throughout the state.

The basic function of the Commission is to give the local SCDs support for their programs and to help them carry out their responsibilities. The major responsibility of the local SCD is to have the soil and water conservation efforts carried out on their land, private land, and to give direction to soil and water conservation efforts on the public land within their districts.

The relationship between the SCC and mosquito abatement should always be very close. Most important for you people is to have a close working agreement between mosquito control people and the private owners of the land. Those private owners of the land make up the heart of the soil conservation organization as discussed above. Basic land inventories should be available to you people. Also there should be a dialogue between mosquito abatement organization and soil conservation people who are designing irrigation systems so that through design we may be capable of eliminating breeding areas for mosquitoes.

It is my belief that the city and county planners could possibly do a better coordinating job with both the mosquito abatement people and the SCD to prevent problems which come from the expansion of our cities. We have noted that our SCDs are spending many hours trying to arrange their systems through subdivisions and I have also seen breeding areas where mosquitoes develop because of the improper planning to care for the irrigation water that was allocated to the farm turned into a subdivision.

The urbanization of our farmlands need better coordinated planning. There is an interesting situation that occurs when urbanization takes over farmland. In most cases the water stays with the property. Much of this water is turned over to the cities where it is diverted into the culinary system. But one acre of houses does not use as much water as that acre of farm crop land. Thus in an average year, this leaves an excess of water. Then because of the complexities of the irrigation delivery systems, very often the main line irrigation canals and some secondary lines remain in operation. Thus water continues to go through the urban development, and in some cases garden ditch systems are reserved for delivery of water to the back yard gardener. What does all this mean? Puddles of water all over the place and I don't have to tell you people what that means for the mosquito control programs! The urbanization of our farmlands needs better coordinated planning.

It is my opinion that generally speaking there is a good cooperative relationship between the mosquito control officials and the soil conservation district supervisors. I feel this cooperation stems from the fact that there is a synergistic relationship between the objectives and purposes of the two organizations. They are both trying to utilize water in the best possible way. This non-wasteful use of water by the farmer means he can spread his irrigation coverage and increase his yields. For you, the mosquito control people, efficient water management means fewer mosquito breeding grounds.

How do the farmers get these more efficient water usage systems? For the most part, it is through the service coming either directly or indirectly through the local soil conservation districts. When an individual landowner wants to make a water or land improvement he usually seeks the technical expertise of the USDA-SCS. And from the conception of the local soil conservation districts, their major function is to give direction to and help the employees of the SCS prioritize these conservation practices. Then when the landowner has plan-in-hand he may go to the USDA – Agricultural Stabilization and Conservation Service for the cost-share funding for the project. Here again the SCD supervisor has an input.

The majority of the conservation practices recommended by the SCS have built into them directly or indirectly characteristics that reduce ponding or puddling of water and by nature are designed to reduce the amount of water directed to the land. In this case the effect on the population of mosquitoes has to be a reduction.

I believe if we have well-organized, active, strong local soil conservation districts we will have fewer mosquito problems. And as I said before, it is the State SCC's role to help get and keep these SCDs strong. This is the focal point of the relationship between my organization and the members of your association.

The leadership of the State's soil conservation movement is presently working on a long-range goal that should be very beneficial to your program through source reduction if it succeeds. It is no secret that the present federal administration is cutting federal programs including soil and water conservation activities. It was announced recently that there would be an additional cut of at least 12% in these programs. That is going to hurt the conservation work. Some of us think that we shouldn't be hurting ourselves in the area of present and future capabilities of producing food and fiber.

With reductions of funding from all sources we (and I include your organization) could be the first to be sacrificed. The conservation of our most dependent natural resource, water, is of the greatest priority. It is the concensus of the people in our department that if we conserve the water we have and we reallocate what we do not need, we will be able to begin new farming areas of this state and be capable of having culinary supplies for those folks who are moving into our state along with the needs of industry.

Properly-managed water resources step over into your area and includes properly-managed breeding areas for mosquitoes. You and I need to work together.

PERSPECTIVES ON THE UNIVERSITY OF CALIFORNIA MOSQUITO CONTROL RESEARCH PROGRAM

Russell E. Fontaine
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Davis, CA

This year marks the 10th anniversary of the University of California Mosquito Research Program organized in 1971. In some respects it is a unique program in the University system, and I would like to touch briefly on the reason for its formation, the objectives, the organization, the administration, the type of research, the progress made and perspectives for the future.

The program is defined as, "a goal-oriented University-wide, coordinated mosquito research effort aimed at solving mosquito control problems in California."

Goal-oriented means that the research is directed toward meeting the needs of California mosquito control. Some basic research is supported, but the main thrust is applied research.

University-wide means that the program is open to participation by researchers in all nine campuses and schools in the University system. In this way, the program has access to all the University's research resources.

Coordinated implies the program is centrally administered and directed and that the research is subject to peer review by research advisory and evaluation committees. In addition a coordinator is appointed to centralize communication, to mobilize resources to monitor progress, to advise on research direction, to evaluate the research, to implement research committee recommendations and to report on progress.

There is no other coordinated research program in the University that encompasses all nine University campuses. It is a special arrangement reserved for coping with extraordinary problems not normally amenable to standard administrative procedures. When the program was funded in 1971, the mosquito problem in California was considered sufficiently critical to justify a very extraordinary organizational arrangement.

The background leading up to the program is a long, involved story but can be briefly summarized as follows:

In the late nineteen sixties, most of the 60 mosquito abatement districts were facing serious deterioration in control standards due to generalized mosquito resistance to virtually all commercially available synthethic insecticides. Since the advent of DDT in World War II, nearly all of the MADs had relied almost exclusively on broad spectrum insecticides as the backbone of their control operations. In effect they were spray-dependent districts, without alternative controls to fall back on against resistant pest and vector mosquitoes. Their problem was further complicated by tighter EPA restrictions on registration of new synthetic compounds and the escalating cost of insecticides.

The situation in the late 1960's was described as a crisis in control because practical alternatives to pesticides were simply not available. Apart from mosquito fish, biological control had not advanced much beyond the laboratory stage. Our knowledge of the ecology of mosquitoes and the use of mosquito predators, pathogens, and parasites in the breeding habitat had only scratched the surface.

There was total agreement that what was needed was an accelerated research effort to put new controls on the line to get away from total dependence on insecticides. An array of control measures was needed that MADs could select from to meet their special needs for an integrated mosquito management strategy.

With this objective clearly in focus the University backed by the California Mosquito and Vector Control Association won legislative approval for a special appropriation to support an expanded coordinated mosquito research effort in the University system.

In 1971-72, $300,000 was appropriated for a University-wide Mosquito Research program organized as a coordinated, goal-oriented University effort, involving the Division of Agricultural Sciences, the Schools of Public Health, Cooperative Extension and the nine University campuses. The funds were not intended as a replacement for other mosquito research support but as augmentation and seed money to attract extramural funds to ensure continuity of an adequate program.

