Proceedings of the

Forty-Fourth Annual Meeting

of the

UTAH MOSQUITO ABATEMENT ASSOCIATION

Held at the

State Line Convention Center

Wendover, Nevada

September 22-24, 1991

Edited by

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MERITORIOUS SERVICE AWARD

The Meritorious Service Award is presented to persons who have furthered mosquito abatement efforts in Utah in a manner far exceeding what they have been asked to do. This award was first presented by the Utah Mosquito Abatement Association in 1970. **Rex Passey**, in 1991, becomes the 20th individual to receive this award.

Rex Passey served as the manager of the Davis County Mosquito Abatement District from 1976 through 1989. Although Rex received compensation for a part-time position, he treated the job as a full-time occupation. The devotion Rex gave to his work resulted in a mosquito abatement district that the taxpayers could be proud of.

Mr. Passey served on most of the UMAA committees, including Wildlife Resources and Water Management, where he was very effective as a liaison between the needs of State and Federal wildlife agencies and mosquito control. Rex has earned the respect of all mosquito workers in Utah.

Rex continues to serve; he is currently on the Board of Trustees of the Davis County Mosquito Abatement District. The UMAA is proud to present this award to our friend and colleague, **Rex Passey**.

AMCA UPDATE: BACK TO BASICS

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Last year I talked a little about perception problems facing those of us in vector control. I went into some detail about the public's attitude about our work and our attitude about the problem. I noted that societies' attitudes about pesticides and the value the public places on mosquito control had shifted to a greater degree than we were aware. We had been, I said, too busy doing good science to realize that good science was not enough in our present society. I did not go into detail, but I also mentioned that we had left some of our field workers behind and that the American Mosquito Control Association (AMCA) and we managers were not serving their needs adequately. We are not malicious. We are not insensitive. We are not inadequate. We have simply been acting on our perception of what the world is. A perception formed in our early years. We were "brainwashed", to use a term familiar to us baby boomers.

This year I would like to see if we can begin to understand the basis for the shift in the public's attitudes about insecticides, and understand why as managers, and as an association, we have reduced services to operational members of the AMCA. I believe we can better remedy the problems if we understand the reasons for these problems. I will first talk about the public's perceptions and then address the perceptions in the AMCA that have led us away from one of our primary missions of serving operational members. I will then tell you what the Board of Directors (BODs) of the AMCA is doing to correct some of these problems.

We were a different society in the 1940s and 1950s. Society was different and mosquito control workers were a reflection of that society. A review of what mosquito control was like in the forties can help us understand what has happened since then and perhaps will be a clue as to how we can bring about positive changes to deal with some of our current problems.

The following excerpts from Mosquito News give a very clear account of some of the things that helped determine the public's attitude about mosquito control during the late 1940s, all of the 1950s and much of the 1960s. Consider this quote:

> "Strangely enough, the malaria we see in New York City comes from Cario, all the way from Egypt. It seems that drug addicts there found they got a greater kick out of heroin when they took it intravenously or by "shooting the main line" as they call it. Moreover, if a single addict could not afford to buy heroin at the retail price he "chipped in" with five or six others toward the purchase or a wholesale supply. Then they would all gather in a group and take their "shot" using the same syringe. One of them had malaria and passed it along in a syringe to his friends and it's been going that way ever since," (Most 1941).

We were naive about many things then. Not so now, even children know about and are exposed to drugs daily in our schools.

Mosquito control workers were perceived as being on the leading edge of science in the 1940s and 1950s. Consider the following:

> "Mosquitoes Declared Guilty Sleeping Sickness Carriers-Washington (U.P.) -- One of the most baffling mysteries of medical science was believed solved last night with a government announcement that mosquitoes carry sleeping sickness," (Anonymous 1941c).

The public's perception of mosquito control and mosquito control workers was very different then. Consider this quote:

> "Mosquito Extermination, once a subject of ridicule and amusement in the public press, has now taken the spotlight of public attention. Popular magazines, newspapers, trade and organization papers, all have seen how closely the control of the mosquito is linked with the successful prosecution of the war in areas where the mosquito-borne diseases occur. Valuable educational articles, for which publication

was secured formerly only with considerable difficulty, now appear almost daily.

All of this means a public that is mosquito control conscious. We may look for even greater public interest in the post war period when men return home who have had malaria or have seen their comrades fall ill because of it, and when the thousands who have avoided this disease only because of the training or protective service furnished them in the armed forces are home to stay. These men are not going to stand idly by and allow mosquitoes to continue unabated. It thus appears that in the post war period we shall see great strides toward the ideal of a mosquito-free community.

Mindful of the widened scope of interest in mosquito work, the Eastern Association has caused to be prepared a new constitution which would permit ready nationalization of the organization if it is adopted," (Mulhern 1944).

And finally, the public was very involved in supporting mosquito control, as is shown in this quote:

"Mrs. A. S. Chenoweth, Chairman, Mosquito Control Committee of the New Jersey State Federation of Women's Clubs and author of the interesting booklet "Companion to Mosquito Study", has again contributed a valuable idea to the publicity side of mosquito control in New Jersey. She suggested a slogan on a sticker to be used on envelopes by all the Commissions in New Jersey which has been attached below,

MORE EASE, LESS DISEASE
NEW JERSEY
MOSQUITO CONTROL," (Anonymous 1941b).

Mosquito control and mosquito control pesticides were being lambasted in Lake Charles, Louisiana, when I left Louisiana Saturday. Similar attacks have been made all over the country in recent months. Why are we vulnerable now when we were so popular just 50 years ago? What has happened to change public perception and opinion and why has it happened?

In the 1940s following World War II and into the fifties and sixties, we experienced phenomenal growth and prosperity, in part as a result of pesticides. This was all accomplished by people born before 1940: No baby boomers in this group. Things were too easy for many of us baby boomers during the fifties and sixties. We baby boomers got what we wanted when we wanted it and did not realize the time and effort which went into producing the wondrous new things we took for granted.

We baby boomers, and our parents, began to worship science during this period. And, when we found in the 1960s that science was sometimes wrong, we became bitter, disillusioned, angry, frustrated and fearful. I think some of our generation and many of our disciples...the younger brothers and sisters and the youngsters a few grades behind us in school...became even more angry with science because of our attitudes.

Sputnik... Who remembers where you were when it went up? Sputnik changed our world forever. We became overnight a country of scientists, out of fear. We all became scientists because our society, our parents, and our country (the good old U.S. of A.) said we should. Then, incredibly, we could not get jobs. Our country had overproduced scientists. We felt that we had been betrayed by our parents, our teachers and our country. But we did eventually get jobs, at salaries higher than we had ever dreamed possible. Perhaps we had too much money and too much spare time.

We were angry people in the sixties and seventies when Rachel Carson's book, Silent Spring, came along. Perhaps we were angry because of unfulfilled dreams or unrealistic expectations. Or, perhaps we had bought into someone else's dream in our efforts to become scientists and we were angry about that. For whatever reason, we seemed to blame our parents, our country, our teachers and anyone else in authority for everything we perceived as wrong. And everything, in our opinion, was wrong. So we bought into all of Silent Spring and became activists to save our planet and ourselves from anyone in authority and those awful chemicals. The same chemicals which gave us a quality of life unprecedented in human history. We had longer lives, lower death rates in every age group, less disease and shorter duration of disease, hot and cold water, and heat (even in poverty level housing). But, we did not appreciate it. Our parents thought it wondrous because it was new to them. It was the norm for us. These wondrous things had been around all our lives.

Incredible, isn't it? The workers of the forties and fifties, without questioning anything, produced incredibly. The baby boomers of the forties and fifties questioned everyone and everything in authority and consumed incredibly. However, I think many baby boomers have begun to reassess issues, and many of us have matured in our thinking. Perhaps we baby boomers and our children worked too hard at enjoying all the affluence of the sixties and seventies to take time to mature then.

Dr. Bruce Ames is a good example of one who has reassessed his position on issues of the sixties. Dr. Ames is the one who developed the Ames test for detecting and identifying carcinogens. He even used the test to have several products removed from market shelves because of their "potential" for causing cancer. He believed then that carcinogens at any level were bad. Listen to what he says now.

> "Synthetic pesticide residues do not present a significant risk to either children or adults," (Ames 1990).

He also states that:

> "Evidence from both epidemiology and toxicology suggests that synthetic pesticide residues are not likely to be a significant cause of cancer," (Ames 1990).

Unlike Dr. Ames, however, there are a number of exceptions to the maturing process that many of us baby boomers have gone through. It seems to me that media people have stayed in the sixties and seventies in their thought processes about pesticides. Or, they are keeping the matters alive and engaging in selective and biased reporting for personal reasons. And, unfortunately, the 20 and 30 year old children of baby boomers who are entering the work force now are like most disciples and they continue to over react and do not trust anyone in authority. They mirrored us well, and magnified our "over reactive" attitudes.

So, what does all this mean? I am not sure. But I do see signs of encouragement. Dr. Ames and other researchers are beginning to set the record straight now. Their perspectives have changed and they are beginning to give us all information that will help us, and our neighbors, readjust our thinking processes in a manner consistent with the facts.

I believe that reason will eventually win out in mosquito and vector control too, if we will become active in identifying underlying causes of perception problems and work diligently at improving our public image. We are unlikely to ever have the status we had in the 1940s and 1950s in vector control, at least in this country. However, the tide does seem to be turning on public perception in the area of pesticides. But, we must continue to be very diligent in working on our public image and getting the facts out or we could be in serious trouble. I am convinced that the National Research Defense Council has targeted mosquito control in the United States. We must not let our guard down and we must become more vocal in our communities. To paraphrase Benjamin Franklin, it is essential that we hang together or we shall surely hang separately. It is most important now that you be either a regular member or an associate member of the AMCA and add your strength to our mutual cause!

We were so involved in professionalism and good science for the last few years in the AMCA that we failed to meet the needs of some of our members. And, in some areas some of our members perceived that the AMCA was not doing very much when, in fact, we had been quite active. If you read the last issue of the AMCA Newsletter, you saw where I detailed several areas where some of our AMCA members feel we are falling short in serving them and the needs of Mosquito Control workers across the country. I think these failures and the perception of shortcomings, are because we have gotten away from some of the basics. So, how does the AMCA fix it?

Obviously, part of the solution is in identifying the problems. So, the AMCA will involve the board members and committee chairpersons in identifying problems, defining goals, and establishing a plan of action. Since all officers pay for their own travel and some board members can not get their agencies to fund travel for a special meeting, we have arranged to have a workshop to accomplish all this just before the AMCA Board meeting in Corpus Christi, Texas, in March of 1992. That way we can go into the board meeting on Sunday, March 17, 1992, with clearly defined goals and objectives.

The AMCA will continue to provide the services provided this year by the Scientific and Regulatory Liaison Committee. This committee was successful at getting language into HR-1330 that recognizes the importance of public health in developing and applying wetlands policies. You should review this legislation and contact your legislators and let them know how you feel about it. It may make the difference as to whether or not we can continue to work in some wetlands areas which have historically been major mosquito producing areas.

Sally Wagner and the AMCA Public Relations/Public Education Committee has been working on a project that will improve the image of mosquito control with children. This committee is developing a board game that is entertaining and educational. It can be used in the home or at school, and Sally says that some schools are already interested in the project even though the prototype has not been developed. Mosquito control does not "sell papers," so we do not get air time on radio and television with nearly enough frequency. If we want a positive image in mosquito and vector control, we must "buy" it. So, this AMCA committee may need contri-

butions from MADs to complete this project. Industry has indicated that it likes the project and will support it financially. However, it will be perceived as just another industry project and as industry propaganda unless we also support it financially. We need to show AMCA involvement by backing this project. We also may need financial backing from individual mosquito abatement agencies. You may be called on to contribute $10, $30, $50 or $100 from your agency. This project is still in the formative stages. I hope we will hear more about it during Cy Lesser's year as president of the AMCA.

WING BEATS is new but it is an excellent publication and it is allowing us to exchange ideas about daily mosquito control operations. By learning what others are doing, we can improve our operations. By sharing what you are doing, you can help others improve their operations. We need your input just like Mosquito News needed Contributions in 1941. An editorial comment in 1941 about Mosquito News stated,

> "The success of this medium for exchanging information of value to all of us will depend entirely on the interest, cooperation and contributions from every possible source. If such contribution of material is not forthcoming, your committee will have nothing to print. From now on, we urge you not to wait for a solicitation from the committee to send material. Write up anything that might be of interest to others in the work and send it on to the committee," (Anonymous 1941a).

So, help Wing Beats become as successful as Mosquito News. Contribute your idea now.

We now have the AMCA's first full-time executive director. His name is Mark Vinsand, and he has absolutely no background in mosquito or vector control. Mark is an association management specialist. He comes from a family of association managers. Both of his parents are association managers. He has won special recognition from his professional association as one of the most promising young association managers in the country. He is one of only a handful of people to receive this recognition. Mark Vinsand will help the AMCA in many areas and contribute greatly to our association. We know he is going to be able to negotiate better deals for our meetings, which will result in lower costs for members and increased revenues for our associations, both state and national. He is also developing a standardized registration procedure that will make things flow smoother for everyone. It will produce an instant membership list update, an immediate list of non-members (who can be contacted and encouraged to join the association) and updated addresses for current members. These are great ideas. I wish some of us had thought of them sooner. But, that is why we hired Mark. He has the expertise to do the job. We hired him because we needed someone who knows association management to manage our association. We can then get on with the business of managing the things we know best--our vector control programs.

We are also working to get a better handle on the costs of publishing the Journal of The American Mosquito Control Association. This is one of the premier services offered to AMCA members but it is expensive. We are working to balance the costs in a way that will allow us to continue to provide a quality journal without bankrupting the Association. We hope to resolve this in Missoula, Montana, on Saturday.

We have begun to work at streamlining and coordinating committee activities to speed up the process of getting good ideas into action plans. This has been a problem in the past and we are dealing with that now. And, the addition of a full time executive director will assist us greatly in this area. Communicating with committees, the board of directors and AMCA members has been a problem. Poor communications have delayed implementation of many good ideas. And, poor communications have resulted in many perception problems for the Association. It is difficult to communicate effectively with a membership as diverse as ours. And, since most of us do not travel a lot outside our regions during the course of a year, this increases the degree of difficulty in communicating and developing programs and services for AMCA members. One of our major goals is to improve and facilitate communications among members. Wing Beats is one of the tools we are using to do this. We must, however, do more.

There are some things under consideration and review by committees that you may wish to communicate with your regional director (or other officers) about so that your feelings are made known. These ideas are in committee, so you still have time to communicate your feelings and have a say in the direction the AMCA takes.

We had a very successful spanish speaking symposium at the AMCA meeting in New Orleans, Louisiana this spring. One of your committees is considering adding a french language symposium at the annual meeting. This same committee, the Worldwide Committee, would also like to explore the idea of conducting regional meetings outside the United States.

For lack of an editor, the cost of publication and the degree of interest, we may discontinue publication of the literature references section in the Journal. Most

university personnel have easy access to numerous other indexing services and do not use this service. A few of you may, however, have an interest in seeing it continued. If so, make your feelings known soon.

There has also been some discussion of developing a working relationship with The Society for Vector Ecologists. This might allow the AMCA to provide a service to them to save and reduce their expenditures and provide income for the AMCA.

There has also been some discussion of placing more emphasis on "vector control" in the publications and the annual meetings since many of our agencies are involved in activities other than mosquito control. I do not anticipate any immediate action in this area, but there is strong interest.