In 1980, funding for mosquito research in the University system from state, federal, industrial, and international sources totaled approximately $2,022,040. This is broken down as follows: state and university $1,173,240; federal $824,560; mosquito abatement districts (MAD) $6,740; international $9,750, and industry $1,850.

In addition, the California Mosquito Abatement Districts stepped up their research activities in three ways: by direct grants to UC researchers, by providing assistance in kind (materials, equipment, facilities and labor), and by conducting independently supported investigations.

The program organization is shown in Figure 1. It is headed by the Assistant Vice President, Agricultural Sciences and Director of the Experiment Station. The coordinator's broad function is to work with all components of the program: the three research evaluation committees (CMVCA, Mosquito Research Technical Committee (MRTC), and University-wide), the researchers, the CMVCA, the MADs, Cooperative Extension, national and international agencies and other institutions, societies, and commercial groups associated with mosquito research and control.

The research projects are generated by a University-wide call for proposals. These are reviewed and evaluated by the research committees who submit their recommendations to the Assistant Vice President for final decision.

Research Categories

Since the beginning of the program, the research has been grouped into the following categories:

Vector Borne Diseases	Chemical Control
Genetic Control	Physical and Cultural Control
Biology and Ecology	Application Equipment
Biological Control	

This range of categories provides a balance to the research as a basis for development of integrated control. The studies on Ecology and Control of Arthropod-Borne Viruses is our oldest project under Dr. William Reeves. His research has produced scientific information on disease transmission and behavior and habits of the vectors. This has enabled development of a control technology in California to prevent epidemics of three mosquito-borne diseases: western equine encephalomyelitis and St. Louis encephalitis and malaria. Encephalitis has virtually disappeared as a clinical disease from California while in some other states, major epidemics have occurred. However, we know from the statewide virus surveillance system that virus is ever present in the *Culex tarsalis* mosquito population.

Canine heartworm disease is growing in prevalence in California and we now have a good picture of the distribution of the disease from recent studies. Several vector mosquitoes are involved in transmission and not only one as was previously assumed. Human cases occur in California. The worm will produce a coil lesion in the lung, but it is not fatal.

Genetic Control

Genetic control is potentially one of the most cost effective and useful natural controls. It is species-selective, limiting reproduction and survival by a process of self destruction. A study on Genetic Control Systems in *Culex tarsalis* for possible application in integrated control programs conducted by Sr. Monica Asman is only one of three projects in the nation and two of four worldwide. The question is: Will we see genetic control as a practical control method for MADs in this century? An earnest attempt is being made but with very limited funds.

John Anderson, working in cooperation with Monica Asman at UC Berkeley, has successfully developed a mass production technique for *Aedes sierrensis* sterile males. The mating competitiveness of wild and laboratory strains of irradiated sterile males has been verified and marking males with fluorescent dust did not affect their survival and longevity.

Mosquito Biology and Ecology

There is a growing appreciation of the importance of mosquito biology and ecology as researchers and control workers alike strive to develop integrated mosquito control. The category of research is aimed at adding to the knowledge of the behavior, habits, survival rates, host preferences, and other characteristics of pest and vector mosquitoes, and also to elucidate the interaction between mosquitoes and their parasites, pathogens, and predators in the aquatic habitat. There are three projects being supported in this area: the Relationship between Blood Meals and Egg Development in Mosquitoes, the Population Dynamics of *Aedes sierrensis*, and the Population Biology of Adult *Anopheles freeborni*.

Biological Control

Biological control is the largest component of the program with a dozen projects covering pathogens, parasites, and vertebrates and invertebrate predators. Among the bioagents being researched only the mosquito fish, *Gambusia affinis*, is presently widely used operationally. However, we are beginning to see a rising interest in the use of nematodes, flatworms, notonectids, and other insect predators for integrated control. The Delano MAD in the San Joaquin Valley has taken the initiative to rear and use nematodes and notonectids routinely in their integrated operations. The Sutter-Yuba MAD has recently introduced nematodes for operational use.

Bacillus thuringiensis israelensis (Bti) has been extensively researched in the UC research program since 1977 when a small sample was brought over from Israel for testing at UC Berkeley and UC Riverside. It was registered this year for use in California mosquito control and should be a very useful addition for integrated control. Although Bti is a spore-forming microbial, its mode of action on the mosquito larval stage is insecticidal rather than infectious and there is no recycling effect. Therefore, functionally it can be categorized as a bio-insecticide.

Another microbial with near term promise for larval control is *Bacillus sphaericus*. Recent intensive evaluations of this bioagent indicates that it would be a good supplement to Bti in polluted larval sources where Bti is not as effective.

There is growing evidence that flatworms are important predators of mosquitoes in rice fields whenever present in large numbers. Studies are being intensified to determine how to exploit them for integrated control.

Chemical Control

Chemical control will continue to be an essential component of integrated control programs despite mosquito resistance, high cost and EPA constraints. The aim should be to use them selectively in conjunction with other controls in such a way as to avoid resistance and with safety to non-targets. Current studies include insect growth regulators, pyrethroids, and various natural products such as oviposition attractants, repellents, and novel mosquito larvicides derived from various plant products. Some show promise for mosquito control, but registration for use in mosquito control is an obstacle.

Research on mosquito resistance has shifted from testing to working on patterns of insecticide usage to inhibit or prevent the development of resistance. The potential of mosquitoes to become resistant to Bti toxin has been severely challenged by the Georghiou group (UC Riverside) but no evidence of developing resistance has been observed.

Research is progressing on development of a rapid, reproducible, and inexpensive immuno-assay for detection of Bti in the field.

Physical and Cultural Control

Physical and Cultural Control of mosquitoes is fundamental and cost effective; however, research has lagged due to the lack of researchable proposals. Only two projects were approved. One study on the environmental impact of mosquito control recirculation ditches on salt marsh biota revealed no harmful effects but indicated an enhancement.

Application Equipment

In the field of application equipment, the use of the laser beam to measure the droplet size spectrum of cold fogger machines appears to have some promise based on preliminary testing results.

Progress Made

Since the program is funded in part from state appropriations, it is subject to legislative scrutiny each year. To satisfy this requirement, a research progress report is prepared and submitted annually to the legislature. A question frequently raised by legislative committees is, "What has your research done for California mosquito control?" This is not an easy question because we find that research results are more often negative than positive and breakthroughs are rare.

After nearly 10 years of coordinated research what can we show for the effort? On close examination of the program, we find that much of the research has been necessarily expended in preparatory and developmental activities required to carry the research forward to a stage of field and operational use in the decade of the 1980's. However, some specific results can be identified in terms of impact on MAD operations.

1. The use of broad spectrum chemical pesticides has been greatly reduced and now stands at only a fifth of the level used ten years ago. Economic factors, together with improved oil larvicides, selective rather than mass application techniques, and biological control, implemented by the MADs, have all contributed to the reduction.

2. Integrated mosquito control is now an accepted control practice, limited in scope only by the availability of new methods and techniques.

3. The major mosquito-borne diseases, such as encephalitis and malaria, have been effectively suppressed, despite sources of infection within the state, and despite continuing eruptions of encephalitis epidemics outside the state.

4. We have one breakthrough in the development of Bti previously mentioned. Most of the basic research was done by UC.

5. Lately we have seen a definite trend toward greater recognition of the beneficial effects of insect predators such as notonectids, dragonflies, damselflies, diving beetles and many other aquatic organisms in mosquito breeding habitats. Studies on how to harness and conserve these natural controls as adjuncts to other controls offers great possibilities for boosting integrated control at no additional cost.

Much of the credit of these successes is due to the initiative and progressive attitude of California mosquito abatement districts. They have not passively waited for University research to provide new controls but have actively participated with University researchers in the evaluation of promising materials and methods. This research cooperation has reinforced and stimulated the University program.

The Future

It was Einstein who stated, "I never look into the future. It will come soon enough!" Nevertheless a look at the future is useful for planning our research in the nineteen eighties. There is one trend we can be sure of: Because of the high population growth rate in California, agriculture, industry, and urbanization is almost certain to expand. This is bound to impact on mosquito problems in several ways:

1. Recent trends would suggest that more mosquito problems will arise from reclamation and reuse of waste water for agriculture, industry, recreation, and wildlife enhancement. New sources of water are getting very scarce in California, and waste water reuse is the only recourse for a water-depleted state.

2. Irrigated agriculture will continue to expand because the demand for California agricultural products will continue to increase, limited only by the availability of water. Perhaps the concern with water conservation will improve water management and help keep the mosquito problem from getting out of hand. Farm advisors working with MADs and growers can help with this.

3. We are seeing a strong population movement to the Sierra Nevada foothill region where residential housing is springing up in all directions. New mosquito problems are being created from waste water disposal and from disruption in the natural flow of water courses in the hill counties, and this is being reflected in rising mosquito complaints.

4. Rice field mosquito problems will continue because of expanding production in all parts of the Central Valley and the lack of funds to cope with the vast areas under rice culture. Biological control offers the most economical solution to this problem because chemical control is economically infeasible and possibly counterproductive.

5. If we have adequate funds in the 1980's, some important new controls should emerge. We now have Bti and it's a good one, and there are many new strains being isolated that are better than the original product. Another bacterium, *B. sphaericus*, is close at hand.

6. Pesticides will continue to play an important role but more as an adjunct to other controls in an integrated mosquito control operation. The use of broad spectrum, synthetic insecticides on the basis of a mono-control strategy is a thing of the past.

7. We should see some improvements in mass rearing of *Gambusia affinis* from current University research, although this appears to be a much slower process than was anticipated a few years ago.

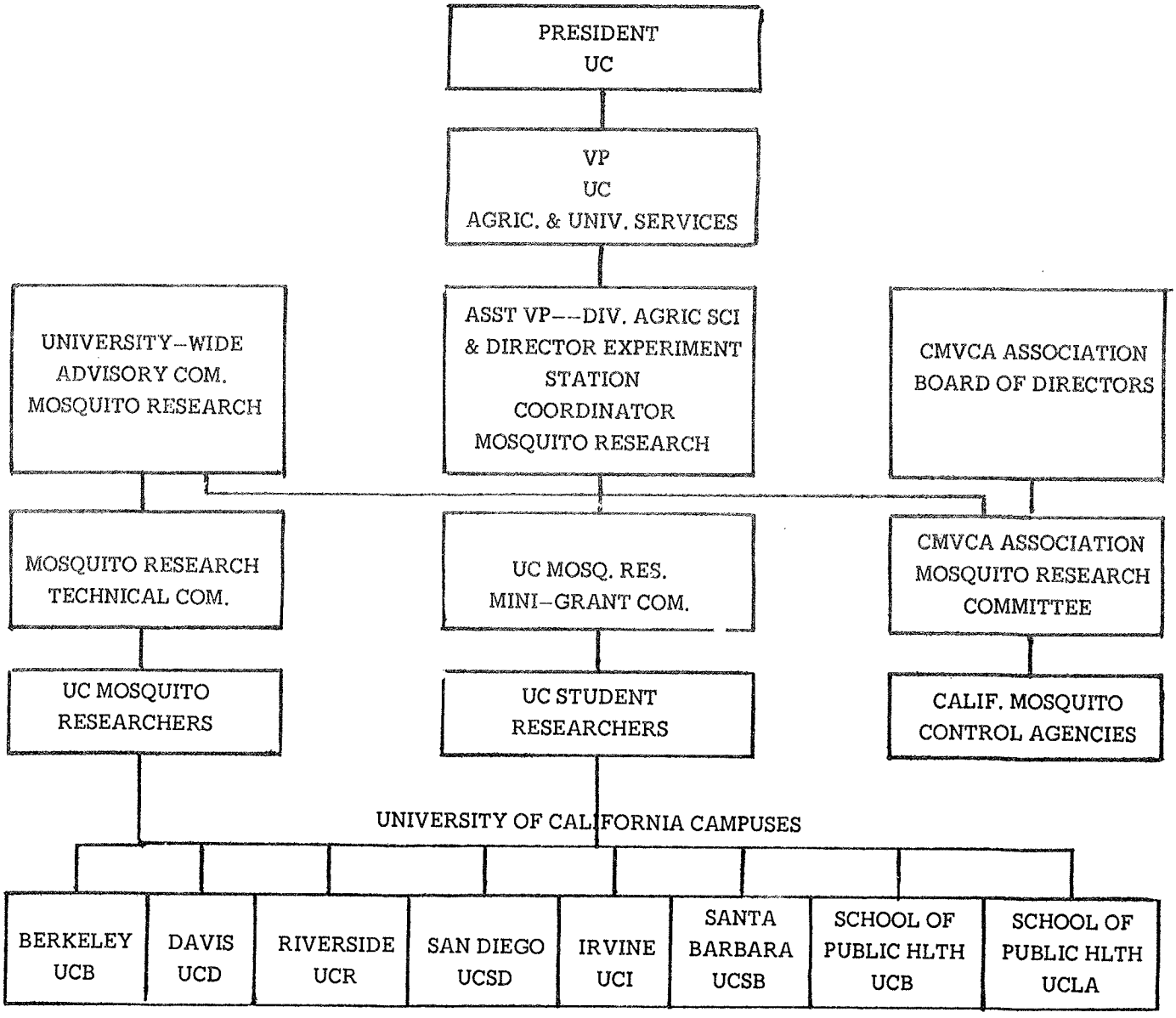
8. Progress in physical and cultural control in irrigated agricultural areas is less optimistic than other controls because many of the things that need doing are not researchable. We know what needs to be done. The problem is getting it done through a multidisciplinary approach involving MAD managers, farm advisors and growers working together to resolve many of the agricultural-associated mosquito problems that abound in California.

The University mosquito research program will continue to stress collaboration and participation of MADs and other agencies. We have financial and scientific contributions from MADs, state and federal units, foundations, industry and inter-

national institutions. The World Health Organization, in particular, has been an active international collaborator in biological control research.

It is our intention to continue the program along the same multidisciplinary cooperative lines and to intensify efforts to develop integrated control as a standard approach to mosquito control in this decade.