I will present an idea to the AMCA Board in Missoula, Montana, on Saturday concerning a plan which would provide for accreditation of mosquito and vector control agencies. A committee, chaired by Gil Challet, will be appointed to study the idea and report back to the BODs if the board agrees to pursue this matter. Dr. Sammie Dickson is to be a member of this accreditation committee. I would like to see a program established whereby the AMCA would, at the request of the agency, provide a peer review of individual mosquito abatement and vector control programs. The AMCA Peer Review Committee would use the Elements of a Vector Control Program as a guide for evaluating individual programs. The AMCA peer review committee would "score" the agency in several areas and make comments about strengths and weaknesses that the agency could use to further improve their mosquito abatement program. If the agency scored above some yet to be determined score, the agency would be accredited or certified by the AMCA.

The mechanism is already partially in place to initiate an accreditation procedure (Challet 1991). Bob Hyde, president of AMMIA Insurance, has indicated that his agency would give discounts up to 20% off the agencies insurance premiums to those mosquito abatement districts who successfully complete the accreditation procedure. This would represent a substantial savings to some of our mosquito and vector control districts. He mentioned one agency in New Jersey which would save as much as $7,000 on their insurance premiums. In some agencies, the cost of the accreditation procedure could be off set by savings in insurance premiums. Another possible benefit is that it might discourage politicians from raiding mosquito abatement district budgets to provide funds for other pet projects. For example, a politician who took funds away from a good disease surveillance program might be more than embarrassed when the media got hold of information that it would lower that agencies score on the accreditation process. Our public is already aware of the importance of a good ratings for fire departments and that the fire department ratings affect personal insurance premiums in an area. This kind of publicity could create a bad perception problem for a politician.

The accreditation program will have to be designed so that agencies with small budgets are not measured by the same yard stick as agencies with large budgets. Differences in geography, mosquito fauna, political considerations and many other matters will have to be factored into the accreditation process. However, I do think it can be done and that it will provide a needed service in mosquito and vector control. The program, if recommended by the committee and accepted by the AMCA Board, will probably be funded by fees from the agencies which request that they be included in the accreditation process. I do not anticipate that an agency which chooses not to participate will have any additional cost as a result of this proposed new AMCA service.

We have been busy. The AMCA has been trying to get back to basics by doing basic things. The following summary applies to our activities in the AMCA as we attempt to deal with the issues and perceptions we face in our organization. However, the comments are also applicable to how you and I handle our daily operations and how we relate to the public.

We are recognizing that some problems exist in the AMCA and that they must be dealt with. This includes recognizing the importance of public perception and AMCA member perception. We are planning to use the AMCA organizational workshop in Corpus Christi, Texas, to identify, define, and target areas where we need to focus our efforts. The BODs of the AMCA will use the information we gain from the workshop to develop a plan to attack our problem. We will involve every AMCA member willing to participate in our plans--operational workers, commissioners, academicians, etc. We will communicate, communicate, communicate. Finally, we will coordinate, coordinate, coordinate. A similar approach to perception problems from without and within is also a good idea for those of us who manage vector control programs.

The AMCA needs you to be a member of our organization. If you have not already joined, please join as either a regular member or an associate member. We need your skills, your talents, your numbers, your political contacts and your expertise. We must be united and of

one accord if we are to overcome our present difficulties with public perception. You could very well be the person who makes the critical difference between whether we reach our goals or fail. Please join with us and contribute your talents.

REFERENCES CITED

Ames, B. 1990. A forum: Are children at greater risk. EPA Journal. 16(3):28-29.

Anonymous. 1941a. Editorial Comment. Mosq. News. 1(1):1.

Anonymous. 1941b. Untitled. Mosq. News. 1(2):30.

Anonymous. 1941c. Mosquitoes declared guilty sleeping sickness carriers. Mosq. News. 1(4):18-20.

Challet, G.L. 1991. Elements of a vector control program. J. Amer. Mosq. Control Assn. 7(1):103-106.

Most, H. 1941. Epidemic malaria in New York. Mosq. News. 1(4):22-23.

Mulhern, T.D. 1944. Business of Eastern Association, News of the Association. Mosq. News 4(1):6.

RECENT DEVELOPMENTS IN PESTICIDE REGISTRATION

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Introduction. When I last spoke to this group, the 1988 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) had just been passed, and the future of the use of public health pesticides was uncertain. Three years has elapsed and the re-registration process by the Environmental Protection Agency (EPA) is now well underway, with many of their deadlines now past. EPA's Endangered Species Protection Program, first announced in July, 1989, has moved ahead, with important implications for public health use of pesticides. I offer now what might be considered to be a status report on pesticide use for mosquito control, along with my view of what the future holds in this area. Much of the data I will rely on for this is furnished by EPA in a packet of information on re-registration which was distributed widely (EPA 1991a, 1991b). I also considered data from the California State Department of Health Services on pesticide use. I emphasize that my perspective is from the State of California, and specific details will vary for other states.

Re-registration of pesticides. Before I continue it might be best to provide a recapitulation of recent federal legislation that has had the greatest impact on pesticide use in mosquito control. The most significant is undoubtedly the 1988 amendments to FIFRA. You will recall that pesticide registration (then by USDA) began with the original FIFRA in 1947. The 1988 amendments called for the accelerated re-registration of nearly all pesticides to conform with modern, more stringent test data requirements. This re-registration was to take place in five phases. Phase 1, which was completed in 1989, called for EPA to publish lists of pesticide active ingredients subject to re-registration and to ask registrants whether they intended to seek re-registration. Phase 1 resulted in 4 lists of pesticides, according to their registration status at that time, and according to their probable human or environmental hazard:

List A comprised 194 groups of active ingredients for which EPA had already released re-registration standards (identified the data gaps). Included on this list were allethrin, *Bacillus thuringiensis,* carbaryl, chlorpyrifos, deet, diflurbenzuron, fenthion, malathion, methoprene, naled, resmethrin and temephos.

Lists B, C and D contained about 500 groups listed according to their probable environmental or human hazard, with the B list being of most concern, the D list the least. Although the grading of these 3 lists is explained in recent EPA publications, it was not easily discernable at the time the lists were originally published. On list B was diphacinone, permethrin, piperonyl butoxide, pival, propoxur, and pyrethrin. Lists C and D contained few ingredients used in mosquito control pesticide formulations.

Phase 2 was completed in 1990. In this phase, registrants responded concerning their intention to re-register and identify missing or inadequate studies needed for re-registration. Phase 3 was also completed in 1990. Registrants summarized and re-formatted existing studies for EPA review and certified the existence of "raw" data needed for re-registration. Phase 4 was completed in July of this year. In this phase, EPA completed its review of submissions, identified data gaps, and issued requirements for additional studies.

From this brief review one can see that the original re-registration process has continued along pretty much on schedule and that many significant checkpoints are now behind us. Still remaining is Phase 5. EPA will complete the re-registration process by either re-registering or canceling existing registrations. For some products, something called a re-registration eligibility document (RED) has been issued. Issuance of a RED means that EPA is satisfied with the data that have been submitted and that the product can be registered. To date, only a hand-full of REDs have been given out, and by the end of the year, the number should be about 15 (EPA 1991 b).

I should say something about the "more stringent data requirements" that are often alluded to, but seldom explained in detail. Under present regulations, registration data must include information on the chemistry, environmental fate, toxicology, and ecological

effects on any candidate material. Further, all data must have been gathered under EPA's Good Laboratory Practices standards, to assure the quality and integrity of data submitted. These standards are extremely complex and require not only the periodic calibration of all testing equipment and the chemical analysis of all test reagents, but also a comprehensive system of record keeping and inspection of laboratory activities.

EPA's Endangered Species Protection Plan. In July, 1989, EPA proposed a plan by which certain pesticides could not be used within the range of any endangered species. This plan was in response to pressure from various groups who contended that EPA's registration of pesticides constituted "authorization," and that the federal Endangered Species Act stipulates that no federal agency may carry out or authorize any act which may jeopardize any endangered species (EPA 1991c). Because of various problems with the original proposal, including the very poor state of information regarding ranges of species, EPA has delayed implementation of the plan, and has changed from a "pesticide cluster" approach to a case by case approach. Primary emphasis will be on endangered species whose status is most fragile. The California Mosquito and Vector Control Association and the American Mosquito Control Association have developed a Public Health Emergency Exemption procedure which has been accepted by EPA for use in cases where a genuine threat to public health exists within the range of an endangered species. Earlier this year a workshop was held in California detailing the procedures to be followed in cases where a public health emergency exists because of the threat of vector-borne disease, and where the presence of an endangered species may prevent the effective control of the disease threat.

The procedure involves local vector abatement agencies, state (or federal) public health agencies, the federal EPA and local and federal fish and wildlife agencies. The plan is too complex to explain in detail, but generally it involves procedures to be followed well in advance of an actual public health emergency because of vector-borne diseases in those instances where a local abatement agency believes certain indicators make an eventual emergency likely. These indicators include things like abnormal precipitation, unusually large vector populations, high incidence of pathogen-infected vectors, seroconversion of sentinel chicken flocks, or cases of zoonotic disease in domestic animals. If treatment must eventually be done within the range of an endangered species, and all other options have been considered and discarded for suitable reasons, treatment may be done under Section 18 of FIFRA to protect human health and lives. Section 18 of FIFRA is short and I'll quote it: "The Administrator may, at his discretion, exempt any Federal or State agency from any provision of this Act if he determines that emergency conditions exist which require such exemption" (EPA 1988).

In California, a state EPA has been created, and they have shown themselves to be active players in pesticide regulation early in their lives. They have already announced a deadline for the submission of registration data and registrants who missed the deadline have been notified that suspension of registration action has been initiated on the pesticides for which data have not been submitted.

Current status of mosquito pesticides. EPA's information on the re-registration of pesticides reports that the number of pesticide groups (of active ingredients) is down from 600 to 400. Pesticide manufacturers and formulators have notified EPA that they will not seek re-registration for about half of the List B, C, and D pesticides. The number of product registrations is down to 20-25,000 from 45,000. About 15 RED's should be done by the end of the year, including methoprene for mosquito control use (EPA 1991b).

In California, the situation from where I sit looks like this: Registration is current for both state and federal EPA, and re-registration seems likely for the following mosquito insecticides:

1. **Malathion.** The re-registration process continues, and malathion will probably be re-registered for mosquito use. Re-registration for mosquito use is supported by the Malathion Re-registration Task Force. Use in California is up to 62,607 pounds for 1990 after many years of gradual decline in use (23,025 pounds in 1988, 15,771 pounds in 1989).

2. **Methoprene.** A RED has been issued by EPA. In California, 5,040 pounds were used in 1990.

3. **Pyrethrum.** This was on EPA's List B. I have heard of no re-registration problems on the horizon, but availability in the United States is a big problem. A total of 1,004 pounds were used in the state in 1990.

I mentioned earlier the California EPA has begun a suspension of registration process because of failure of registrants to submit re-registration data by the March 1, 1991, deadline set by California Senate Bill 950 (State of California 1991). Those pesticides are:

1. **Deet.** There are, according to California EPA, 72 registered products containing deet, with 116,000 pounds sold in the state in 1989.

2. **Fenthion.** This is registered only for mosquito control in California, but no mosquito abatement district in the state reported using any in 1990.

3. **Resmethrin.** There are 221 products registered in California, with approximately 7,800 pounds sold in 1989. Of this, 2,285 pounds alone were used for mosquito control. In 1990, this had dropped to 1,389 pounds.

4. **Rotenone.** This material is not a public health pesticide, but I include it here because of the irony of the situation. Rotenone is allowed for insect control qualified to be a Farm Certified or California Certified Organic Farmer.

There are some products which are no longer sold in California, and usage is limited to the exhaustion of existing stocks. Those materials include:

1. **Chlorpyrifos (Dursban).** Usage in California is down to 557 pounds in 1990. Use in California as an adulticide has been dropped from the label.

2. **Propoxur (Baygon).** Usage in California is essentially down to nothing.

3. **Temephos (Abate).** Usage in California is also down to almost nothing.

It is generally believed that no one will support re-registration of ethyl parathion (parathion) for mosquito control. On September 5, EPA announced that it has reached a settlement agreement with registrants of the product whereby most uses would be voluntarily canceled immediately, and further that EPA intended to cancel the remaining uses in the near future (EPA 1991d).

The future of mosquito control using chemical pesticides. A few years ago it was difficult to make a prediction about the future of chemical pesticides. Now it is easy, and I would guess that any one of you in the audience could come very close armed with the information that is currently available from EPA and other sources. Malathion could be the sole remaining conventional chemical pesticide used in California for mosquito control. No research on conventional pesticides is presently being conducted under the University of California Mosquito Research Program. Insect growth regulators, microbial insecticides, biological control agents, and breeding source modification will be the basis for mosquito control.

I hope that I do not paint a picture that sounds pessimistic or suggests that mosquito control as we know it is doomed. I do not believe that to be the case. There are many positive signs for a strong mosquito control enterprise as we begin to enter the next century. Here are a few:

1. EPA has granted an unconditional registration for *Lagenidium giganteum* (California strain, mycelia plus oospores) for mosquito control use. Registration by California EPA has been requested.

2. EPA registration for *Bacillus sphaericus* is under review.

3. Dr. Charles Schaefer of the University of California is now conducting research on insecticidal plant extracts, and has several promising leads.

4. Research on new types of insecticides based on mosquito reproductive hormones and enzymes that degrade reproductive hormones is underway at the University of California at Davis.

5. Research on improved formulations of microbial insecticides as well as searches for new microbial products is ongoing in a number of laboratories. Furthermore, research on mode of action, resistance mechanisms, and entirely new products produced through recombinant DNA technology is being done at many places.

Summary. I leave you with these thoughts:

1. The age of control of mosquitoes by conventional (broad spectrum) chemicals is fast coming to an end.

2. We need to adapt to this change and to be aware of the need to study new methods of testing and bioassay, new modes of action, and new physiological responses by mosquitoes which may lead to resistance.

3. We must maintain in reserve some effective fast-acting pesticides which can be used in the case of a public health emergency. It is well to have an Emergency Public Health Exemption plan in place, but it will be of little use if there are no effective and available materials.

4. The use of "third generation" pesticides will not be without regulatory, economic and ecological problems. It took many years and considerable public expense to obtain EPA registration for *Lagenidium giganteum*. When EPA first announced its "cluster" approach to its Endangered Species Protection Program, several "third generation" products appeared on its matrix of hazard evaluations. It is well to remember that there is probably no such thing as a completely safe pesticide, especially when one considers possible effects on non-target arthropods and other invertebrates.

5. The public does not always make a distinction between conventional pesticides and highly specific materials such as *Bacillus thuringiensis*, and it is our job to educate people concerning the characteristics of the materials we use for mosquito control.

6. Supply of newly developed mosquito pesticides will continue to be a problem. Highly specific materials usually have a smaller market for manufacturers than do conventional materials. Presently there is no producer for *Lagenidium*.

7. Finally, I urge all of you to continue to be aggressive in your efforts to protect the health of the public. Sometimes this goal gets lost in the shuffle, but there is no reason why public health professionals should ever have to be on the defensive, unless it is because we have folded our tents and gone away.

REFERENCES CITED

EPA. 1988. The Federal insecticide, fungicide, and rodenticide act as amended. U.S. Environmental Protection Agency Publication 540/09-89-012, October 1988. 73 p.

EPA. 1991a. Pesticide reregistration. U.S. Environmental Protection Agency Publication 21T-1004, March 1991. 13 p.

EPA. 1991b. Pesticide reregistration progress report. U.S. Environmental Protection Agency Publication 21T-1006, May 1991. 11 p.

EPA. 1991c. EPA's pesticide programs. U.S. Environmental Protection Agency Publication 21T-1005, May 1991. 25 p.

EPA. 1991d. EPA announcement on parathion. U.S. Environmental Protection Agency, Environmental News, September 5, 1991. [Press release and supplemental materials, 3+11 p.].

State of California. 1991. Suspension process begins against pesticides with data gaps. Department of Pesticide Regulation. [Press release and supplemental materials, 2+4 p.].

MEDIA MANAGEMENT OR DON'T PANIC

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Clearly with people becoming more and more aware of vector control agencies and their plight in the control of many target species it became evident, in Washoe County, Nevada, that the public would need help. The help I selected some 10 years ago was from the media. Washoe County District Health Department uses the media in vector control to its fullest in a positive fashion. Some 10 to 20 news releases and presentations are given on average per year. These reports cover chemical application and evaluation, target species, equipment, possible disease outbreaks or anything to do with the program in question that the media considers newsworthy.

Remember, during interviews, that in some cases the simpler, the better, i.e. when talking about control measures in larvicide or adulticides. Try to remember that the average person will not know what is being said, unless it's explained without all the technical jargon that we sometimes forget and use on anyone willing to listen.

1. Always be courteous and pleasant when being interviewed.

2. Try to get the ground rules set before the interview; ask questions of what the interviewer wants.

3. Be truthful and don't hide anything.

4. Encourage the reporter to get involved with what you're doing, i.e., dipping larva, sitting in the aircraft before taking off for the close of his or her interview, sitting in a truck while setting up to spray, having the reporter ride along in the District's amphibious vehicle.

Since many of these things are different than what people normally do, they will enjoy the experience of being involved with a positive aspect of vector control.

5. Don't look directly into the camera. While the camera does not have teeth or a brain, I've found that there is something intimidating about them so I never look at the camera, but rather at another object or person when speaking.

6. Normally, you will know at least a couple of hours before an interview, so dress accordingly (coveralls, Levi's and work-shirt for outside; nice shirt, tie and slacks for inside).

7. If a reporter becomes pushy, abusive or is changing the context of your report, you do have a recourse; contact the reporter's production manager. If still no satisfaction or agreement is reached, go to the following with your case: Assignment Editor, News Director or Station Manager. In most situations, these misunderstandings can be resolved without damage to either party.

In conclusion, working with the media in Washoe County District Health Department has helped us give all residents of northern Nevada some education and positive insight into all facets of vector control, before, during and after the occurrence of newsworthy information.

BARRIERS IN MOSQUITO CONTROL OPERATIONS IN DEVELOPED WETLANDS

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Washoe County was named after a tribe of American Indians which inhabited the area. On September 9, 1850, Congress created the Territory of Utah which included the present day Washoe County. In March 1861, Congress created the Territory of Nevada. With the discovery of the Comstock lode came the populations to inhabit Nevada and Washoe County. Washoe County's present population is approximately 250,000, with 130,000 in Reno and 60,000 in Sparks.

Washoe County District Health Department is located in Reno. The inception of our current interlocal agreement was September 27, 1972, though as far back as 1902 we've had a bona fide city/county health agency.

Washoe County consists of 1,195 square miles of which approximately 58,500 acres are under surveillance and control for mosquito activity. Plague and rabies surveillance and treatment is mostly confined to populated and adjacent areas, but does not exclude rural camping and hunting sites.

Most people envision Reno as a very populated resort community consisting of cement, asphalt, and tourists. It's also a place where people live and conduct business. Many of these homes and businesses are situated adjacent to agricultural and wetland areas. Because of a booming increase in population, open lands are giving way to housing and the once safe interface between humans and the wild animal population is diminishing.

Washoe County District Health Department's Vector Control works in four main areas, plague, rabies, ticks, and mosquitoes. Our programs consist primarily of three facets: surveillance, control, and education, with our basic purpose being that of disease prevention.

Plague surveillance is accomplished through host rodent population monitoring, rodent and flea sampling and testing, and responding to citizen service requests. Control measures are directed against the vector fleas. Rodent burrows in identified problem areas are dusted, with special emphasis being given to "high use" areas, e.g., parks, schools, and campgrounds. Education is implemented through: public service announcements, community and school presentations, in-service workshops for Health Dept. personnel, animal control officers, park rangers and aides, Humane Society personnel and individual public inquiries.

Rabies surveillance is conducted primarily in response to citizen requests. Specifically, specimens of high risk species are picked up and tested with the cooperation of our State Animal Disease Laboratory. Also, known bat colony populations are monitored. Our role in rabies control is the investigation and quarantining of domestic animals that have been exposed to a high risk species. We also investigate any reported exposure of a human to a high risk animal, as well as certain bites by domestic animals that the animal control agencies do not handle. Once again education is accomplished via public service announcements, school presentations, in-service workshops and on an individual basis.

Our activities in the area of ticks have been somewhat limited due to a lack of budget and personnel. Minimal surveys of species present in the area have been conducted and the Nevada Department of Wildlife has been very cooperative in helping with deer hunter check station surveys. We also identify specimens submitted by the public and advise on associated tick borne diseases. Education is through individual contacts, literature and our hunter awareness program.

Additionally, we respond to citizen requests for a wide variety of other arthropod related problems, e.g., cockroaches and identification of various unknown specimens.

In all of these areas we maintain a close working relationship with our epidemiologist, Pam Young. In suspected human exposures she is our liaison to the medical community.

In mosquito control we have a unique situation, at least to us. It involves the modified use of wetlands for community and recreational development. Have you noticed that we rarely use the word swamp these days? Today the buzz word is wetland. Some have slightly

different ideas of just exactly what these terms mean. Actually these words have legal definitions. A wetland consists of an area which supports specific plant species and is covered by water for definite periods of time.

Attitudes have changed towards these areas. In Nevada we seem to have a fascination with water, probably because it is such a rare commodity here. Our recreational activities tend to focus around it, from fishing to waterskiing to bird watching. This fascination has extended into where we choose to live. Our most costly homes are located on creeks, rivers, and lakes (consider Lake Tahoe). And, where there is no water we go to extreme lengths to put some, for example, ornamental ponds, streams, etc.

What we seem to be seeing more of is the "Planned Community." This is a place where one can live where one plays. The next step should have been predictable, residential and recreational development of wetlands. The specific problem we are currently struggling with is just such a development.

Up until about 1989 this area was a healthy marsh. What we have today is an 18-hole golf course and surrounding planned community built on this existing 180 acre wetland. The area has provided ideal habitat for both migratory and local waterfowl and various shore birds, offering feeding, nesting, and resting sites. It has also supported a wide variety of predator species, e.g., hawks, owls and coyotes. It has been used for cattle grazing along the drier margins, waterfowl hunting, and as a natural filtration system for agricultural irrigation tail water and runoff.

We have made ourselves a part of this marsh community. Of the original 180 acre tract some 100 acres have become golf course. To the east is Hidden Valley and to the west and south is Donner Springs, both residential areas. Together these areas have a population of approximately 15,000 people. The area to the west is currently being developed for multiple family housing. The areas to the south and east are being prepared for single family homes. When complete, these new residential areas will add another 1800 people to the community.

The marsh receives water from several creeks and one major irrigation ditch. There are several control structures on the main channels. When closed, they can flood a considerable amount of ground. The water level fluctuates with upstream usage, thus we have several *Aedes* species present including *Ae. melanimon, Ae. nigromaculis, and Ae. dorsalis.* Also present are a number of permanent water species, most prevalent are *Culex tarsalis, Cx. erythrothorax* and *Culiseta inornata.*

Prior to regulatory constraints and development our agency maintained an attitude and commitment toward preservation of sensitive ecosystems. This has extended throughout all of our activities from surveys to spray applications. Physical controls such as channeling, while a very real option in the early years, was not implemented in order to preserve this great water-fowl habitat. Biorational materials have been in use since their registration. We selected vehicles that would have the least amount of negative impact on the terrain. Further, we have always tried to use them in an environmentally conscious manner. These methods worked. We were able to achieve adequate control without significant damage to the wetland. With the new golf course, housing, and community attitude enters a new factor: appearances.

While these methods inflicted little or no real damage to the marsh, today they are visually unacceptable. The fact that golf course rules prohibit retrieval of golf balls from anywhere beyond posted wetland boundaries illustrates the degree of scrutiny that the area is now under. Thus, even foot traffic is considered aesthetically detrimental. The golf course meanders around and through the marsh. One can no longer exist without the other.

Where does all this put mosquito control? Certainly control is even more critical now. People are now living and playing in an integrated marsh community. The marsh is fairly typical in vegetation with cat tail, tule, willow, various marsh grasses and sedges. It is atypical, however, in its abundant growth of white top. This occurs in those areas only flooded intermittently. White top is a noxious weed (*Lepidium latifolium*). It is very invasive and a great colonizer. Height may exceed 5 feet, and can be dense enough to prohibit penetration of virtually all chemical formulations excepting sand, dense pellets and briquets. Walking through it is nearly impossible. It is, obviously, quite tolerant of intermittent flooding and has become so well established as to constitute an integral part of the plant community. Thus, the appearance of even this weed is something that must now be considered.

We have been forced to resort to frequent aerosol applications of adulticide to achieve even minimal control because of these real and imposed barriers to larvicide techniques. The larval treatment options are: ground application (with all-terrain-vehicles), hand application

(backpacks or briquets), aerial applications and *Gambusia affinis* transplanting.

Ground treatments have given acceptable control levels, but have drawn criticism for disturbing the appearance of the vegetation. Hand treatments have resulted in less disruption of the vegetation, but has been impractical for adequate surveillance and control due to personnel limitations and the nature of the terrain.

Aerial applications are currently a viable technique. This too has its drawbacks. As we do not have local helicopter agricultural services, we must contract with out-of-state companies. This often means 3 to 5 days to get the pilot and equipment to the site. During very warm weather, this delay could mean missing a hatch altogether. Further, as buildings go up around the wetland, helicopter access will be reduced. Finally, helicopters are very expensive. Of the remaining 80 acres of wetland, it might be necessary to treat only a small portion at a given time. Thus, the expense is often not justified.

Gambusia affinis have been established for a number of years. While they do offer some control in the ponds and channels, their effectiveness has been limited in the denser vegetation. Also, we have fairly cold winters and year-to-year survival has been minimal.

Physical controls, at this point in time, are not an option. This project has been planned, engineered, and is well on its way to being implemented. The changes that can be made now are few.

It is up to you to be involved in all planning stages of similar developments. Establish communication, if it does not currently exist, with whatever regulatory agency or agencies that review and approve plans for development. Get your two-cents in while the project is still only on paper. Also, be prepared; familiarize yourself with the area in question and identify your needs. Know what you want before you go into the meetings. Make sure your board members and administrators are educated; you need their support. Don't forget the basics: easements, access and hydrology. We have a "mitigated" area which now is a static backwater. It fills when the water level rises but never really flushes, a simple problem that was overlooked.

Consider alternative methods to offset budget problems. With increased human population comes increasing demands for control. Developers and recreational property owners can be a source of additional funding, especially when faced with unhappy customers and the resulting loss of income. One can also gain other forms of cooperation from the developer. For example, we did get three permanent, hard-wired light trap sites installed at their expense, as well as the purchase of the traps. Aerators were also installed and are being maintained at the golf course's expense. We also had input regarding the grading of the slopes of the pond margins. While the course management is extremely cooperative, the basic design problems remain.

Future problem areas locally include the Spanish Springs Valley north of the Truckee Meadows which has some 3000 acres of agricultural and wetlands. Development plans here include 3 golf courses, 2300 acres of parks and wetlands, some 200 acres of business and offices and 4000 acres of residential areas. Another is the Double Diamond Ranch development with some 270 acres of mitigated wetland. It would probably be prudent for all of us to be aware of similar projects in our own regions and take full advantage of being involved in the planning process.

BLACKFLY CONTROL IN HUMBOLDT and LANDER COUNTIES, NEVADA

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Blackfly and Mosquito Abatement
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Humboldt and Lander Counties lie in the north central part of Nevada. The Humboldt, the only major river in this part of the state, flows through both counties and through or in close proximity to the towns of Battle Mountain, Golconda and Winnemucca. Of the various kinds of biting flies that are produced in association with the river, black flies (Simuliidae) constitute the most severe problem, outranking mosquitoes in the degree of nuisance produced to the public when left untreated.

In contrast to mosquitoes, blackflies breed in running water. The prime breeding ground for blackflies in Humboldt and Lander Counties is the Humboldt River and most of the effort to control these insects is focused there. Other significant sources do exist, including tributary streams such as the Little Humboldt and Rock Creek, irrigation ditches and runoff areas in flooded pastures. In wet years mountain streams can penetrate lowland areas and cause problems.

There are at least 8 species of blackflies in the Humboldt River. The dominant species appears to be *Simulium vittatum*, though other species such as *S. meridionale, S. arcticum, S. bivittatum* and *S. venator* are abundant. Annoyance is at least as important as biting in making these species pests to humans.

Before 1985, there was no effective or coordinated program for blackfly control anywhere along the Humboldt River. In Winnemucca people sometimes wore bee-keeper like masks to keep the blackflies off. In 1984, there were nearly 160 emergency room cases of blackfly bites in Winnemucca.

In 1985, with the help of Dr. Mir Mulla, the present blackfly abatement program was commenced. It is larval based and initially centered on Winnemucca (population 10,000) and Golconda (population 300). In 1986, the program was expanded to include Humboldt and Lander Counties as well as the City of Winnemucca.

The control season lasts from March to September. During this time breeding sites are checked once a week and larval densities and ages, as well as the number of pupae and presence of egg masses, are noted. To do this, 5-minute counts on natural substrates are used. In the past, artificial substrates, such as cinder blocks, plastic strips, rope, wooden dowels and fishing line were tried, but vandalism, algal buildup and fluctuations in water levels caused their abandonment.

After making such checks, the stretches of river or water course needing control are treated. The backbone of the control program is methoxychlor, used under a 24c permit from the State of Nevada. It is applied at a rate of 0.2 ppm for a 15-minute period at each site. Each application will provide control for about 5 miles of river. Methoxychlor is used only in the Humboldt River and only at river flows over 200 cubic feet per second (cfs). Below this flow rate ponding in lagoons begins to occur and the danger of a fish kill begins to appear, especially in summer when the water is warm and oxygen levels are low.

Liquid *Bacillus thuringiensis israelensis* (Bti) is the other major material used in blackfly control in Humboldt and Lander Counties. It is applied at 10 ppm over a 5-minute period at each site. In the Humboldt River this dosage will provide control for about 1.5 to 2 miles of river. Bti is used in all blackfly infested areas outside the Humboldt River. In the Humboldt River it is used when the river is flowing at less than 200 cfs. Because methoxychlor has a 10-day restriction on its use, Bti is also used at river flows above 200 cfs when larval populations rebound before methoxychlor can be used again. In the southern part of Humboldt County, Bti is used on the Humboldt during the walleye spawning season around the end of April to preserve the fish.