Figure 1. Program Organization



OUTLINE FOR SAFETY ON THE JOB

Truman Carver
Supervisor, Standards and Training
Occupational Safety and Health Division
Industrial Commission of Utah
Salt Lake City, UT

Cost of Accidents per Year

1. 100,000 killed
2. 11,000,000 disabling injuries
3. 83 billion dollars

Cause of Accidents

1. Poor job discipline
2. Lack of concentration
3. Unsafe practices or habits
4. Improper instructions
5. Supervisor's setting a poor example
6. Horseplay
7. Mentally or physically unfit for the job
8. Inexperienced or unskilled
9. Poor judgement

Principles of Accident Control

1. Engineering
2. Education
3. Enforcement

The supervisor is responsible for the enforcement of safety. Safety inspections are before-the-fact accident prevention. Attitude is the most important part of accident prevention.

HUMAN VECTOR-BORNE DISEASE UPDATE - UTAH

Craig R. Nichols, MPA
Director, Bureau of Communicable Disease Control
Utah Department of Health
Salt Lake City, UT

Mosquito control is much like the control of communicable diseases. Some years, all goes well; often, irrespective of our efforts, other years present innumerable problems. Fortunately, during the past 10 years vector-borne diseases have not been a major public health problem in Utah.

I would like to briefly review the vector-borne diseases which have been reported and investigated from 1971 to the present.

Figure 1 shows 33 cases of malaria in Utah from 1971 to the present. Twenty-one of the cases occurred from 1979 through 1981. Twenty of these cases were Southeast Asian refugees who relocated in Utah and one case was a Nicaraguan who was visiting in the state.

The seven cases in 1971-72 were the final military importations as a result of the Viet Nam conflict.

Foreign students from Pakistan and Nigeria accounted for the 2 cases in 1973-74. Only 2 Utah natives contracted malaria while traveling in foreign countries. Both cases occurred in 1975, one from New Guinea and one from Zaire.

At the bottom of Figure 1, the number of cases due to each *Plasmodium* species is listed. Most disease (82% of the total) was caused by *P. vivax*. Because malaria due to *P. vivax* has relapses and a protracted incubation period, as long as 8-10 months, many cases seen in refugees are actually chronic infections. When refugees are interviewed, most give a history of previous malaria attacks.

Three cases of *P. falciparum* malaria have been confirmed. None were chloroquine-resistant.

Several other unusual importations have been investigated. In 1979 one case of leishmaniasis was confirmed in a Salt Lake resident who had been working in the Middle East as an advisor at a dairy farm on the West Bank of the Jordan River. The patient reported numerous insect bites on the back, arm and leg which developed into extensive ulcerated lesions. The disease was compatible with cutaneous Old World leishmaniasis, rural type (Oriental sore).

Two cases of filariasis were reported in 1980. One patient, a Laotian refugee, had started to develop an elephantiasis of the right arm. The other patient most likely acquired her disease in Polynesia.

Of the most interest to mosquito abatement personnel is the incidence of the arthropod-borne viral encephalitides. Figure 2 lists the total cases of encephalitis in Utah from 1971 through September 11, 1981. Only 2 of the 55 cases were arthropod-borne. Both were confirmed through serological studies to be due to California group virus. The two patients, brothers aged 3 and 5 years, were residents of St. George, Utah. At the time of their illnesses, Nevada health authorities were investigating an outbreak of aseptic meningitis in the Virgin River Valley, especially near Bunkerville, Nevada, which they suspected may be arthropod-borne. Our investigation concluded that the outbreak was due to the enteroviruses which were causing illness throughout Utah. The brothers with California encephalitis most likely contracted their disease while vacationing in West Virginia. Because the usual incubation period for California encephalitis is 5-15 days, and the brothers became ill only 5 days after returning to St. George, these cases were not counted as Utah-acquired.

All 12 tularemia cases in 1981 have been related to insect bites. Over the past ten years, approximately 50% of disease was vector-borne and the other 50% was due to handling of infected carcasses or meat.

Figure 3 is a graph of reported cases from 1971 to the present. The peak in 1971 was caused by an outbreak near Delta and Grantsville, Utah. Twenty-eight of the cases in this outbreak of 39 cases were related to insect bites.

Most patients who develop tularemia as a result of an insect bite identify the vector as a deer fly (*Chrysops spp.*). Others are not able to identify the biting insect or report exposure to a variety of flies and mosquitoes.

Figure 4 shows the incidence of Colorado tick fever and Rocky Mountain spotted fever. This year has been an all time record for Colorado tick fever with 60 laboratory confirmed cases. Colorado tick fever is a viral disease while Rocky Mountain spotted fever is a rickettsial disease. Very few Rocky Mountain spotted fever cases occur each year and many are acquired outside of Utah.

There are no vaccines for protection against either of these two tick fevers. The Department of Health has stressed that repellents and protective clothing can reduce the number of tick bites.

During the spring of 1979, two cases of relapsing fever were reported from a group of biology students who stayed in a large cabin at Bryce Canyon National Park. No ticks were recovered from the cabin, but several rodent carcasses were found in the cabin's attic. It is suspected that the ticks were forced to seek human hosts when the rodents began to die.

Although we were unable to confirm tick transmission of relapsing fever, the rodent carcasses were sent to the Center for Disease Control (CDC) Laboratory in Fort Collins, Colorado for analysis. The CDC did confirm that the animals had died of plague.

Plague, another disease which is vector-borne, does occur throughout the Southwestern United States, including Utah. Fortunately, human cases are rare here, with only one case occuring during the past ten years. Plague enzootics which are common do not present a serious risk to humans.

Our present low incidence of vector-borne disease is not due to chance but is the result of past accomplishments and a sustained effort. I believe it is our duty to continually remind the policy makers that maintenance programs are not programs of the past. Rather, they are programs with a proven record of success which must be supported if we are to continue to enjoy our present state of health.

Figure 1. Malaria – Utah, 1971 - 1981*

1971	5
1972	2
1973	2
1974	1
1975	2
1976	0
1977	0
1978	0
1979	1
1980	16
1981	4
TOTAL	33

Species	
Plasmodium vivax	27
Plasmodium falciparum	3
Plasmodium malariae	0
Plasmodium ovale	0
Unknown	3
TOTAL	33