Applications of materials to the Humboldt or other watercourses are made as needed. In general the frequency of treatment ranges from once per week to once per 3 weeks. To make the treatment, the desired amount of chemical is measured out, mixed with water and poured into the river. If bridges are available or the water is shallow enough, the width of the river is covered back and forth while applying the material to the water. If this is not possible the application is made to a riffle

where the current will carry the chemical out away from the shore. Under rare circumstances Bti has been applied from a canoe being paddled in a zigzag fashion back and forth across the river.

In flooded pastures where breeding areas are found in scattered locations and unconnected with the source of the water, a backpack sprayer with Bti is used. In this case, each infested area is found and treated separately.

The current blackfly program has been very successful during the time it has been in place. However, some problems have cropped up. In Winnemucca, during 1989, it was noticed that the kills achieved with methoxychlor were beginning to drop off seriously. In 1990, all treatments with methoxychlor were complete failures - no effect on the blackfly larval population could be seen in any case. In 1991, methoxychlor treatments regained sufficient potency that they were effective in giving adequate control of blackflies. There were two curious features to this situation. The first was that in Battle Mountain in 1989 and 1990, using the same methoxychlor, excellent kills continued to be achieved. In 1991, however, 2 total failures of methoxychlor were experienced. The second feature was that, in 1991, samples of the methoxychlor in both Winnemucca and Battle Mountain were taken by the Nevada Department of Agriculture, were tested and found to be fully potent. At present, the cause of the erratic behavior of the methoxychlor is unknown. Bti is being used to fill the gap when a failure occurs.

The other major problem encountered is larval drift, the main means by which blackflies reinfest treated stretches of river. Mature larvae from untreated areas upstream drift in and pupate before treatment can be effected. This is particularly a problem at high river flows where methoxychlor is used and a 10-day restriction applies. Bti can be used, but is very expensive under such conditions. The other apparent solution, applied in both Winnemucca and Battle Mountain, has been to increase the length of treated river above town in the hope of diminishing the number of larvae that would drift in. However, for reasons unknown, this tactic has been unsuccessful in both locations.

The most serious potential problem in the future for the blackfly program is the possible disappearance of methoxychlor, either through revocation of the 24c permit (as has happened in some states) or through a cessation of its manufacture. In this case only Bti would be available for control of blackfly larvae. In drought years such as have been experienced since 1987 such an eventuality might not produce too severe a financial strain. A return to normal or above normal river flows could cause a breakdown of the program unless additional funding could be found. Efforts are being made now to address this potential problem.

Bti SAND GRANULE SHELF LIFE and USE IN THE SALT LAKE CITY MAD

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Bti (*Bacillus thuringiensis israelensis*) sand granules consist of uniform size sand with Bti technical powder adhered to its surface with mosquito larviciding oil (MLO). The Salt Lake City Mosquito Abatement District (SLCMAD) began making these granules in response to control failures with commercially available organophosphate coated sand granules and application difficulties with Bti corn-cob granules. Initial success with the preparation, dispersal and control with Bti sand granules led to the continuation of the program at the SLCMAD. Part of the success was believed to be due to the storage of granules in plastic buckets with air-tight lids. This prevented the evaporation of the oil, thus leaving the technical powder attached to the sand. Preparation and effective- ness of the Bti sand granule at the SLCMAD was described by Hatch and Dickson (1989).

During 1989, it was found that there was no noticeable loss of potency in the granules after 8 weeks of storage. To evaluate the long-term shelf life of the granules approximately 50 lbs. were stored in an unheated and uncooled building to be tested in the field and laboratory studies at a later date. Two years later, 1991, the granules were tested.

Testing Procedure and Results

The limited amount of test material allowed only one field trial. An overgrown pasture approximately 5 acres in size was chosen as the test site. The larval population was exclusively 2nd instar *Aedes vexans*, with pre-treatment counts averaging 2.7 larvae/dip. The 4% Bti sand granules were applied by hand with modified "horn seeders," at a rate of 6 lbs./acre. Twenty-four hour post-treatment dip counts averaged 0.35 larvae/dip, with the resulting control being 87%. This compared favorably with the results from 1989 trials (field trials of Bti sand granules in storage for 1 to 8 weeks produced mortality rates ranging from 70 to 100% with a mean of 90.4%).

The laboratory test was conducted at the SLCMAD office. The test consisted of two trays filled to the depth of 1 inch with distilled water. One tray was used as a control and the other for Bti sand granule treatment. The surface area of each tray was 1.66 sq. ft. An effective application rate of 6 lbs/acre was used which equaled 0.1 gram or, on the average, 25 grains of the test material. Larvae were collected in pesticide free containers during the pretreatment evaluation of the field trial site. Fifty larvae were transferred to each test tray after being allowed to acclimate to room temperature. Twenty-four hour post treatment results showed a 5% mortality in the control and 100% mortality in the treated tray.

Discussion

Bti sand granules are a very effective tool in controlling larval mosquito populations. The sand serves as the carrier, assisting in its dispersal when applied by hand or mechanical device. MLO adheres the Bti technical powder to the sand. Most importantly, the MLO allows the release of the Bti from the sand immediately upon application to water. The Bti then slowly settles through the water column where larvae, regardless of where they feed, come into contact with it. The key is to store the Bti sand granules so that the Bti remains attached to the sand. By storing the granules in plastic buckets with air-tight lids, the limited tests made show that shelf-life is at least 2 years.

Daily temperatures in the building where the granules were stored range from highs of over 100°F to a low of -10°F. Freezing temperatures do not appear to be a problem with storage. However, granules left in the back of pickups for 2 - 3 days and exposed to direct sunlight and severe agitation showed poor results. Also, granules left in containers that are not air-tight give similar poor control. It is believed that the extreme heat and agitation separate the Bti from the sand, thus giving poor dispersal.

REFERENCE CITED

Hatch, G. L. and S. L. Dickson. 1989. Bti sand granules. Proc. UT Mosq. Abate. Assn. 42:20-24.

MOSQUITO AND ARBOVIRUS SURVEILLANCE PROGRAM OF THE KERN MOSQUITO AND VECTOR CONTROL DISTRICT

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INTRODUCTION

During the late summer and fall of 1989 an unexpected outbreak of St. Louis encephalitis (SLE) occurred in Kern County with 17 confirmed human cases (Tueller 1990). SLE viral activity apparently began on the west side of the San Joaquin Valley and quickly dispersed eastward into the more heavily populated areas of Bakersfield, and its outlying municipalities of Wasco, Shafter, Lamont and Arvin.

Throughout California, the primary vector of mosquito-borne encephalitides is *Culex tarsalis* Coquillett (Reeves 1990). The seasonal abundance of *Cx. tarsalis* measured throughout the summer of 1989 peaked in July and August during the period when SLE activity was increasing as indicated by the SLE antibody conversion rates in sentinel chickens (Fig. 1). The rapid spread of SLE in the southern portion of the San Joaquin Valley clearly demonstrated that the current surveillance system to monitor encephalitis activity in the Kern Mosquito and Vector Control District (KMVCD) was inadequate and needed improvement. This paper briefly describes the 1990 augmentations to the KMVCD mosquito and arbovirus surveillance program.

SURVEILLANCE PROGRAM OVERVIEW

Previous studies by the University of California, Berkeley (Reisen, et al., 1990, Reeves 1990) have shown that, historically, western equine encephalomyelitis (WEE) and SLE viral activity is more likely to occur on the west side than on the east side of the San Joaquin Valley. The current expansion of Bakersfield is occurring to the west where urban neighborhoods are rapidly encroaching on habitats that support encephalitis activity. This westward growth pattern of urbanization has compelled the KMVCD to increase surveillance efforts in western periurban areas where encephalitis transmission to humans is most likely to occur during the initial stages of a possible epidemic.

The augmented surveillance program incorporates the expansion of 2 surveillance methodologies currently being used by the KMVCD for monitoring mosquito abundance and encephalitis activity within the District, 1) CO_2 traps [CDC traps of Sudia and Chamberlain (1962) supplied with ca. 2 kg of dry ice and operated without light], and 2) sentinel chicken flocks comprised of 10 to 20 white leghorns each. CO_2 traps provided information on mosquito/vector abundance and arbovirus activity from pools of live-trapped females. Sentinel chickens provided a sensitive and constant level of exposure to mosquito attack (e.g., *Cx. tarsalis*) for determining encephalitis transmission to reservoir vertebrates, primarily birds.

In 1990, both CO_2 traps and sentinel chicken flocks were deployed at fixed sites along 3 transects in the western portion of the District and along the Kern River to the foothills of the Sierra Nevada Mountains. The array of CO_2 traps and sentinel flocks along with the 3 transects gave the KMVCD the best overall strategy for measuring mosquito abundance and virus activity in encephalitis sensitive areas. The habitat along all three transects was predominately rural with representative sections of riparian areas (Kern River), mixed agricultural farmland, and the western fringes of heavily populated urban neighborhoods. Transect 1 followed the Kern River from Hart Park to Buena Vista Lake. Transect 2 followed a diagonal (NE to SW) from Oildale to Rosedale. Transect 3 also followed a diagonal (NW to SE), but from Rosedale to Greenfield. CO_2 traps were hung from standards at a height of 1.5 m. Distances between CO_2 traps within each transect ranged from 2 to 3 km. Sentinel flocks were interspersed between CO_2 traps at rural farm residences.

RESULTS OF SURVEILLANCE EFFORTS IN 1990

Monthly (April - October) mosquito abundance data combined for all 3 transects in 1990 clearly demonstrated that *Culex quinquefasciatus* Say was the most abundant species sampled, followed by *Cx. tarsalis* (Fig. 2A). Historically, the August abundance of *Cx. tarsalis* was coincidental with the period of greatest SLE transmission potential in the southern San Joaquin Valley (Reeves 1990). *Cx. tarsalis* abundance at sentinel chicken flocks remained above 40 females per trap night from July through August (Fig. 2B). Thus, sentinel flock placement was spatially appropriate to monitor potential encephalitis

activity along transects 2 and 3. Along with *Cx. tarsalis*, the sustained abundance of *Cx. quinquefasciatus* during late summer and early fall also indicated that a potential threat existed for periurban and urban SLE transmission by that species.

CONCLUSION AND ASSESSMENT

The arbovirus and mosquito surveillance program of the KMVCD briefly described herein represents our attempt at developing an organized and stratified strategy for monitoring mosquito abundance, mosquito control efforts, and arbovirus activity in the southern San Joaquin Valley. Although our current surveillance program is labor intensive, the efforts are justified considering the fact that recent epidemics of SLE in California have occurred in the absence of the usual environmental factors that portend a possible outbreak.

ACKNOWLEDGEMENTS

The authors wish to thank the support of the University of California, Berkeley, for providing additional data on surveillance efforts in encephalitis critical areas within the Kern Mosquito and Vector Control District, and the personnel of the Kern Mosquito and Vector Control District for their efforts in trap deployments and retrievals.

REFERENCES CITED

Emmons, R. W., M. S. Archer, D. V. Dondero, B. Enge, M. M. Milby, L. T. Hui, R. A. Murray, B. A. Wilson, F. Ennik, J. L. Hardy, S. B. Presser, W. C. Reeves, L. Barrett and J. C. Combs. 1991. Surveillance for arthropod-borne viral activity and disease in California during 1990. Proc. CA Mosq. and Vector Control Assn. 59:4-9.

Reeves, W. C. 1990. Epidemiology and control of mosquito-borne arboviruses in California, 1943-1987. CA Mosq. and Vector Control Assoc., Inc. Sacramento, CA. 508 pp.

Reisen, W. K., J. L. Hardy, W. C. Reeves, S. B. Presser, M. M. Milby and R. P. Meyer. 1990. Persistence of mosquito-borne viruses in Kern County, California, 1983-1988. Am. J. Trop. Med. Hyg. 43:419-437.

Sudia, W. D. and R. W. Chamberlain. 1962. Battery-operated light trap, an improved model. Mosq. News. 22: 126-129.

Tueller, J. E. 1990. Human cases of St. Louis encephalitis virus in California, 1989. Proc. CA Mosq. and Vector Control Assn. 58: (in press).

Figure 1. Monthly comparison of *Culex tarsalis* female abundance [females/trap night (TN)] determined by CO_2 trap and cumulative % SLE antibody conversion rates in sentinel chickens in the southern San Joaquin Valley, 1989.

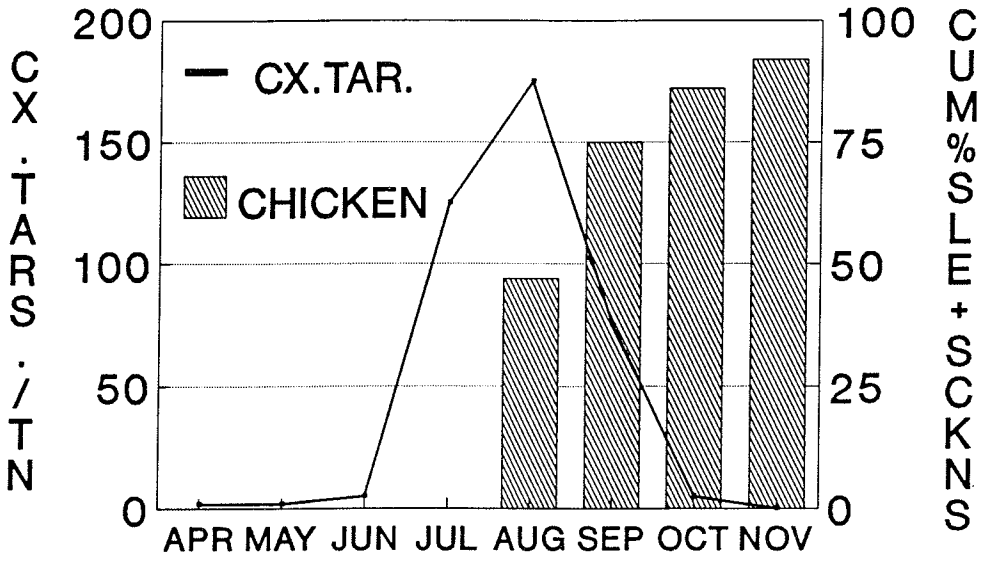
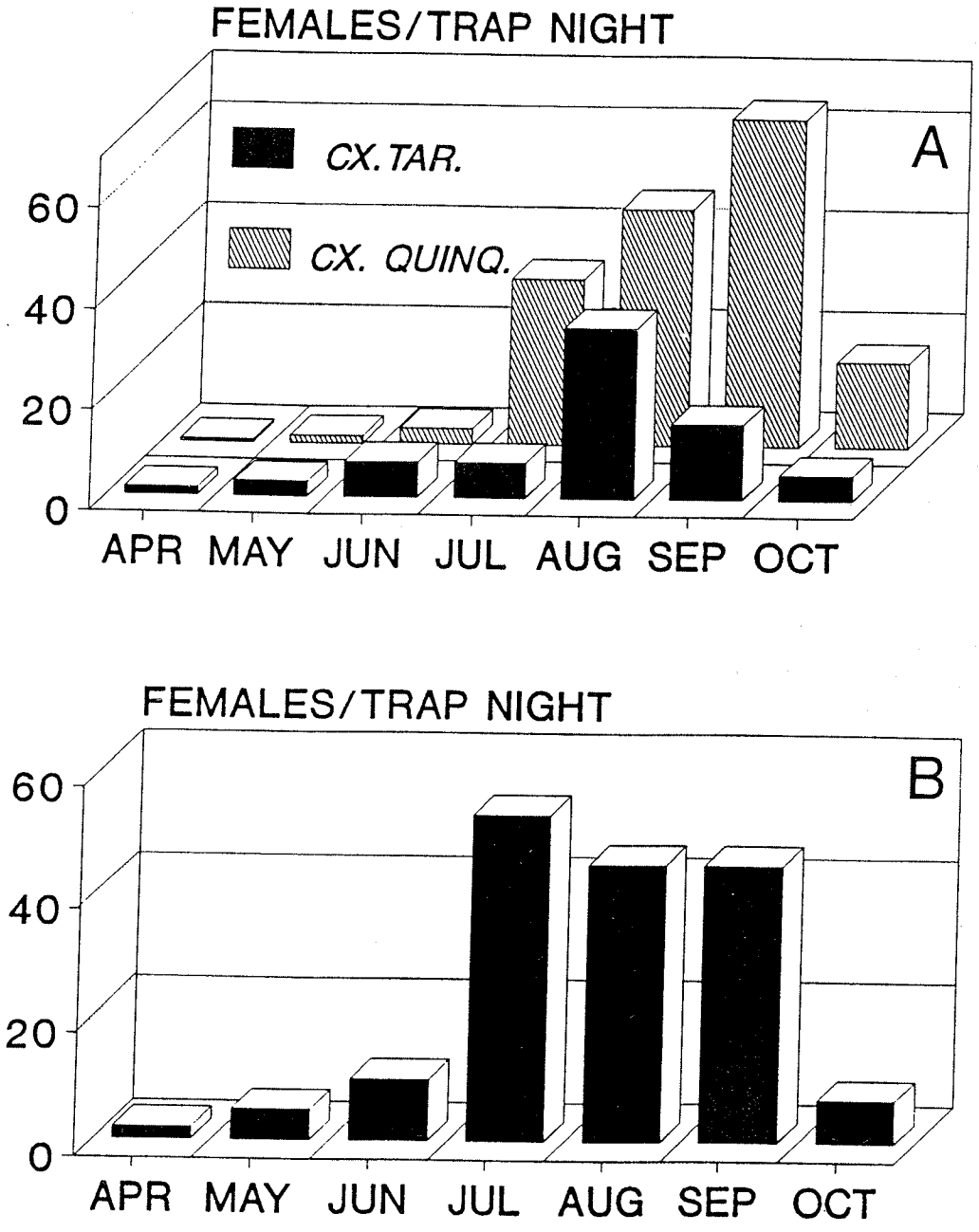


Figure 2. A. Monthly abundance (females/trap night) of *Culex tarsalis* and *Culex quinquefasciatus* sampled by CO_2 traps among transects (data combined), 1990. B. Monthly abundance (females/trap night) of *Culex tarsalis* sampled by CO_2 traps operated at sentinel chicken flock sites, 1990.



UMAA COOPERATIVE ENCEPHALITIS SURVEILLANCE - 1991

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This year completes the ninth year of the Utah Mosquito Abatement Association (UMAA) cooperative encephalitis surveillance program that began in 1983. A detailed explanation of the history behind the surveillance program can be found in earlier publications (Dickson 1986, 1988; Dickson and Wagstaff 1985; Mason 1983; Wagstaff 1987 and Wagstaff et al. 1986).

The surveillance program is sponsored by the Utah State Department of Health, the Utah State Department of Agriculture and the UMAA. In 1991, 21 sentinel chicken flocks, each with 20 white leg-horn chickens, were placed by 16 participating mosquito abatement districts (MAD's) throughout the state. Flocks were distributed on April 25 with an initial baseline bleeding on May 6. Seven biweekly bleedings were made beginning on June 17 with a final historical bleeding made on September 30. Bloods collected during May and June were stored but not processed. This was done to save laboratory time and money since seroconversions have not been found prior to August in past years. The early bleedings are processed if seroconversions are found at a later date to help rule out a false positive.

Four seroconversions for western equine encephalitis (WEE) were found in the Jensen flock of Uintah County MAD (two on Sept. 9, and two on Sept. 30), as well as, two for St. Louis Encephalitis (SLE) (one each in Uintah and Box Elder County MAD's, Sept. 30, 1991) (Table 1). These were the only seroconversions found in the approximate 3,780 blood samples collected in 1991. This is the second consecutive year and the fourth time in the 9 years of surveillance that Uintah County MAD has had seroconversions to WEE in their chicken flocks. Fourteen of the 20 seroconversions to WEE statewide from 1983 to the present have been from Uintah County. Uintah County has never recorded a human case of WEE, but experienced an equine outbreak in 1978 involving at least 60 horses (Romney et al. 1980). In 1986, both Uintah and Emery County MAD flocks had chickens which seroconverted to SLE. This was the first reported occurrence of the virus in Utah. The presence of SLE in Uintah County was not unexpected since western Colorado has had several human outbreaks of SLE with the latest in Grand Junction in 1985 (Tsai et al. 1989). The seroconversion of a sentinel chicken in Box Elder County MAD is the only one to be found in that district in the 9 years of this project. Duchesne County located on the west side of Uintah County has had chickens seroconvert to WEE (1986) and SLE (1990). The Uintah Basin, the area covering both Uintah and Duchesne Counties, has been the primary focus for both WEE and SLE in recent years. It is important to note that both counties have very active MAD's, which is undoubtedly the reason that human cases of either virus have not occurred.

WEE can be expected to occur in any of the participating districts, even though only 4 of the 18 participating districts have had chickens seroconvert for WEE (Table 1). The paucity of viral activity along the Wasatch Front is puzzling since that area was the focus of a WEE outbreak in both 1933 and 1958 (Rees and Collett, 1959; Jenkins and Donath, 1959).

All 30 seroconversions found in the surveillance program have occurred after the middle of August. While seroconversions late in the Utah mosquito season probably represent little to no risk of epidemic potential, they do show that the viruses are present and active. These late seroconversions help to remind the public at budget time that outbreaks and epidemics are not predictable and can occur during any year. Therefore, surveillance for early detection and organized mosquito control must not just be funded but continue to grow and improve.

REFERENCES CITED

Dickson, S.L. 1986. UMAA co-operative encephalitis surveillance in Utah, 1986. Proc. UT Mosq. Abate. Assn. 39:34.

Dickson, S.L. 1988. UMAA cooperative encephalitis surveillance - 1988. Proc. UT Mosq. Abate. Assn. 41:29.

Dickson, S.L. and K.H. Wagstaff. 1985. Encephalitis surveillance in Utah, 1985. Proc. UT Mosq. Abate. Assn. 38:12.

Jenkins, A.A. and R. Donath. 1959. The 1958 encephalitis outbreak in northern Utah. I. Human aspects. Mosq. News. 19(3):221-222.

Mason, J.O. 1983. Cooperative roles of the Utah Department of Health and the mosquito abatement districts. Proc. UT Mosq. Abate. Assn. 36:4-5.

Rees, D.M. and G.C. Collett. 1959. Factors influencing the encephalitis outbreak in Utah in 1958. Proc. CA Mosq. Control Assn. 27:88-97.

Romney, S.V., G.C. Collett and F.J. Schoenfeld. 1980. Report of an outbreak of western equine encephalitis in the Uintah Basin, Utah. Mosq. News. 40(1):104-104.

Tsai, T.F., G.C. Smith, C.M. Happ, L.J. Kirk, W.L. Jakob, R.A. Bolin, D.B. Francy and K.J. Lampert. 1989. Surveillance of St. Louis encephalitis virus vectors in Grand Junction, Colorado, in 1987. J. Am. Mosq. Control Assn. 5(2):161-165.

Wagstaff, K.H. 1987. Encephalitis surveillance - 1987. Proc. UT Mosq. Abate. Assn. 40:41.

Wagstaff, K.H., S.L. Dickson and A. Bailey. 1986. Western equine encephalitis surveillance in Utah. J. Am Mosq. Control Assn. 2(2):201-203.

Table 1. Seroconversions in sentinel chicken flocks 1983 - 1991.

Year	# of Flocks	Seroconversions WEE	SLE
1983	11	3 (1 Ss, 2 Ut)	0
1984	20	0	0
1985	21	0	0
1986	21	5 (3 Du, 2 Ui)	5 (2 Em, 3 Ui)
1987	21	5 (5 Ui)	0
1988	20	0	0
1989	21	0	0
1990	21	3 (3 Ui)	3 (3 Du)
1991	21	4 (4 Ui)	2 (1 Ui, 1 Bx)
Total		20	10

Bx = Box Elder County MAD
Du = Duchesne County MAD
Em = Emery County MAD
Ss = South Salt Lake County MAD
Ui = Uintah County MAD
Ut = Utah County MAD

CALIFORNIA SEROGROUP VIRUSES IN WESTERN UTAH: SEROLOGIC RESULTS IN HUMANS AND RABBITS AND ISOLATIONS FROM MOSQUITOES[1]

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In 1990 Elbel and Rosenfeld showed a 20-year inverse association between Jackrabbit (*Lepus californicus*) populations and California serogroup (CAL) virus - *Aedes dorsalis* infection rates at Blue Lake and the entire western Utah. That study prompted a re-examination of the serologic effects of CAL viruses on humans and rabbits and the 1983-85 mosquito-arbovirus survey (Crane et al. 1977, 1979, 1985, Elbel 1986, Elbel et al. 1989).

Blood samples were obtained from humans at the West Desert Fair, Callao, Juab County, Utah on 21 August 1976 and from Jackrabbits at Blue Lake, Tooele County, and Fish Springs, Juab County, Utah in October 1978. Tubes of blood were chilled, "ringed," centrifuged and clots removed. Serum samples were frozen on dry ice and transported to the laboratory at Dugway Proving Ground, Utah (DPG) where they were tested by neutralization in suckling mice. The virus used as antigen was strain 30521, a CAL isolate from *Ae. dorsalis* collected at Blue Lake in 1965 which Crane et al. (1970) showed was closely related to the prototype strain (BFS 283) of California encephalitis (CE) virus.

Mosquitoes were collected with CDC miniature light traps and dry ice attractant once a month, June through September 1983-85, except for June 1984. Specimens were sealed in vials, frozen on dry ice and transported to the laboratory at DPG where mosquitoes were pooled visually by Crane and Elbel by species, date and area using a CDC chill table on which verifications were made under a stereo microscope by Elbel. In 1983 mosquitoes were collected only at Blue Lake, a spring-fed marsh 17 miles south of Wendover, Utah, on the western boundary of the Great Salt Lake Desert. In 1984-85 collections were also at Fish Springs, a National Wildlife Refuge, and Callao, a small farming community east of the Deep Creek Mountains, both on the southern boundary of the Great Salt Lake Desert. Dominants near light traps were: at Blue Lake saltgrass (*Distichlis stricta*), bulrushes (*Scirpus* spp.) and pickleweed (*Allenrolfea occidentalis*) with some rabbitbrush (*Chrysothamnus* spp.) and greasewood (*Sarcobatus vermiculatus*) along the lake margin, at Fish Springs saltgrass, bulrushes and reed grass (*Phragmitis communis*) along a road separating marshland from a canal, at Callao Russian olive (*Elaeagnus angustifolia*), willows (*Salix* spp.) and wild rose (*Rosa* spp.) along a fence in an irrigated meadow of *Carex* spp. and other grasses.

In 1983 virus assays and identifications were done at DPG using suckling mice similar to procedures of Crane, et al. (1970) except that Crane used fetal bovine serum instead of normal rabbit serum in the assay diluent; viruses were identified by neutralization tests in suckling mice. The 1984-85 virus assays and identifications were done at the Fort Collins, Colorado Centers for Disease Control (CDC) using Minimum Essential Medium with 1% Bovine albumin and antibiotics as diluent; the assay system was monolayer cultures of Vero cells. In 1984 Crane helped with virus assays and Calisher preliminarily identified isolates by complement fixation. In 1985 Francy did virus assays and identifications which were made by indirect immunofluorescence. Virus identifications in 1984-85 were confirmed by plaque-reduction neutralization tests.

Results show that 50% of 48 human sera had antibody to CE virus (Table 1). However, 73% of adult males and 50% or less of adult females and children had antibody suggesting that adult males had greater exposure to mosquitoes ostensibly while working in the fields in the early mornings and evenings.

Data in Table 2 shows that 58% of 89 Jackrabbit sera had antibody to CE virus. However, 69% of the positive sera were at Blue Lake compared to 27% at Fish

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Springs. Therefore, previous data is reinforced that CAL viruses are most abundant at Blue Lake (Elbel 1986) and that rabbits are hosts of CAL viruses as suggested by Crane et al. (1983); they stated that precipitin tests indicated prior feeding on rabbit at Blue Lake for an engorged abdomen removed from an *Ae. dorsalis* pool that tested CAL virus positive. They also showed that 46% of 164 feedings by *Ae. dorsalis* were on rabbits at Blue Lake and Fish Springs.

Table 3 corrects Elbel's (1986) table in which 400 *Ae. dorsalis* in 1983 were inadvertently tabulated as *Cx. tarsalis* and 300 *Ae. nigromaculis*, 5 *Ae. vexans*, 42 *Anopheles freeborni* in 1984 were shown with 1983; also, not all "Others pooled" in either year were tabulated. These changes do not sufficiently alter the 1983-84 CAL virus-*Ae. dorsalis* infection rates to necessitate changes in the table or figure of Elbel and Rosenfeld (1990). Most of the mosquitoes collected each year were *Ae. dorsalis* at Blue Lake except for *Cx. erythrothorax* at Fish Springs in 1984 when approximately 46,500 mosquitoes were not assayed for virus. Most *Ae. campestris* were collected at Blue Lake in 1985 and 1983, most *Cx. tarsalis* were collected at Fish Springs and Callao in 1985 and most *Culiseta inornata* were from 1985 collections at Callao.

Ae. dorsalis accounted for all 95 virus isolations (Table 3), 85 being from Blue Lake, and most, 67, were form 1984 collections of which 63 were CAL viruses, 49 from August, 12 from July and 2 from September collections; three isolates from July were CE virus strains, 2 from Blue Lake and 1 from Fish Springs. Most isolations, 54 CAL, 1 Bunyamwera serogroup (BUN) and 2 mixed CAL-BUN viruses, were from Blue Lake in 1984 when the trap night average (TNA), 1,646, and the number of *Ae. dorsalis*, 14,401, were both the second highest values. The second highest number of isolations, 27 CAL viruses, was at Blue Lake in 1985, but the TNA, 2,058, and the number of *Ae. dorsalis*, 21,202, were both the highest values. The third highest number of isolations, 8 CAL and 1 mixed CAL-BUN viruses, and the third highest TNA, 1,244, were at Fish Springs in 1984 when the number of *Ae. dorsalis*, 7,667, was the fifth highest value. There was 1 CAL virus isolation at Blue Lake in 1983 when the TNA, 433, and the number of *Ae. dorsalis*, 8,759, were both the fourth highest values. Also, there was 1 CAL virus isolation at Callao in 1984 when the TNA, 47, and the number of *Ae. dorsalis*, 1,392, were both the lowest values. There were no virus isolations from Fish Springs or Callao in 1985 when the values for TNA were low, 327 and 324, respectively; the number of *Ae. dorsalis* at Fish Springs, 7,091, was the next to the lowest value but the number of *Ae. dorsalis* at Callao, 12,835, was the third highest value. There appears to be little relationship between abundance of CAL viruses, TNA and *Ae. dorsalis*.