*As of September 11, 1981

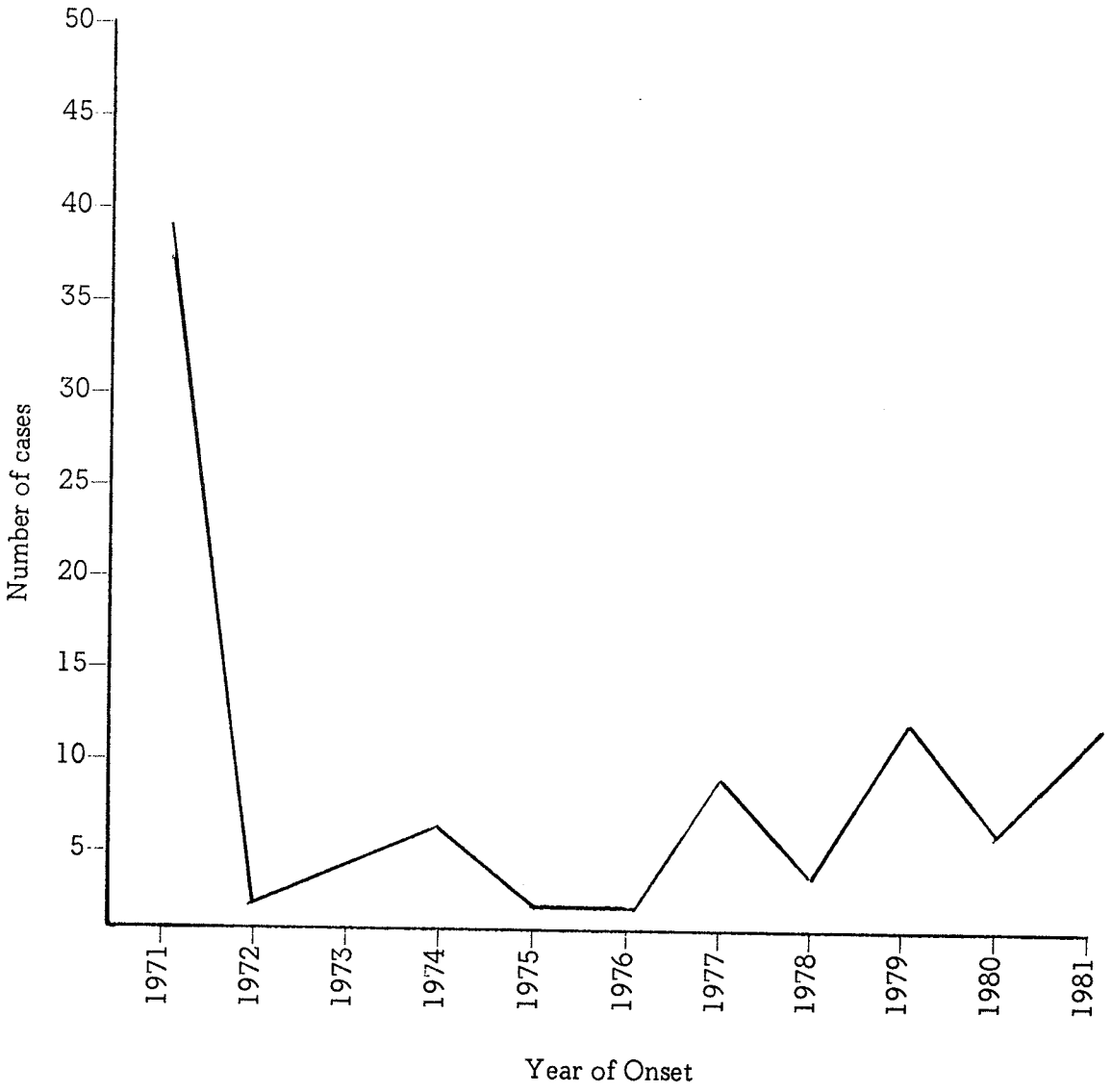
Figure 2. Encephalitis – Utah

Year of Onset	Number of Cases
1971	6
1972	2
1973	0
1974	3
1975	2
1976	6
1977	4
1978	1
1979	16
1980	7
1981*	8
TOTAL	55

Etiology	
Echovirus	18
Coxsackievirus	2
Adenovirus	1
Herpes simplex	5
Measles (Rubeola)	5
Influenza	1
Chickenpox	1
Arthropod-borne (California group)	2
Bacterial	2
Unknown	18
TOTAL	55

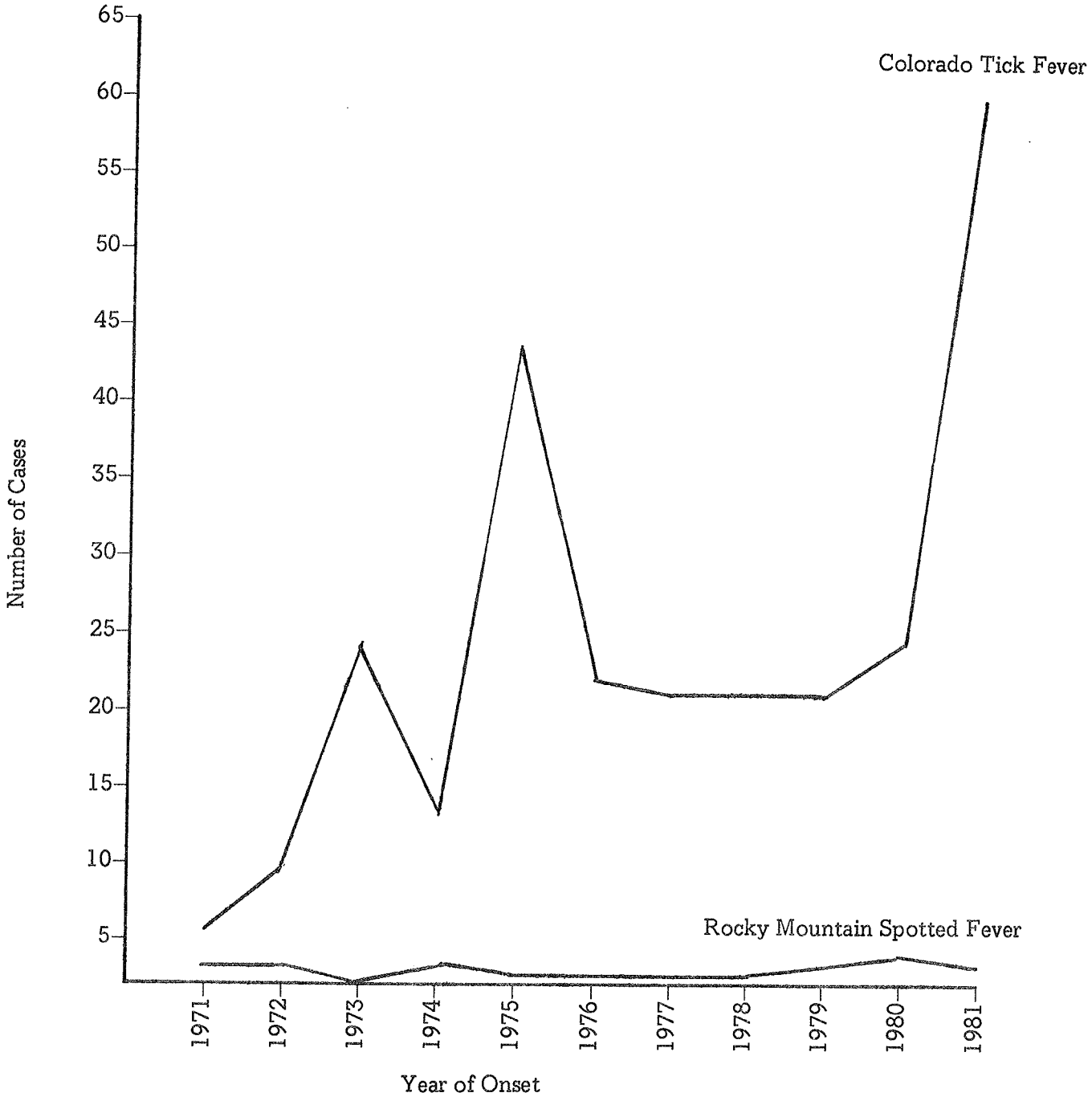
*As of September 11, 1981

Figure 3. Tularemia -- Utah, 1971 -- 1981*



*As of 9-11-81

Figure 4. Tick Fevers – Utah, 1971 – 1981*



*As of 9–11–81

ENCEPHALITIS SURVEILLANCE IN UTAH – 1974 – 81 REPORT

Lewis Marrott
Utah County MAD
Provo, UT

Encephalitis surveillance in Utah was started in 1958 by the Salt Lake City and South Salt Lake County Mosquito Abatement Districts. The program included *Culex tarsalis* population studies, weather conditions, monitoring mosquito production, and the use of sentinel chicken flocks. The present program, initiated in 1974, includes previous activities but introduced live mosquito virus surveillance.

At the present time the encephalitis surveillance program is involved in the following activities: Virus isolation, mosquito aging, sentinel chicken flocks, wild bird serology, equine virus activity, human virus activity, mosquito abatement practices in relation to encephalitis virus, and compiling, coordinating, and disseminating information relating to encephalitis virus. The program is funded through the cooperative efforts of the Utah mosquito abatement districts, the Utah Mosquito Abatement Association, the State Department of Agriculture, the State Department of Health, and the University of Utah.

Basically, the encephalitis virus is transmitted by the vector, a mosquito, from biological reservoirs such as wild birds, domestic fowl, and reptiles to the host, man or equine In our area, *Culex tarsalis* has been found to be the principal vector of western equine encephalitis. Other common mosquitoes such as *Aedes dorsalis, Aedes nigromaculis, Aedes vexans, Culex pipiens, Culiseta inornata,* and *Anopheles freeborni* are known to transmit several viruses.

Annually a budget for the ensuing year is presented for approval which includes cost of laboratory work, equipment, salaries, travel, bird serology, and educational material. An estimate is also given of each district's costs for the collection of mosquito specimens.

Each month throughout the summer, a budget summary is prepared and a discussion of mosquito activity in relation to encephalitis surveillance takes place at the Utah Mosquito Abatement Association's monthly meeting.

Detection of virus activity in mosquito populations is felt to be the most meaningful type of surveillance because results can be available shortly after collections are made. CDC light traps are placed in strategic locations with high mosquito populations and with high human and equine activity such as in recreational areas. Mosquitoes are collected the first of each week from areas throughout the State and transported to a central laboratory in Salt Lake City where they are identified by species and placed in pools for testing. At the University of Utah Virus Research Laboratory, the pools are ground, and the liquid extract is injected into the brains of suckling mice. If a suspicious reaction occurs, the cerebral material is passed into other mice after which the virus is identified by tissue culture methods. Two positive pools were isolated during 1981. Identification of the virus is pending. Table 1 shows the numbers of mosquito pools submitted by MADs for virus testing during 1981. Table 2 is an annual comparison for the past eight years of the seasonal duration and the number of pools.

For a mosquito to transmit encephalitis virus, two blood feedings must occur. Therefore, the age of the mosquito population being sampled is important. Throughout this past season, samples were taken from specimens collected for virus isolation tests. These mosquitoes were dissected and the reproductive organs examined to determine the number of ovarian cycles the females had experienced, thus estimating the chronological age of the mosquito. Results of the dissections are given in Table 3. It was concluded that a reasonable portion of the mosquito population sampled was surviving long enough to transmit virus and the placement of CDC traps was adequate for collecting older mosquito age groups.

In some areas of the State, it was impractical to transport live mosquitoes over long distances for live virus isolation work. Therefore, sentinel chicken flocks were placed in Cache, Uintah, and Emery Counties. The chicken flocks were bled monthly throughout the summer. The blood specimens were packed in ice and transported to the University of Utah Virus Research Laboratory, centrifuged, and the serum was frozen and stored for final testing.

Wild bird serology has been done in past years on sparrows with negative success. Other workers have shown that perhaps encephalitis viruses overwinter and may be transported in some wild bird populations.

Horses are big business in Utah. Encephalitis virus activity is of great concern from breeders to persons with one or two horses in their back yard. Each year there are a number of suspected horse cases scattered throughout the State. When an infected mosquito feeds on a horse, localized infection occurs at the bite, a viremia develops, and the central nervous system is affected. If an accurate diagnosis is to be made, an acute blood sample must be taken followed by a convalescent sample two weeks later. If a titer change is evident, encephalitis is diagnosed for there are many illnesses with similar symptoms. It is important to know for certain the actual illness to protect other horses in the herd and in neighboring areas so vector control and vaccination can protect other horses.

Young horses are more susceptible to western encephalitis. Permanent damage is common and the mortality rate is 20-30%. The following are symptoms of equine encephalitis: Early febrile reaction with temperature representing the viremic phase, restlessness and mild excitement, and as the illness progresses, the animal may walk in circles, crash into fences and other objects, refuse to eat, stand with its head depressed with lower lip hanging, fall asleep standing or when eating. There may be paralysis of parts of the body and death may occur.

Horses are not the only victims of encephalitis. Humans are also affected with old and young being susceptible. The symptoms may vary considerably. Convulsions with restlessness and irritability are common. In children the symptoms are headache, vomiting, and a stiff neck. In adults there may be drowsiness, lethargy, fever, stiff neck and back, severe occipital headache, mental confusion, stupor or coma. The mortality rate is 2-3%.

If an encephalitis outbreak occurs, and to avoid unnecessary confusion, the lines of communication with the State are shown in Fig. 1.

Table 1. Number of pools of female mosquitoes by MADs – 1981.

	Cx. tarsalis	*Cs. inornata*	*Ae. dorsalis*	TOTAL
Box Elder	4	0	0	4
Weber	35	0	0	35
Davis	104	0	0	104
Salt Lake City	9	0	0	9
Magna	16	0	3	19
Utah	16	1	0	17
Emery	9	0	0	9
TOTAL	193	1	3	197