As shown for 1983-85 and our previous studies (Elbel 1986, Elbel et al. 1989), CAL viruses are not affected by climate, particularly at Blue Lake where CAL viruses and *Ae. dorsalis* are abundant in the flooded saltgrass at the lake margin. However, as shown by Elbel and Rosenfeld (1990), CAL virus-*Ae. dorsalis* infection rates and Jackrabbit cycles appeared to be inversely associated although Spearman rank correlation tests were not significant. When infection rates were highest, Jackrabbits were at the lowest part of the cycle and when infection rates were lowest, Jackrabbits were at the highest part of the cycle. In 1983 Jackrabbits were in the middle of a sharp decline but the population was still high so the infection rate at Blue Lake was still low. By 1984 Jackrabbits had reached the bottom of the cycle so infection rates were high. Since the CAL virus-*Ae. dorsalis* infection rates each rise and fall in a step rather than a straight line, the infection rate lows in 1985 were likely just steps on the way to peaks in 1986 while Jackrabbit populations were still low. The U. S. Army studies ended in 1985 for the mosquito-arbovirus surveys and in 1986 for the Jackrabbit census. If there is statistical concordance between CAL virus-*Ae. dorsalis* infection rates and Jackrabbit densities, further study is needed (Elbel and Rosenfeld 1990).

ACKNOWLEDGEMENTS

We express sincere thanks to the Environmental and Ecology Branch, U.S. Army Dugway Proving Ground, for administrative and technical support, John S. Allan, for technical support, Max Green, Tom Kincaid, Rich LeClure, Steve Lenz, and to the U.S. Public Health Service, Centers for Disease Control for technical support, Christine Happ, Larry Kirk, Wendy Vesley.

REFERENCES CITED

Crane, G.T., R.E. Elbel, D.E. Klimstra and K.L. Smart. 1970 Arbovirus isolations from mosquitoes collected in Central Utah in 1967. Am. J. Trop. Med. Hyg. 19:540-43.

Crane, G.T., J.C. Spendlove, T. Fukushima and D.W. Hill. 1977. ABSTRACT: Evidence for California encephalitis in western Utah residents. Proc. UT Mosq. Abate. Assn. 30:20.

Crane, G.T. and J.C. Spendlove. 1979. ABSTRACT: Western Utah Lagomorphs and California encephalitis virus. Proc. UT Mosq. Abate. Assn. 32:43.

Crane, G.T., R.E. Elbel, D.B. Francy and C.H. Calisher. 1983. Arboviruses from western Utah, USA, 1967-1976. J. Med. Ent. 20:294-300.

Crane, G.T., R.E. Elbel, L.J. Kirk and W.L. Vesely. 1985. ABSTRACT: Arbovirus surveillance of western Utah mosquitoes, 1983-1984. Proc. UT Mosq. Abate. Assn. 38-39:12

Elbel, R.E. 1986. Twenty years of arbovirus studies in western Utah. Proc. UT Mosq. Abate. Assn. 38-39:35-38.

Elbel, R.E., G.T. Crane and D.B. Francy. 1989. Mosquitoes and viruses from western Utah in 1985. Proc. UT Mosq. Abate. Assn. 42:13-15.

Elbel, R.E. and M.J. Rosenfeld. 1990. Relationship between Jackrabbit populations and California serogroup viruses in western Utah. Proc. UT Mosq. Abate. Assn. 43:1-4.

Table 1. **Prevalence of antibody to CE virus in human sera from western Utah.**

	Age	Male	Female	Total
Children	8-18	5/14 (36)*	4/9 (44)	9/23 (39)
Adults	20-62	8/11 (73)	7/14 (50)	15/25 (60)
Totals	8-62	13/25 (52)	11/23 (48)	24/48 (50)

* Number positive/number tested (% positive)

Table 2. **Prevalence of antibody to CE virus in Jackrabbit sera from western Utah. (There was no difference in prevalence by sex.)**

Area	Total
Blue Lake	46/67 (69)*
Fish Springs	6/22 (27)
Total	52/89 (58)

* Number positive/number tested (% positive)

Table 3. **Mosquitoes collected by light traps in western Utah, 1983-85, and arbovirus isolations (C-California serogroup, B-Bunyamwera serogroup, CB-mixed California-Bunyamwera serogroups).**

Area	Year	*Aedes dorsalis*	*Ae. campestris*	*Culex tarsalis*	*Cx. erythrothorax*	*Culiseta inornata*	Others[1] pooled	Total pooled	Trap nights	Average/ trap night
Blue Lake	1983	8,759 (1C)	505	1,093	3	14	10	10,384	24	433
	1984	14,401 (54C,1B,2CB)	190	2,060	9,025	26	626 [2]	26,328	16	1,646
	1985	21,202 (27C)	735	2,364	713	32	12,002 [2]	37,048	18	2,058
Fish Springs	1984	7,667 (8C,1CB)	259	3,102	18,034	85	46,722 [2]	75,869	61	1,244
	1985	7,091	412	6,743	9,270	301	2,024 [2]	25,841	79	327
Callao	1984	1,392 (1C)	0	590	286	114	378	2,760	59	47
	1985	12,835	4	6,790	119	1,381	2,835 [2]	23,964	74	324

[1] Specimens with no virus isolations, mainly *Ae. melanimon, Ae. nigromaculis, Ae. vexans* and *Anopheles freeborni* at Callao in 1984, and mosquitoes included here that were not assayed for virus.

[2] Mosquitoes that were not assayed for virus, ca. 46,500 at Fish Springs and 600 at Blue Lake in 1984, 12,000 at Blue Lake, 2000 at Fish Springs and Callao in 1985.

UTAH HEARTWORM IN DOGS STUDY 1991

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Utah has had sporadic reports of individual cases of Canine Heartworm Disease (CHD) over a long span of years. Dr.'s Merrill G. Shupe and F. James Schoenfeld reported on 7 cases of CHD to the Utah Mosquito Abatement Association in 1973. Since that time there have been only a few reports, with records starting in 1987 until present (Table 1).

Due to this evident increase in CHD incidence it was determined that a general state wide survey might be beneficial. Utah Department of Agriculture's Heartworm Survey was a joint effort of government and private industry. Participants included: Merck and Company, who contributed money to help pay expenses; Idexx Corporation donating test kits for the Cite test; Symbiotics Corporation donating test kits for the Dirocheck tests; Utah State University Veterinary Diagnostic Laboratory who did the testing at a reduced rate and Utah Department of Agriculture Division of Animal Industry (UDADAI) who correlated the whole survey. 118 local veterinary clinics were invited to participate. UDADAI sent out publicity, protocol, and data forms, did the compilation and reporting of the survey.

Publicity was in the form of a news release issued by the Department of Agriculture which went state-wide. There were also some television segments that had been run by the Utah Veterinarian Medical Association (UVMA) and the Salt Lake Veterinary Association alerting the public to the need for testing.

A kit containing a cover letter, a heartworm Survey Protocol and data sheets were sent to 118 veterinary clinics throughout the state.

The State was divided into 3 districts, each county was numbered and each clinic in the district was numbered. Thus each sample had a unique number, consisting of a 5 digit clinic number plus sample number.

All 267 samples submitted for the survey were negative. However, 25 confirmed cases of positive dogs were reported to the UDADAI from the routine testing done at veterinary clinics around the state (Table 1). The greatest number of tests and positive dogs were all on the Wasatch Front area (Fig. 1). In 1990, CHD cases occurred mostly around Hill Air Force Base in Davis County. That trend continued with some other areas (Salt Lake and Brigham Cities) showing an increase. It appears that those clinics reporting positives tested about 500 - 700 dogs per positive.

Cases of heartworm are in a geographically small area but 1 positive dog was reported from the northern portion of Salt Lake City in an area recently identified as having a new population of the 'treehole mosquito' *Aedes sierrensis*, the presumed vector in Utah. It would be interesting to have a broader picture of the incidence of *Ae. sierrensis* around these areas of heartworm cases. We do know that some *Culex* species can carry *Dirofilaria immitis* and are wide spread in the state.

In some other states the pattern has been to begin with some local pockets of infection which tend to enlarge then coalesce and it is always dependent upon the vectors being present and some infected carrier dogs. The Hill Air Force Base has a large turnover of personnel who come from endemic areas with their pets, thus providing a source of infection to the local vector population. If in fact our vector population base is also growing then we may expect to see some increasing incidence of infection.

We hope to continue to cooperate in these mutually interesting areas of concern and especially if the mosquito abatement districts can broaden the areas of surveying to get data on the spread and availability of this apparently new mosquito to our area.

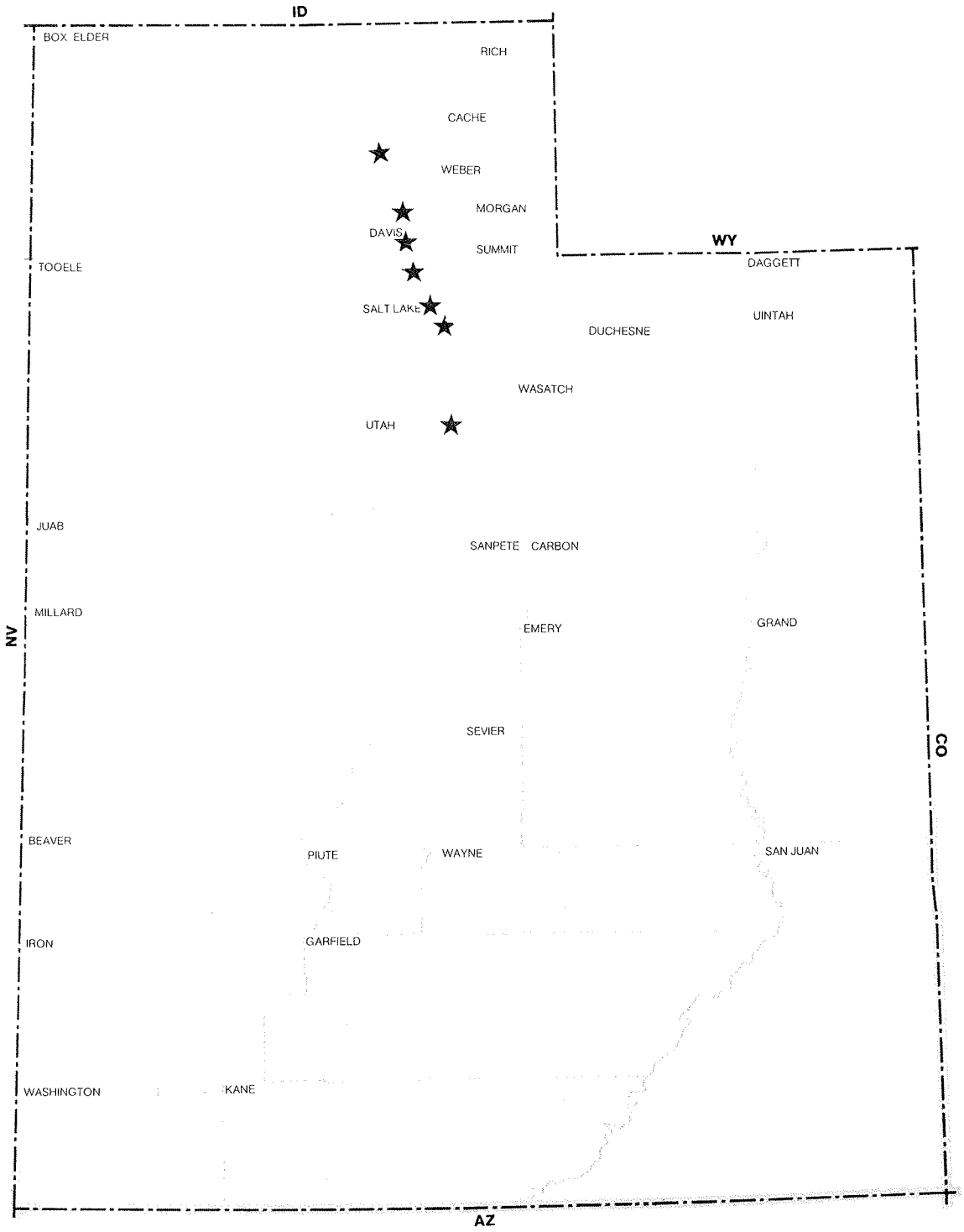
Table 1. **Cases of dog heartworm reported in Utah.**

DATE	OWNER	TOWN	ZIP	FILTER	ANTGEN	P.M.
87-7-01		Clearfield	84015	+	0	0
89-3-15		HAFB	84401	0	0	+
89-7-27		Payson	84651	0	+	+
89-8-12		Syracuse	84075	0	0	+
90-3-17		Layton	84041	+	+	0
90-3-24		Layton	84041	+	+	0
90-4-27		Layton	84041	+	+	0
90-5-07		West Point	84015	+	+	+
90-5-22		Clinton	85015	+	+	0
90-6-21		Layton	84041	+	0	0
90-8-03	* So. Carolina	Grantsville	84074	0	+	0
90-8-06	* So. Carolina	HAFB	80456	+	0	0
90-9-06		Clinton	84015	0	+	0
90-9-18	* Texas	Provo	84601	+	0	0
90-10-2		Layton	84041	0	+	0
90-10-8	* California	Roosevelt	84066	+	+	0
90-10-8		Hooper	84315	+	+	0
90-10-15		West Point	84015	0	+	0
90-10-30	* California	Salt Lake City	84124	+	0	0
90-11-06	* N. Carolina	Vernal	84078	0	+	0
90-12-14		Ogden	84403	+	+	0
91-2-19		Salt Lake City	84107	0	+	0
91-2-23		Salt Lake City	84107	0	+	0
91-3-11		Clearfield	84015	+	+	0
91-3-29		Salt Lake City	84109	0	+	0
91-4-8		Salt Lake City	84115	0	+	0
91-4-19	* Texas	Provo	84601	0	+	+
91-4-30		Fruit Heights	84037	0	0	+
91-4-30		Fruit Heights	84037	0	0	+
91-5-6		Kearns	84118	0	+	0
91-5-21		Salt Lake City	84103	0	+	0
91-5-30		Salt Lake City	84106	0	+	0
91-6-3		Brigham City	84302	0	+	0
91-6-11		Clearfield	84015	+	+	0
91-6-13	*? Texas	HAFB	84401	0	+	0
91-6-13		Provo	84601	0	+	0
91-6-13	* Arkansas	Layton	84041	0	+	0
91-7-16		Syracuse	84403	+	+	0
91-7-22	* Arkansas	Parowan	84761	0	+	0
91-7-23		Farmington	84025	+	+	0
91-7-25		Brigham City	84302	0	+	0
91-8-1		Syracuse	84403	0	+	0
91-8-22		HAFB	84401	0	+	0
91-8-30	*? Florida	Brigham City	84302	+	+	0
91-9-9	*? Arkansas	Springville	84663	0	+	0
91-9-12		Brigham City	84302	+	+	0

* Indicates that dog was probably infected outside of Utah.

There are 25 confirmed positive cases so far in 1991. There is at least one more awaiting confirmation.
Prepared 9-19-91, by Dr. Norman T. Erekson.

Locations of veterinary clinics reporting positive dog heartworm cases.