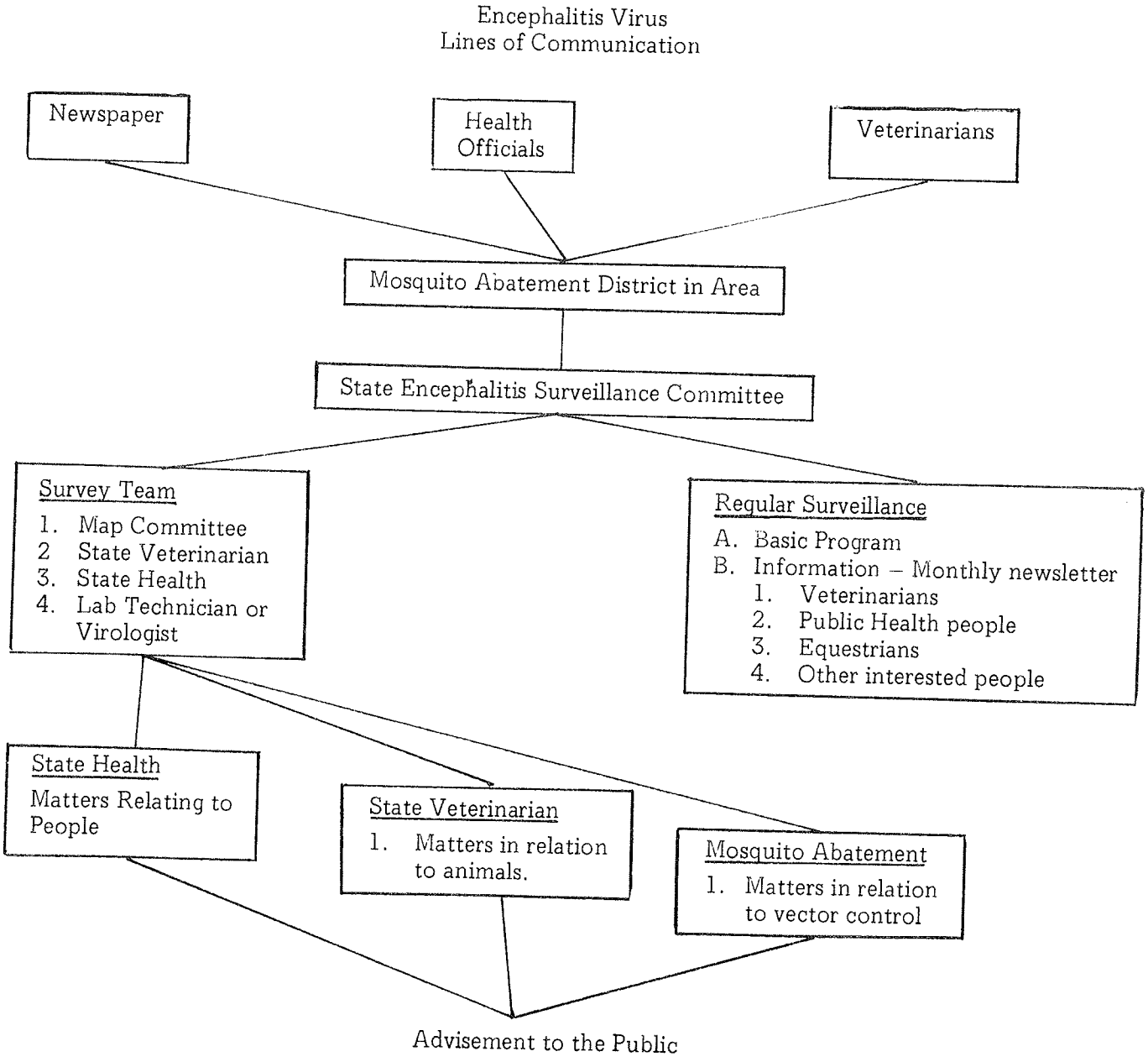
Table 2. Comparison of number of pools of female mosquitoes and seasonal duration by year.

	SEASONAL DURATION	NUMBER OF WEEKS	NUMBER OF POOLS
1981	16 June – 1 Sept.	12	197
1980	11 June – 29 Aug.	12	161
1979	26 June – 5 Sept.	9	88
1978	13 June – 6 Sept.	12	112
1977	7 June – 13 Sept.	14	193
1976	8 June – 28 Sept.	16	149
1975	1 July – 16 Sept.	12	122
1974	11 June – 24 Sept.	15	114

Table 3. Results of dissections of female *Culex tarsalis* mosquitoes during 1981 by MADs.

	NUMBER DISSECTED	PERCENT PAROUS
BOX ELDER	56	34
WEBER		
Sta. 1	56	25
Sta. 2	56	38
Sta. 3	73	11
Sta. 7	84	15
Sta. 8	84	25
Sta. 10	19	10
DAVIS		
New State Gun Club	437	14
Farmington Bay	278	17
Bay View Gun Club	240	22
Rouche'	242	32
SALT LAKE CITY		
UPL Substation	16	44
Tippetts	16	0
MAGNA	232	20
UTAH		
Provo Boat Harbor	43	9
Mud Lake	52	4
Provo Dump	44	11
State Park	16	12
Powell Slough	9	56
EMERY	7	0
TOTAL DISSECTIONS	2060	

Figure 1. State of Utah Plan of Action



ANIMAL VECTOR–BORNE DISEASE UPDATE IN UTAH

F. James Schoenfeld, DVM
State Department of Agriculture
Salt Lake City, UT

EQUINE ENCEPHALOMYELITIS

The equine encephalitides constitute a group of diseases of the equine characterized by similar clinical nervous disturbances with generally high mortality. These arboviruses can infect a variety of other animals including man.

The disease creates a public health problem. The horses may be infected with group A arboviruses which includes EEE and WEE. The group B includes VEE. In Utah, we are mostly concerned with WEE even though we do see some EEE.

The WEE and EEE viruses that we see in Utah are maintained in nature by bird, rodent, or reptile reservoirs from which the infection is transmitted to horses or man by biting insects -- principally mosquitoes of the genus *Culex*. Mosquitoes act as vectors in which the viruses multiply. Wild birds serve as the principal reservoir.

A presumptive diagnosis may be based upon clinical signs, history, and seasonal occurrence. Diagnostic support is obtained from the results of positive virus neutralization or hemagglutination-inhibition tests on acute phase and convalescent serums. We should also consider differential diagnoses for botulism, rabies, other forms of encephalitis, tetanus, listeriosis, fungal toxicosis, chemical poisoning, plant poisoning, and disease hepatitis.

Nine cases of equine encephalitis were reported during the 1981 season. Some details of the cases are listed below. The disease can be prevented by vaccination of horses in the spring and by control of the vectors.

Thanks go to the many people in the mosquito abatement program for their management of water, control of vectors, surveillance of mosquito populations, and bird-bleeding and virology services.

ENCEPHALITIS CASES IN UTAH – 1981

Date	County	Laboratory findings	Veterinarian
July 30	Duchesne	WEE	D. Dennis
August	Utah	WEE	J. Thomas
August 21	Utah	WEE	R. Porter
August 26	Utah	NEG.	R. Porter
September 5	Kane	WEE & EEE	D. Urie
September 15	Tooele	WEE	A. Clark
September 22	Salt Lake	WEE	L. Taylor
September 29	Sevier	WEE	D. Utley
September	Grand	WEE	D. Hoffman
October 4	Duchesne	WEE & EEE	M. Isom

ANAPLASMOSIS

Anaplasmosis is a preacute to chronic infectious disease of ruminants characterized chiefly by anemia, icterus, and fever. It is transmitted mechanically through dehorning, bleeding, and vaccinating. It can be transmitted by the bites of ticks, horse flies, stable flies, and mosquitoes. These vectors transfer the disease by means of the proboscis which carries fluid blood from infected cattle to susceptible cattle when bloodsucking is interrupted. The passage must be immediate to be effective.