Aedes sierrensis-A NEW PROBLEM FOR SALT LAKE CITY

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Salt Lake City Mosquito Abatement District
SLC, UT 84116

Aedes sierrensis, "the western tree hole mosquito," has a distribution limited to California, extending north into British Columbia and east into Idaho, western Montana and southerly into northern Utah. The species extension from California to the east tends to surround the northern edge of the Great Basin ending in the area just north of Salt Lake County (figure 1) (Arnell 1971). The discovery of *Ae. sierrensis* in Utah was made in 1965 along the drainage of a single river (Nielsen et al. 1967). Since then extensive searches failed to locate this species in other parts of the state. In 1987, a single adult female specimen, identified as *Ae. sierrensis*, was collected in a Salt Lake City MAD light trap; however, this specimen was destroyed and confirmation of the identification was never made. In 1990, four *Ae. sierrensis* adults were collected from two of the District's light traps on opposite sides of the city and identification was confirmed. This was a range extension of only 30 miles and was looked at as an interesting find but of no real importance because of the low numbers.

In June of last year two *Ae. sierrensis* adults were taken in a rural light trap in the northwest portion of the city. At about the same time several mosquito complaints were received from the east side of the city. Complaints from that part of the city usually occur in early summer and are attributed to *Culex pipiens*. As the complaints were followed up on a pattern unlike that of *Cx. pipiens* emerged. Several people described tiny black mosquitoes whose bite was more severe than they had experienced in the past, and some even noticed the distinct white markings on the legs. Investigation of one complaint finally put the puzzle together. *Aedes sierrensis* readily sought out the investigator during both the middle of the day and at dusk. A dry ice baited CDC light trap yielded 45 *Ae. sierrensis* adults in a single night at the complaint residence. Approximately 20% of the complaints received from April until mid September were linked to this species. It is likely that this species has been present in Salt Lake City for several years but in numbers that were low enough not to complained of by local residents or to be collected in the District's light traps.

Adults were collected from 10 locations across the city. The sites were usually located as a result of mosquito complaints. The collection areas were generally found in the eastern portion of the city with several close to creeks (figure 2). In all locations the adults were active and biting especially at dusk.

The search for larval sources did not begin until July because personnel could not be transferred from other duties. Inspection began within a quarter mile radius of the complaints and adult collection sites. Efforts were initially concentrated along two of the six creeks (Red Butte and Emigration Creeks) that flow into the Salt Lake Valley, since a literature search suggested that all previous collections of this species in Utah were from trees immediately adjacent to rivers. Even though Salt Lake City is a semi-arid area, the Salt Lake City Shade Tree Department (SLCSTD) has on file over 100,000 trees in public parks and parking strips (area between the side walk and curb) throughout the city. The search for larvae soon spread to these trees. All tree holes found were recorded so that they could later be reexamined for water and larvae, and control measures could be taken. Many tree holes were found along the creeks that may have been productive earlier in the season but were only damp or dry by July. Four larval sources were located, all were within a 7 block radius. The first larval source found on July 12 was located along Emigration Creek. Two larval sources were found in trees in the parking strips. One more source was located in the front yard of a residence. The last collection was taken on August 8. This source had been located earlier in July but was found to be unproductive until it was rechecked prior to filling it in with sand in August.

Each of the four larval sources were from different tree species: *Acer neglindo* (Box Elder) tree, which is the prevalent tree growing along the creeks running into the city, *Aescules glabra* (Ohio Buckeye), *Acer plantanoides* (Norway Maple) and *Ulmus americana* (American Elm). *Aedes sierrensis* has been reported as collected from 17 species of trees including sycamore, cottonwood, oak, maple, buckeye, bay, elderberry, black walnut, English walnut, white fir, olive trees, eucalyptus, willow and California laurel (Peyton 1956). Prior to this paper the species has been reported as collected only from the two cottonwoods *Populus fremontii* and *P. angustifolia* in Utah (Arnell 1968). Nielsen (pers. comm.) suggests that *Ae. sierrensis* will probably inhabit any deciduous tree that produces tree holes that fill with water.

In the first part of August employees began filling known tree holes that were or could be mosquito productive. They were filled as full as possible with sand and when the opening was small enough, it was sealed with a brown, exterior caulking. To date 32 tree holes located primarily in the parking strip and residences have been filled. The SLCSTD is interested in finding trees with large hollowed-out areas because the holes weaken the structure of the tree and are a possible safety hazard. These trees will be removed.

Ae. sierrensis has become a pest species in the Salt Lake Valley, but of a greater importance is believed to be the vector potential of this species. *Ae. sierrensis* is the main vector for *Dirofilaria immitis* (canine heartworm) in many parts of California (Hansen 1982; Weinmann and Garcia 1974). Locally transmitted cases of canine heartworm were un- known in Utah until 1987 (Marshall 1990). The first substan- tiated cases of canine heartworm in the Salt Lake Valley occurred in 1991 (Erekson 1991). It appears to be more than a coincidence that *Ae. sierrensis* and canine heartworm were reported to occur in the Salt Lake Valley at the same time. The American people have become a very mobile society, traveling or moving and transporting their pets. Of the 60 mosquito species known to be capable of supporting development of *D. immitis* in the laboratory (Ludlam et al. 1970) the Salt Lake Valley has 6 (*Ae. fitchii, Ae. sierrensis, Ae. vexans, Anopheles freeborni, Culex pipiens and Cx. tarsalis).* The relationship between the location of *Ae. sierrensis* adult and larval collection sites and confirmed canine heartworm cases is shown in figure 2. *Ae. sierrensis* has a limited flight range, therefore, if it were the vector species, we would have expected to collect adults or larvae in close proximity to canine heartworm cases. At only two locations were *Ae. sierrensis* (adults or larvae) collected in close proximity to known canine heartworm cases. However, only a cursory search for *Ae. sierrensis* has been made. It is anticipated that this species will be found throughout the east side of the valley. Also, the local habits or movement of the dogs that were affected is not clear. It is possible that they may frequent areas where *Ae. sierrensis* has already been found.

Plans for 1992 include: expanding the search area for larval sources especially in areas where dog heartworm has been found, to locate sources and control this pest species; working with the SLCSTD to select trees for planting that are less likely to develop tree holes; and to coordinate findings on mosquitoes with the state veterinarian to determine if *Ae. sierrensis* is indeed the primary vector of canine heartworm in the Salt Lake City area.

REFERENCES CITED

Arnell, J.H. 1968. The taxonomy, distribution, and biology of *Aedes varipalpus* complex mosquito in Utah. M.S. Thesis, Dept. of Biology, University of Utah.

Arnell, J.H. 1971. A study of the systematics of the *Aedes* (ochlerotatus) *varipalpus* mosquito complex. Ph.D. Dissertation, Department of Biology, University of Utah.

Erekson, N.T. 1991. Utah heartworm in dogs study 1991. Proc. Utah Mosq. Abate. Assn. 44:30-32.

Hansen, C.P. 1982. Canine heartworm in the San Francisco Bay area: Epizootiology and control. M.A. Thesis, Department of Biology, San Francisco State University.

Ludlam, K.W., Jachowski, L.A. and G.F. Otto. 1970. Potential vectors of *Dirofilaria immitis.* J. Amer. Vet. Med. Assn. 157:1354-1359.

Marshall, M. 1990. Canine heartworm infection. Proc. Utah Mosq. Abate. Assn. 43:17-18.

Nielsen, L.T., J.H. Arnell and J.H. Linam. 1967. A report on the distribution and biology of tree hole mosquitoes in the Western United States. Proc. Calif. Mosq. and Vector Control Assn. 35: 72-76.

Peyton, E.L. 1956. Biology of the Pacific coast treehole mosquito *Aedes varipalpus* (Coq.). Mosq. News. 16:220-224.

Weinmann, C.J. and R. Garcia. 1974. Canine heartworm in California, with observations on *Aedes sierrensis* as a potential vector. Calif. Vector Views. 21(8):45-50.

Figure 1. **Distribution of *Aedes sierrensis*.**

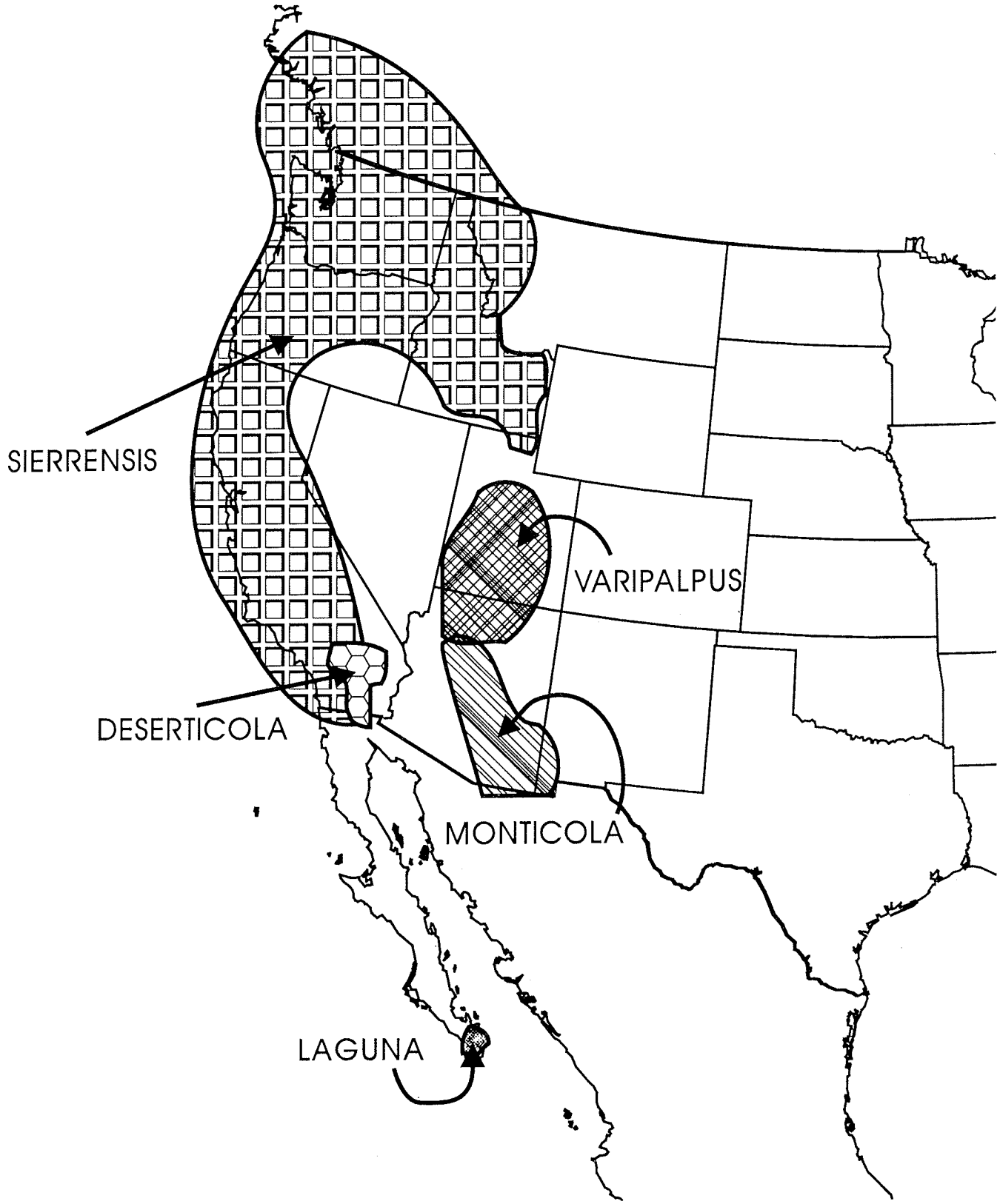
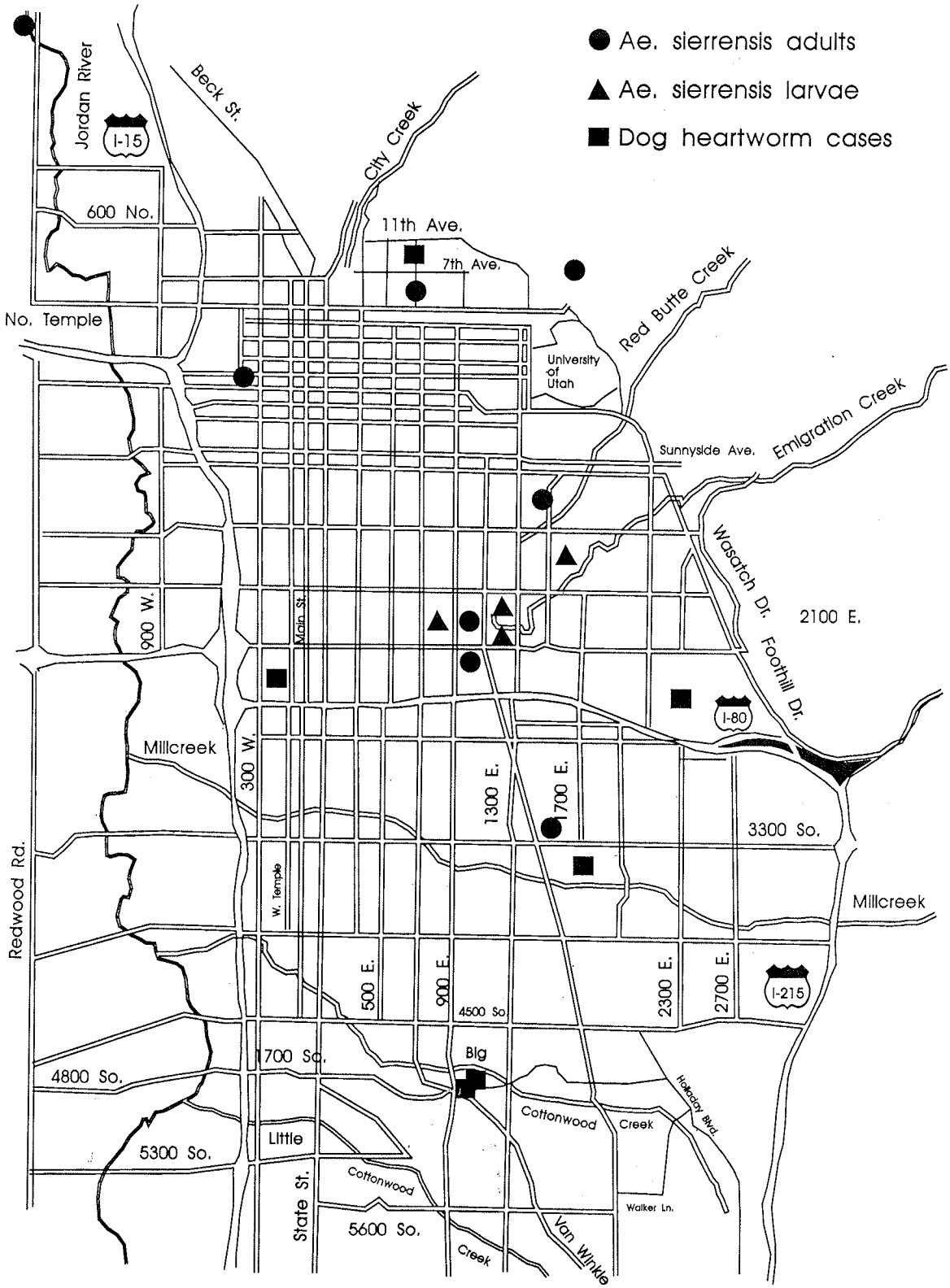


Figure 1. ***Aedes sierrensis*** **distribution in Salt Lake City.**



NEW BUDGET PROCESS

ECKHARD BAUER

Utah State Auditor's Office
Salt Lake City, Utah 84114

A. Budget timetable, requirements, and who prepares it. (The following timetable is for calendar year end.)

1. Sometime in early October the budget officer (clerk) should prepare a tentative budget and present it to the board for their input, changes and approval.