Rich and Davis counties had the greatest number of infected animals this past year.

BLUETONGUE

Bluetongue is a noncontagious insect-borne virus disease of sheep, cattle, goats, and wild ruminants. The principal biological transmitting agent is the biting midge of the genus *Culicoides*; thus the disease is generally seasonal.

Bluetongue is becoming a great concern to Utah cattle breeders who have developed a large foreign market. Many sales have been lost because of the blood titers for bluetongue carried by the animals. The sheep industry is also threatened and a continual program of vaccination is required.

STATE BEE REGISTRATION PROGRAM AND MOSQUITO CONTROL

Ed Bianco, State Entomologist
Utah Department of Agriculture
Salt Lake City, UT

Every year, most often in the spring and early summer, our office will receive calls from irate beekeepers complaining about bee kills from pesticides. Sometimes these calls are as frequent as several times a week. Very often the caller will accuse the mosquito abatement district. These accusations may or may not be true, but when a beekeeper finds dead bees around his hives that appear to have died from pesticide spraying, very often the nearest mosquito abatement district gets blamed.

However, it has been my experience that the directors and personnel of the mosquito abatement districts in Utah do try to work with the beekeeping industry to do all that is possible to protect our honey bee population.

I think a good case in point occurred in July of 1976 when there was an emergence of mosquitoes in the northwest part of Salt Lake City. Because of many complaints, a decision was made to use both aerial and ground applications of ULV malathion to control the mosquitoes. Considering the need for extra precautions because of two apiaries located in the area to be sprayed, the beekeepers were contacted. They were told it was necessary to spray to control the mosquitoes and that every precaution would be taken to protect their bees. The bee yards were checked with the beekeepers the evening after spraying, and a minimum of dead bees was found. The beekeepers were thankful for the efforts of the mosquito control district and the precautions that were taken to protect their bees. Had they not been contacted, I'm sure the story would have been quite different. I think this is a good example of how mosquito control districts can cooperate with beekeepers to help protect bees from pesticides that are necessary for mosquito control.

To help you in your efforts to cooperate with beekeepers, the Utah Department of Agriculture has updated and changed the State Bee Laws and Regulations. We now require identification of all beehives with the owner's registration number printed on the outside of a hive to aid in identification. Oftentimes in the past, it was impossible to contact the owner of an apiary because no one knew who the hives belonged to. The State Entomologist's office will now have a list of beekeepers with registration numbers and a list of county beekeepers available to all mosquito abatement districts.

SUMMARY

1. Mosquito abatement involves good P. R. work.
2. Pesticides are a necessary part of mosquito abatement.
3. Pesticides can be used effectively in mosquito control and still minimize bee kills.

BLACK FLY CONTROL IN SALT LAKE COUNTY

Kenneth L. Minson, Supervisor Black Fly Control
South Salt Lake County MAD
Midvale, UT

ABSTRACT

A black fly survey and control program was initiated in South Salt Lake County in the winter of 1979-80. An extensive survey was conducted throughout 1980-81 to determine the major sources of black fly production and where treatment would be most economical and feasible. 24C registration for Abate and methoxychlor was obtained in 1980 with the Abate label being withdrawn in September 1980. Detailed monitoring of the fly population in streams and canals plus work on non-target organisms is in the future to ascertain ecological problems that may arise from pesticide pressure.

REVISED CONSTITUTION OF THE UTAH MOSQUITO ABATEMENT ASSOCIATION

Adopted at the 8th Annual Meeting of the Association – 1955
Revised at the 13th Annual Meeting – 1960
Revised at the 25th Annual Meeting – 1972
Revised at the 28th Annual Meeting – 1975
Revised at the 30th Annual Meeting – 1977
Revised at the 34th Annual Meeting – 1981

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 shall be any individual who has performed oustanding 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 officers of the Association shall be President, President-Elect, Vice President, and a Secretary-Treasurer. The Officers shall be elected at the annual business meeting by a majority vote, except for the Secretary-Treasurer who is appointed annually by the Board of Directors and the President who is automatically succeeded by the President-Elect. 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. He shall name members of the committees with consent and approval of the Board of Directors at their first meeting during his term of office. 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. He shall function as Program Chairman for the Annual Meeting held during his term of 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 Vice President shall assist the President and the President-Elect with the duties of these offices as directed.

Section D. The Secretary-Treasurer shall keep full and correct minutes 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 Associ-

ation shall be signed by the Secretary-Treasurer and one other officer of the Association. 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 new person to serve in this capacity.

Section E. 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 a Secretary-Treasurer for the Association and to discharge him,

(c) 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,

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

(e) to prescribe the duties of officers of the Association not otherwise prescribed in the Bylaws of the Association,

(f) 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,

(g) 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,

(h) to accept or reject applications for memberships in the Association, except Honorary Membership, and to prescribe 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. Election of officers of the Association shall be by majority vote at the annual meeting of the Association. Officers 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 the funds (over and above all liabilities) then in the hands of the Secretary-Treasurer.

TITLES PUBLISHED ONLY

"Aquatic Weed Control." Dale Carpenter, Technical Representative, Magna Corporation, Meridian, ID.

"Drainage Problems and Highway Construction." Glen Collett, Manager, Salt Lake City Mosquito Abatement District, Salt Lake City, UT.

"*Aedes niphadopsis* – A Closer Look." Sammie Lee Dickson, University of Utah, Salt Lake City, UT.

"Eastern Equine Encephalitis in Michigan 1980-81 – Review of Current Arbovirus Activities." D. Bruce Francy, PhD., Chief, Arbovirus Ecology Branch, Vector-Borne Diseases Section, Ft. Collins, CO.

"Dealing Effectively With the News Media." Dave Jonsson, Reporter, Salt Lake Tribune, Salt Lake City, UT.

"Activities of CMVCA." Don Merritt, President, California Mosquito and Vector Control Association, Selma, CA.

"AMCA – Long Time Champion of IPM." Thomas D. Mulhern, Executive Director, American Mosquito Control Association, Fresno, CA.

"Corps of Engineers Permit System – Wetlands." Jerry Newell, Environmental Planner, Corps of Engineers, Salt Lake City, UT.

"Mosquitoes of Newfoundland." Lewis T. Nielsen, PhD., Professor, Department of Biology, University of Utah, Salt Lake City, UT.

"Current Events in Florida Mosquito Control." William R. Opp, Staff Engineer, Office of Entomology, Jacksonville, FL.

"The Hazardous Wastes Program of Utah." Dale Parker, Director, Hazardous Waste Management, State Department of Health, Salt Lake City, UT.

"A Rotary Ditcher in Drainage and Water Management in Davis County: A Beginning." Rex Passey, Manager, Davis County Mosquito Abatement District, Kaysville, UT.

"Teknar – A New Formulation of BTI." Mike Svoboda, Sandoz, Inc., Crop Protection, San Diego, CA.