2. After approval of the tentative budget, the board should send the tentative budget to all constituent entities and customer agencies within its district and set a public hearing date. That hearing date would usually be in late November or early December.

NOTE: S.B. 73, passed by the 1991 Legislature, requires that each independent district with an annual budget of $50,000 or more shall send a copy of its tentative budget (Budget shall include a beginning fund balance and an ending fund balance) and notice of the time and place for its budget hearing to each of its constituent entities and to each of its customer agencies.

A constituent entity (entity) is any county, city, or town that levies property taxes and is located within the boundaries of the district.

A customer agency (agency) means those governmental entities, except school districts, institutions of higher education, and federal government agencies that purchase or obtain services from the special district.

The district shall include with the tentative budget a signature sheet that includes: language that the entity or agency received the tentative budget and has no objection to it; and, a place for the chairperson or other designee of the entity or agency to sign.

If the entity or agency has not returned the signature sheet within 15 calendar days after the tentative budget was mailed, the district shall send a written notice of the budget hearing to each entity or agency that did not return a sig-signature sheet and invite them to attend its budget hearing.

If requested to do so by any entity or agency, the district shall schedule a meeting to discuss the budget with the entity or agency. At that meeting the district shall explain its budget and seek to resolve any objections.

Nothing in this bill shall prevent any district board from approving or implementing a budget over any and all entity or agency objection, protest or failure to respond.

This procedure must happen within 30 days after the board approved the tentative budget and at least 30 days before approval of the final budget.

3. The hearing must be advertised, at least once, in a local newspaper of general circulation, and at least seven days before the hearing.

4. The tentative budget must be available for public inspection, in the district offices during business hours, for at least seven days prior to the hearing.

5. During the hearing those who wish to speak about the budget must be allowed to do so.

6. After the hearing, and before December 31, the board must adopt a budget.

7. A notarized copy of the adopted budget must be sent to the State Auditor within 30 days of adoption. Obviously, the district should keep a copy for its own use and public inspection.

B. The State Auditor's Office provides forms for your use and assistance in filling them out.

C. During the budget year, line item amounts may be overspent with board approval; but, if the total budget is to be increased, a new public hearing must be held and steps 3 through 6 must be followed.

It is illegal to increase the budget after that budget year is over.

PRELIMINARY REPORT ON ADULT MOSQUITO CONTROL PROCEDURES

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ABSTRACT

Members of the Utah Mosquito Abatement Association ULV Application Task Force for 1991 included the following mosquito abatement district managers: Lewis Marrott, Chairman (Utah County), Sammie Lee Dickson (Salt Lake City), Steven V. Romney (Uintah County), Larry Nielsen (Box Elder County) and Robert J Brand (Tooele), as well as ex-officio members, Gary King (Utah Department of Agriculture) and Howard Deer (Extension Pesticide Specialist, Utah State University).

The goal of the task force was to set basic guidelines and general policies and procedures for ULV application for the control of mosquitoes in the State of Utah. Since outside funding was not avail- able for the project, the guidelines were scaled down to outline form covering 13 topics ranging from justi- fication to legal issues.

When the outline is finished, it will be reviewed by the association's board of directors and, if acceptable, be adopted as the approved method for ULV application. Each member district will be asked to incorporate this document into their policies and procedures.

TULAREMIA - UTAH[1]
1908 - 1990

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This paper will review some of the major advances in the understanding of the natural history of tularemia in Utah from 1908 through 1990. I also wish to discuss a few of the historical developments in tularemia epidemiology recorded here.

In addition to my own work since 1973, I am indebted to the many researchers who have kept detailed histories of their investigations and compiled the statistics that I will review. Special mention should be made of the interesting and detailed reference "Tularemia in North American" (Jellison 1974), as well as articles by Pearse (1911), Jellison et al. (1951), Francis (1919 and 1921), Stark (1979) and Klock et al. (1973).

According to Stark (1979), "few areas are as ecologically diversified as Utah. Tularemia is widespread from the Great Salt Lake Desert to the Uintah Mountains. It has transmission cycles involving waterborne tularemia, as with muskrat trappers around Utah Lake . . . ; airborne tick feces as with sheep shearers . . .; direct contact, as with rabbit hunters; and deer fly bites . . ."

Eighty years ago, Dr. Pearse, of Brigham City, Utah, published the first report of tularemia written in English (Pearse 1911). The paper describes patients seen during August of 1908 and 1910. Although Pearse did not name the illness he discussed, he gave a detailed description—"I will give you the histories of a few cases of an infection probably caused by the bite of the large black and yellow horsefly, all cases of which, so far as I know, have been distributed over a definite area about Brigham City. This disease made its appearance in August, 1908, and August, 1910. The point of infection in all my cases has been on an exposed portion of the body. All of the cases give a history of having been bitten by the large horsefly. Most of the patients say they had been bitten by the same kind of flies many times before during that season. The incubation period varies from two to five days.

"In all the cases there has been marked swelling of the glands and lymphatics about the area of the bite.

"In about one-half of the cases some of the glands have gone on to suppuration. Most of the cases have had severe chills, sometimes during the incubation period, others having chilly sensations. The temperatures have run from 98 to 104 degrees. The duration of the disease has been from one to four weeks, the severity of the disease varying from slight malaise to death.

"All of the bites have gone on from a red infiltration, like a mosquito bite, to complete breaking down of the tissues and sloughing, forming a punched-out circular ulcer about one-fourth inch in diameter and one-eighth inch in depth. Within a few hours of the bite there forms a water blister at the apex of the infiltration, this soon changing to pus, and then the tissue begins to slough away, the discharge being like a sero-purulent mucus."

While most writers agree that Dr. Pearse incorrectly identified the vector as a horsefly, rather than the deerfly, there is no disputing his clinical description or purported mode of transmission.

Due to continuing outbreaks of disease associated with fly bites during 1917, 1918 and 1919, the Health Commission of Utah, Dr. T. B. Beatty, requested assistance from the Surgeon General of the United States.

Dr. Edward Francis, a surgeon with the U. S. Public Health Service, visited Utah in 1919 at the direction of the Surgeon General to review the ongoing outbreaks. He conducted his investigations in the Pahvant Valley of Millard County, and was able to demonstrate several key points:

- The outbreaks were coincidental with the peak biting season of the deerfly (*Chrysops discalis*).

[1]Originally presented June 26, 1991
American Association for the Advancement of Science
Society of Vector Ecologists Section
Utah State University, Logan, Utah

- *Bacterium tularensis* [*Francisella tularensis* (McCoy and Chapin)] could be isolated from the blood of the jackrabbit.

- Jackrabbits were proposed as the reservoir of infection for humans.

- Human cases can end in death. (Pearse had already described a fatality in 1910.)

Millard County has some unusual terrain, including a prominent formation known as the Pahvant Butte. Just 45 miles to the west of Pahvant Butte is the Tule Valley. While Tulare County, California, gets credit for the name Tularemia, this is an interesting coincidence.

While Francis failed to isolate bacteria from trapped deerflies, he proposed a name for the new illness: Deer-Fly Fever or Pahvant Valley Plague (Francis 1919). In 1921, Francis used the name Tularemia when describing the Utah outbreaks (Francis 1921).

The first explosive epidemic of tularemia was reported in 1935 at the Civilian Conservation Corp (CCC) Camp at Locomotive Springs, Utah. This spot on the transcontinental railroad line is near Brigham City and Tremonton, the area where Pearse's first cases were seen.

Burnett (1936) describes the CCC Camp: "The District Surgeon had in June reported that because of many general conditions, the campsite was the worst imaginable place to put human beings for out-of-door life and work. Salt-water springs with .4 to .6 percent NaCl and about seventeen other salts; long hauls of fresh water by trains or trucks; no trees within thirty miles; rattlesnakes; mosquitoes; numberless flies; large numbers of deerflies; loneliness; no shade; very bad roads in wet weather; glistening salt beds not far away; swirling dust with intermittent winds of considerable intensity—all this created a sinister environment for the camp's personnel, many of whom had left even before the attack by tularemia developed."

Hillman and Morgan (1937) described the CCC outbreak as affecting 26 of 170 laborers. They reported that "the laborers removed their shirts while working, that sick jackrabbits were seen in the area, and 13 men were known to have killed jackrabbits or handled dead ones. The locations of initial ulcers on the shoulders and backs of the workmen suggested, however, that jackrabbits were not directly involved as a source of human tularemia."

William L. Jellison visited Utah in 1950 to investigate eleven serologically confirmed cases of tularemia that occurred in the late winter and spring of 1950 and were known to have been contracted from muskrats in Utah. Most of these cases were associated with a concurrent epizootic in muskrats on Utah Lake near Provo, but a few were from other sections in the northern part of the state.

Jellison (1951) wrote, "An epizootic in muskrats occurred at Utah Lake during the spring of 1950. Of many muskrats found dead, two were examined in the laboratory. One showed the typical lesions of tularemia and yielded pure cultures of *Pasteurella tularensis* (*Francisella tularensis*). Unusual muskrat fatalities were observed elsewhere in Utah.

"One case of tularemia attributed to muskrat contact on Utah Lake occurred in March, 1948, and eight cases in the vicinity of Provo and Utah Lake occurred in the spring of 1950. Two other cases occurred at Millville and one at Huntsville in the spring of 1950.

"There were other cases of illness, presumably tularemia, attributed to muskrat contact in the Provo area, but these have not yet been confirmed serologically.

"Tularemia has been excluded by serological test in at least one case of serious illness attributed to muskrat contact. We have no information on muskrats as a source of human infection in Utah prior to 1948, although the occurrence of tularemia in muskrats was reported in 1944."

Although water samples taken from the outbreak area were negative for tularemia, "A water sample was taken November 8 from the stream which flows through St. Charles, Idaho, about ten miles north of the Utah line, and empties into Bear Lake on the Idaho-Utah boundary. This sample proved infectious for white mice by intraperitoneal injection of two and one-half ml. doses and a pure culture of *P. tularensis* (*F. tularensis*) was recovered. A second water sample taken January 8, 1951, was likewise infectious for white mice and again a culture of *P. tularensis* (*F. tularensis*) was isolated."

Stark (1979), describing other water sampling in Utah, found that "*Francisella novicida* was isolated and described from Ogden Bay, on the eastern side of the Great Salt Lake (Owen 1974), and has never been reported elsewhere. Thus, Utah differs from all other aras of the world by harboring all three recognized taxa of *Francisella*.

Another landmark investigation was conducted by Klock and associates during the summer of 1971, when an epizootic of tularemia in rabbits occurred in Utah, followed by an outbreak of human tularemia. Over one three-month period, more humans were infected than had been reported in any of the preceding 20 years. Of the 39 patients with this infection, 28 had acquired tularemia from deerflies (*Chrysops discalis*) and 7 were thought to have been infected by mosquitoes or biting gnats.

Klock et al. (1973) reported, "The present study is the first time that *F. tularensis* has been isolated from deerflies collected in close temporal and geographic relationship to infected people. These findings confirm previous epidemiologic evidence that incriminated the deerfly as a vector of tularemia.

"Although more than 60 mammal and avian species in Utah have been shown to have evidence of tularemia infection, the jackrabbit is considered a main source of tularemia for man. Transmission from rabbit to rabbit in Utah is accomplished primarily by the tick *Dermacentor parumapertus*, which rarely attacks man. However, the deerfly will readily bite both jackrabbits and man and thus can effectively transmit the organism to humans.

"In 28 of 39 patients, deerflies were strongly implicated as vectors. However, in seven patients in Grantsville, there is some evidence that insects other than the deerfly may have been responsible for transmitting the disease. First, six of the seven patients recalled being bitten by mosquitoes and biting gnats (*Culicoides* species and *Leptoconops kerteszi*) shortly before developing symptoms of tularemia, but none recalled the painful bite of a deerfly."

Tularemia was first reported on the official mobidity statistics of the Utah Department of Health starting in 1922, when 4 cases were seen.

From 1922 to 1990, a period of 69 years, the Department of Health has recorded 1,116 cases of tularemia. If the early cases (1908-1920) estimated by Pearse (1911) and Francis (1919 and 1921) are included, the total amount now exceeds 1,200. The majority of cases (736 cases, or approximately 66% of the officially reported cases) occurred between 1937 and 1957. There has been a decline in morbidity during the past 25 years. A similar decline has also been noticed across the entire United States.

Possible reasons of the decline may include a decrease of consumption of wild rabbit, broader use of insect repellents, control of other vectors, especially mosquitoes and prophylactic treatment of deerfly bites with antibiotics.

Utah and other western states do not see the preponderance of cases associated with direct contact with rabbits that has been noted across the U. S. as a whole. Of the 81 Utah cases reported from 1979 through 1990, almost half are associated with insect bites. This pattern is typical of the states in the Mountain West.

Some of the cases with unknown exposures are also likely to be vector transmitted. The patient might have failed to notice a bite, especially by one of the smaller flies. In all but one of these recent cases involving direct contact, the implicated animal was a rabbit; the exception was a man who became ill after skinning a beaver trapped in Ogden Canyon.

I would like to close with one of my favorite tularemia investigations involving "transmission" by a pheasant. A group of Utah men, including several physicians, were hunting pheasants and rabbits on a game ranch near Cody, Wyoming and having great success. When they returned to the clubhouse to process the game, a pheasant revived and lead the men on a wild chase. Although the pheasant failed to escape, it did leave some nasty spur cuts on the hands of the hunters.

Immediately after subduing the pheasant, the men cleaned the rabbits without wearing gloves. Two individuals developed tularemia within 3 to 5 days following the hunt and were hospitalized. Both recovered after treatment with either streptomycin or tetracycline. The portal of entry for tularemia bacteria was most likely the fresh cuts on their hands.

Utah does seem to deserve the honor of being recognized as "The Home of Tularemia."

REFERENCES CITED

Burnett, T.W. 1936. Tularemia in a Rocky Mountain sector of the Wasatch Front. Fort Douglas CCC District. Military Surg. 78:193-199.

Francis, E. 1919. Deer-Fly Fever, or Pahvant Valley Plague. U.S. Public Hlth. Rpts. 34:2061-2062.

Francis, E. 1921. The occurrence of tularemia in nature as a disease of man. U.S. Public Hlth. Rpts. 36:1731-1738.

Hillman, C.C. and M.T. Morgan. 1937. Tularemia: Report of a fulminant epidemic transmitted by the deerfly. J. Amer. Med. Assn., 108:538-540.

Jellison, W.L. 1974. Tularemia in North America. University of Montana Foundation, Missoula, Montana. 276 p. Also, U.S. Army Med. Rsch. and Dev. Com., Washington, D.C., Contract DADA-17-73-C-307D.

Jellison, W.L., G.M. Kohls, and C.B. Phillip. 1951. Tularemia--Muskrats as a source of human infection in Utah. Rocky Mtn. Med. J. 48:594-597.

Klock, L.E., P.F. Olsen, and T. Fukushima. 1973. Tularemia epidemic associated with the deerfly. J. Amer. Med. Assn. 226(2):149-152.

Owen, C.R. 1974. Genus *Francisella* In: Buchanan and Gibbons, eds., Burgeys manual of determinative bacteriology. Waverly Press, Inc., Baltimore, Md. pp. 283-285.

Pearse, R.A. 1911. Insect bites. N.W. Med. 3:81-82.

Stark, H.E. 1979. Review of tularemia in Utah and the Great Basin. The Great Basin Natural. 39 (2): 103-121.